

SURVEY RESEARCH DESIGN IN SUPPLY CHAIN MANAGEMENT: THE NEED FOR EVOLUTION IN OUR EXPECTATIONS

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Survey research in supply chain management has been and will continue to be an important methodology in advancing theory and practice. However, supply chain scholars have multiple, divergent views regarding what is acceptable in terms of survey design, especially regarding respondents. We build on insights and commentaries provided by *JSCM* associate editors to develop and share general guidelines we will use during our tenure as editors to judge the rigour of survey research designs. We also outline ways that survey designs for supply chain research can be strengthened. The aim of this editorial is to clearly communicate expectations to the *JSCM* community, so that authors and reviewers can be more successful in advancing the theory and practice of supply chain management.

INTRODUCTION

This discussion forum resulted from our desire to clarify what we, as an editorial team, consider to be acceptable practice in supply chain management survey research. When we started as co-editors, we agreed that we all believe that validity is not a property of methods (Shadish, Cook & Campbell, 2002), and that all empirical research designs are welcome in *JSCM*. However, we also quickly realized that each envisioned somewhat different criteria for determining when we believed a survey research design could provide valid results, particularly related to the use of single respondents providing all of the data. In addition, we were concerned that our AEs and reviewers had an even wider range of views on this topic. The general single respondent issue is magnified for supply chain management research, which necessarily captures a wide range of levels of analysis, ranging from individuals to dyads and triads to networks. Thus, insights that are appropriate in a micro-OB setting might not inform network studies and vice versa.

JSCM is as much a research community as a journal. The diversity of views helps

This is the author's manuscript of the article published in final edited form as:
Flynn, B., Pagell, M., & Fugate, B. (2018). Editorial: Survey Research Design in Supply Chain Management: The Need for Evolution in Our Expectations. *Journal of Supply Chain Management*, 54(1), 1-15. <https://doi.org/10.1111/jscm.12161>

to drive our research forward and increase its impact. However, we found that these differing and sometimes divisive views about research design were getting in the way of our primary task of contributing to supply chain theory. Therefore, we felt that we needed to publically discuss these issues and describe our conclusions about what JSCM's boundaries will be while we are co-editors. These boundaries cannot be static, because research design is situational and research practice continually evolves; matching research design to a research question is more of an art than a science (From the Editors, 2011).

Because we are a research community, we started by soliciting input from our team of AEs who, in addition to being leading scholars, have consistently made significant research contributions to our community. As expected, our AEs provided a range of thoughtful and passionate responses. We followed up with some of them and invited them to develop their brief responses into more substantial commentaries, ensuring that a range of opinions and a diversity of backgrounds were represented. The four commentaries that accompany this editorial are the outcome of that process and were instrumental in informing our conclusions.

The following sections outline the problem, especially in a supply chain management setting, detail how we will handle survey manuscripts for the remainder of our tenure as editors, and provide suggestions for strengthening survey designs for supply chain research. The aim of this editorial is to clearly communicate our expectations to the JSCM community.

THE PROBLEM(S)

Discussions of survey design often focus on single respondent bias and the inability of common tests to detect it. This is a serious problem and one that Montabon et al. (2018)

and Krause, et al. (2018) address in some detail in their commentaries. The potential for bias is an issue for all single respondent survey research, regardless of research domain, particularly for perceptual measures. However, supply chain survey researchers frequently use perceptual measures, for several reasons. First, supply chain management research questions often focus on organizations, groups of organizations or functional areas within an organization, rather than individuals. Latent constructs that are central to the domain, such as power and trust, may be best measured using perceptual reports (Boyer & Swink, 2008; Ernst & Teichert, 1998; Kumar, et al., 1993) of facts, beliefs, motives and activities associated with organizational events and decisions (Huber & Power, 1985).

However, there are many issues associated with the use of perceptual measures of organizational phenomena. As Ketchen, et al. (2018) describe, reporting on organizational phenomena requires respondents to engage in high level cognitive processes that require them to work at a high level of abstraction, weight inferences, and engage in prediction, interpretation and evaluation (Podsakoff & Organ, 1986). Even the most competent respondents can experience perceptual and cognitive limitations that result in response inaccuracies (Huber & Power, 1985), particularly for retrospective reports (Golden, 1992), including imperfect recall of past events and coloring of recollections by their implicit theories and biases (Tversky & Kahneman, 1974). Surveys of respondents' perceptions are thus useful, but potentially seriously flawed (Podsakoff & Organ, 1986).

Although the use of single respondents presents serious issues for survey research at any unit of analysis due to the significant risk of common methods bias, it is a particular problem for many supply chain surveys for three related reasons. First, many constructs that are central to supply chain management, such as integration and coordination, are by

nature polyadic; they can only be assessed through responses from the multiple sources that are integrating or coordinating. Second, supply chain research often makes inferences about organizations, rather than individuals. An organization is a more complex unit of analysis than an individual, thus, it can't be assessed by asking individuals about their personal feelings, opinions or behavior (Phillips, 1981). Because organizations have characteristics that are distinct from the characteristics of individuals, different research methods are required for learning about their behavior (Phillips, 1981). Third, these issues are further exacerbated when the research question focuses on relationships between multiple supply chain members within or across firms. As Roh, et al. (2013) noted, asking a supplier about its customers' perceptions of trust or power is akin to asking women to describe men's perceptions of their health issues. Thus, the single respondent issue is especially salient for research questions that focus on the perspectives of more than one functional area or firm, as many important supply chain research questions do.

However, Kaufmann and Saw (2013) reported that 87.8% of the survey research published in five leading supply chain management journals¹ between 2006 and 2012 used single respondents to provide perceptual reports of organizational constructs, and Montabon, et al. (2018) found that only 23.8% of the articles recently published in the four leading empirical research journals on the SCM Journal List² used multiple sources to report on polyadic constructs.

Figure 1 details the four primary generic survey research designs we see in

Journal of Operations Management, Journal of Business Logistics, Journal of Supply Chain Management, Journal of Purchasing and Supply Management, International Journal of Product Distribution and Logistics Management. and *Journal of Decision Sciences, Journal of Business Logistics, Journal of Operations Management, Supply Chain Management.* and

manuscripts submitted to *JSCM*. Type 1 survey designs employ a single respondent who provides responses for all items, including both the independent and dependent variables. The constructs in this type of study are *monadic*, meaning that they focus on a single perspective, such as that of a firm or a department within a firm. For example, a firm's defect rate or the strength of a department's lean practices are monadic constructs. Type 1 research designs are likely to suffer from common method bias, as described below. However, this type of research may be acceptable in certain situations, such as behavioral operations studies that focus on individual decision makers, research on SMEs that are supply chain members or research questions targeting the perceptions of an individual, such as a CEO.

Insert Figure 1 About Here

Type 2 survey research designs also employ a single respondent who provides responses for all items, including both the independent and dependent variables. The difference between Type 1 and Type 2 research designs, however, is that Type 2 designs contain some polyadic constructs. A *polyadic* construct includes relationships, multiple entities or attributes that cannot be characterized by a single objective description, such as culture, relationship strength or integration. For example, culture is a set of collective values and beliefs (Hofstede, 1991; Schein, 2010); one person's perception is not adequate to assess a firm's culture because of its collective nature. Similarly, the quality of a buyer-supplier relationship cannot be adequately addressed by just the buyer or the supplier. We use the broad term "polyadic" to encompass a continuum of relationships from dyadic (for example, buyer-supplier relationships), to triadic (for example, the buyer-supplier-supplier triads described by Choi (2009)) to network relationships. The Type 2 design is the most

flawed of the research designs that we see, because it uses single sources to address polyadic constructs. Thus, Type 2 designs are likely to suffer from both common method bias and respondent bias.

Type 3 survey designs use multiple respondents, with the dependent variable responses provided by respondents who are different from those who provide responses to the independent variables. Further, each respondent may address different independent variables. Thus, a Type 3 survey research design reduces the risk of common method bias. However, some or all of the constructs in a Type 3 design are polyadic, but are assessed by a single source. For example, a Type 3 design for a research question related to supplier relationships would have multiple respondents within the buying firm addressing questions about relational trust and its outcomes, however, it would not include responses from the suppliers who constitute the other half of the buyer-supplier relationship. Thus, a Type 3 design is likely to suffer from respondent bias.

Finally, a Type 4 design employs multiple respondents, with the independent and dependent variables addressed by different respondents. It contains some polyadic constructs, which are addressed by appropriate respondents from different sources. For example, Dong, et al. (2016) selected 100 buyers per industry at each of four national trade shows (400 buyers). Each was asked to identify their counterpart in one of their firm's major suppliers. 191 suppliers were identified and contacted by telephone, with 156 agreeing to participate in an interview. After removal of incomplete responses, there were 141 pairs of responses. This allowed the authors to assess polyadic constructs, including supply chain performance, information sharing and dynamic adaptation. Other independent variables, including role ambiguity, role conflict and buyer opportunism, were

monadic and were thus assessed by only the buyer (role ambiguity and role conflict) or the supplier (buyer opportunism). Thus, because it employs multiple sources, every item in a Type 4 design is addressed by the best informant(s) for that item. This design should have the lowest likelihood of suffering from common method bias or respondent bias problems. However, the practical implications of this type of research are laden with significant costs to both the researchers and the respondents, making it challenging to undertake.

Prior to presenting guidelines and recommendations, we first provide a detailed discussion of issues related to using single respondents to provide perceptual information and a single source to address polyadic constructs, addressing issues of both common method bias and respondent bias. We then outline our expectations for papers that are submitted to *JSCM*, especially for those that do not use a Type 4 design. Finally, we conclude by describing potential ways to address these issues, providing opportunities to improve research designs when a Type 4 design is not possible.

PROBLEM 1: COMMON METHOD BIAS

True score theory (Lord & Novick, 1968) is based on the premise that every measure has a true, objective score, in contrast to the observed score, which is contaminated (Ketokivi & Schroeder, 2004). There are two sources of contamination. Random error is variability around the “true” mean (Ernst & Teichert, 1998), which can occur when respondents encounter difficulties in making complex organizational judgments (Van Bruggen, et al., 2002). Although it has an expected value of zero, random error attenuates relationships between variables; thus, it can inflate parameter estimates and lead to errors in inference (Bagozzi, et al., 1991; Ketokivi & Schroeder, 2004; Van Bruggen, et al., 2002).

The other source of observed score contamination is systematic error, which affects

the measurement of different variables in a similar way (Van Bruggen, et al., 2002; Roh, et al., 2013). It is the stable variance component of a score, due to the idiosyncratic perspective of individual respondents (Anderson, et al., 2006). For example, a respondent who is fundamentally optimistic about the future may consistently select higher scores across variables than one who is fundamentally pessimistic. Sources of systematic error include both individual respondent characteristics and organizational characteristics (see Table 1). Individual sources of bias include the respondent's background and experiences, need for social desirability, implicit theories, halo effects, leniency or acquiescence biases, positive or negative affectivity and transient mood states (Ernst & Teichert, 1998; Podsakoff, et al., 2003; MacKenzie & Podsakoff, 2012). Organizational sources include the respondent's hierarchical or functional position, length of tenure in the organization, organization size and complexity, breadth of information sources available and volatility of the internal and external environment (Bagozzi, et al., 1991).

Insert Table 1 About Here

Although researchers are interested in the relationship between the true scores for the variables of interest, what they observe is the relationship between measured scores, which includes random and systematic error (Van Bruggen, et al., 2002). This error component can be substantial, estimated at comprising well over 50% of the measured score in many cases (Van Bruggen, et al., 2002; MacKenzie & Podsakoff, 2012; Cote & Buckley, 1987). Thus, systematic error provides a plausible alternative explanation for an observed relationship between constructs because of its potential correlation with them; the presence of systematic error in single-respondent research can lead to misleading conclusions (Podsakoff, et al, 2003). Because systematic error can either inflate or deflate

an observed relationship between constructs, it can cause both Type I and Type II errors (MacKenzie & Podsakoff, et al., 2012).

Systematic error is a form of common method bias; one way of looking at single respondents is as the “method” in common method bias (MacKenzie & Podsakoff, 2012). When the same respondent provides ratings of multiple variables, especially both independent and dependent variables, there is a method effect that produces a rival explanation for observed relationships (Podsakoff, et al., 2003). The expected value of the correlation between systematic errors increases if the scores for the measured values come from the same respondent (Van Bruggen, et al., 2002). Thus, using a single respondent approach contributes to “insidious errors” that are not usually detectable, but which can nonetheless lead to incorrect inferences (Roh, et al., 2012).

In addition, it is impossible to assess the convergent and discriminant validity of a measure when it only has a single respondent (Phillips, 1981). This prevents partitioning the variance between the true score, systematic error and random error, in order to assess the extent to which they are correlated (Jones, et al., 1983; Ketokivi & Schroeder, 2004). Thus, there is no way to determine the validity of a measure that is only assessed by single respondents; measured scores that are aggregated across multiple respondents will be closer to the true score.

The best way to reduce the effect of systematic error is through using multiple respondents (Ketokivi & Guide, 2015), because they have different personal characteristics, organizational perspectives and experiences. Thus, Type 1 and 2 research designs should generally be avoided, although Kull et al., (2018) provide an example of when a Type 1 design might be acceptable.

PROBLEM 2: RESPONDENT BIAS

A number of researchers distinguish between respondents and informants, where a respondent reports on his or her personal feelings, opinions or behavior, while an informant reports on phenomena external to himself or herself (Anderson, 1987; Van Weele, & Van Paoij, 2014). While this may seem like a semantic distinction, it is important to the many supply chain research questions that focus on phenomena that exist at the level of a department, organization, relationship or network. Informants are asked to report on their perceptions of observed or expected organizational relationships, generalizing to organizational patterns of behavior (Seidler, 1974). Because informants are asked to aggregate and summarize, they don't need to represent all members; it is their perceptions and expertise that are sampled (Seidler, 1974). Informants are chosen because they occupy a role that is expected to make them knowledgeable about the issues being researched and are willing and able to communicate with the researcher about them (Camphile, 1955; Kumar, et al., 1993; Bou-Llusar, et al., 2016). Respondents, on the other hand, are selected to be statistically representative of all individuals in each segment of the organization to which a measure applies (Seidler, 1974). They report solely about their own individual behavior and relationships with some other part of the organization (Kumar, et al., 1993; Seidler, 1974).

Key informants. Key informants are expected to be especially knowledgeable informants, selected based on characteristics such as their status in the organization, special knowledge or unique access to the necessary data (Phillips, 1981; Ernst & Teichert, 1998). Because they provide information about the properties of an organization at an aggregated level of analysis (Phillips, 1981), they are often asked to perform complex judgment tasks,

evaluating constructs such as environmental constraints, internal organizational structure, power and conflict (Bagozzi, et al., 1991). Interestingly, the use of key informants was originally intended to be a source of objective data only, rather than the subjective data that it has often been used for (Camphile, 1955).

Traditionally associated with ethnographic research, such as participant observation, [the key informant approach] may be employed in survey context to obtain quantifiable responses, rather than qualitative information (Phillips, 1981, p. 396).

In ethnographic research, such as an anthropological study of a remote culture, a researcher would spend a substantial amount of time identifying appropriate key informants, then enter into a personal relationship with them for a relatively long period of time (Seidler, 1974). It can be a very reliable approach to this type of research if the researcher is able to find key informants who are representative, reflective, articulate and personable; the researcher's skills can correct for any informant biases (Seidler, 1974). In survey research, however, researchers do not enter into a long-term personal relationship with key informants, making it challenging to ensure representativeness and unbiased reporting of perceptual assessments.

This raises the important question of whether any single informant can effectively report on a large organization (John & Reve, 1982) or on a polyadic construct, for several reasons. First, key informants are often asked to perform complex tasks involving social judgment (Phillips, 1981; John & Reve, 1982). Even selecting informants at a higher hierarchical level doesn't necessarily ensure more reliable and valid responses than lower-level managers would (Kumar, et al., 1993), as described in Krause, et al.'s (2018) commentary.

Second, because there is typically only one key informant, their reports are

subject

to the same types of systematic bias as all single respondents' reports are, including systematically under-reporting or over-reporting certain phenomena due to informants' position, job satisfaction or other characteristics (Kumar, et al., 1993; Phillips, 1981). For example, a CEO would perceive a supply chain issue differently than a second-level executive or line manager (Kumar, et al., 1993). A single key informant is still a single respondent (Jones, et al., 1983), with all the associated baggage. Even for a construct that is seemingly objective, such as practices, there are always individual biases. Although practices are a core element of supply chain management research (Carter et al., 2017), almost all SCM research treats them as though they were objective (Pagell et al., 2015); if two respondents disagree on their rating of a practice, it is treated as random error. Yet the cognitive component of the theory of routines suggests that such disagreements can reflect actual differences in practices, in that each respondent interprets what is to be done through his or her own cognitive filters and then proceeds to perform the practice accordingly (e.g. Feldman & Rafaeli, 2002; Parmigiani & Howard-Greenville, 2011). Thus, respondents' cognitive theories are reflected in responses that are systematically biased by their individual interpretation of a practice and how they, themselves, would perform it, which is not necessarily how it is performed by others.

Third, it is unreasonable to expect that any single informant is able to observe the operations of an entire firm and provide crucial information about a broad range of practices and outcomes, even a CEO (Huber & Power, 1985). No one respondent can provide the perspective of a large organization (Boyer & Pagell, 2000; Bou-Llusar, et al., 2016). Different managers have access to different information about practices and performance, as well as making different assumptions about the co-occurrence of events

(Bou-Llusar, et al., 2016). For example, asking a single key informant to provide organization-wide measures for a multidivisional, multinational organization that employs over 40,000 people (Huselid & Becker, 2000) is fraught with the potential for serious reliability problems. The quality of key informant reports is also affected by the types of constructs they are asked to address. As Krause et al (2018) describe in their commentary, the right key informant can address monadic constructs in their own area of expertise, but no single key informant can provide an unbiased assessment of a polyadic construct, such as integration between functions. Thus, we view the notion of an omniscient, all-knowing key informant as a myth in all but a few very specific situations. As Kull, et al. (2018) note, a key informant may be appropriate for a small firm with, say, 43 employees, where the president/owner makes virtually all decisions, and there are no alternative knowledgeable informants (John & Reve, 1982).

Many manuscripts submitted to *JSCM* justify using a single key informant by citing Kumar et al., (1993). However, they overlook Kumar et al's (1993) primary recommendation, which is to use multiple respondents and do so in a manner that does not assume that all respondents perceive the constructs of interest in the same way. Although the decision to use a single informant is sometimes made based on the difficulty of finding multiple competent informants, few researchers have formally evaluated whether this is actually the case (Kumar, et al., 1993). We agree with Kumar et al.'s (1993) position, cautioning potential authors to read this article carefully before citing it.

The best solution to these problems is to use multiple respondents, since aggregation of responses into a single composite score helps address systematic error; the group judgment will have a smaller variance than the individual estimates (Van Bruggen,

et al., 2002). Having more respondents also reduces random error through averaging (Jones, et al., 1931) and provides the opportunity to analyze the impact of various sources of error, in order to determine how to correct for it (Van Bruggen, et al., 2002). However, the use of multiple respondents is not without its costs and challenges, as described by Montabon, et. al (2018) and Krause, et al. (2018), and single respondent designs still have a place in *JSCM*.

Boundary-Spanning Research. As research interest in supply chain management has increased, so has the need to do research that crosses functional and organizational borders (Roh, et al., 2013), in order to get a more complete view of complex phenomena (Kaufmann & Saw, 2013). The assumption that a single source (Ketchen, et al., 2018) can provide valid responses to items assessing aspects of a polyadic construct, such as a supply chain relationship, is another serious and often overlooked problem, in addition to the serious problems associated with using single respondents. Yet, “the vast majority of empirical supply chain management research examines multi-stakeholder constructs using data from only one side of the supply chain relationship (Roh, et al., 2013, p. 712).”

The problems with single source research are well known, as described by Ketchen, et al. (2018). Most supply chain management researchers are painfully aware of the challenge of effectively executing research that avoids respondent biases, for several reasons. First are the “extraordinarily difficult” (p.712) challenges associated with collecting valid, reliable data from multiple sources (Roh, et al., 2013) such as all three members of a triad or from a network. For example, Montabon, et al. (2018) described the challenges of finding equally qualified respondents on both sides of a dyadic relationship. The challenges grow exponentially when we extend this from a dyad to a triad or a network.

Further, as Krause, et al. (2018) point out, multiple source data that is contradictory adds ambiguity to the data and uncertainty to the findings. Other challenges include what to do with multiple source data with missing informants (Bou-Llusar, et al., 2016). For example, Palmatier, et al.'s (2007) study of loyalty found that some of the suppliers' salespeople left their organization prior to completion of the longitudinal study. Partial dyadic data can't be included in matched pairs for data analysis, yet it seems inappropriate and potentially biasing to systematically discard unmatched dyadic data (Svensson, 2006).

Despite the real and present challenges of collecting multiple sources, however, many SCM research questions cross internal functional or organizational boundaries to explore how multiple actors interact or how their individual practices integrate into a supply chain outcome. Using a single source to capture these phenomena would mean ignoring their cognitive element or assuming that respondents from both sides of a dyad would interpret phenomena in the same way (Kaufmann & Saw, 2013). Ketchen et al.'s commentary (2018) likens using a single respondent to study supply chain relationships to a marriage counselor asking questions about a marriage to only one spouse. Asking purchasing managers how decisions are made in the operations function or a buying firm about its supplier's perceptions and how they affect outcomes is incomplete and provides a distorted view of the relationship (Anderson, et al., 2006). "Presuming that one party mirrors the other is potentially erroneous (Roh, et al., 2013, p. 713)."

We posit that many single source studies, which implicitly assume that the cognitions of the respondents are objective and stable across actors, have limited our understanding of supply chain management. This is a missed opportunity. Kaplan (2011) notes that an increased emphasis on the cognitive element in strategy research has

significantly improved the field's understanding. In the supply chain management domain, recent research has studied buyer-supplier relationship asymmetries (e.g. Villena & Craighead, 2017) and used these differences to explore relationships across firms, allowing the development of important new insights.

Thus, in addition to having different respondents address independent and dependent variables, the use of multiple sources is also an important part of effective research design for research involving polyadic constructs, in order to avoid respondent bias. For example, supply chain trust depends on both the buyers' and sellers' perspective of their dyadic relationship (Svensson, 2006). Even a key executive in charge of a portfolio of relationships will only be well informed about the trust perceptions of his or her organization's closest collaborators (Svensson, 2006). Thus, to truly understand polyadic constructs, multiple sources are needed.

John and Reve (1982) found that the key informants from both sides of a dyad were able to provide reliable and valid data about structural characteristics of the relationship. However, data on what they called sentiments variables was not comparable; there were real differences in perceptions across the dyad, which they attributed to key informants' inability to make the complex social judgments needed to estimate attitudinal scores at the organization level. Anderson et al. (2006) reported similar findings, noting significant agreement across dyads about structural relationship properties, such as formalization and centralization of decision making, but lack of agreement on scores for dyadic sentiments, including domain consensus and accomplishments from the relationship. Based on their empirical findings in a similar study, Roh, et al. (2013) recommended that research that uses a single source must either be positioned so that the research question is targeted at

only one side of a relationship or provide an explicit theoretical, practical and empirical rationale for the validity of using this design to explain a polyadic construct.

Although there have been numerous calls for research that examines both sides of a dyadic relationship, there is “a paucity of such research” (Roh, et al., 2013). Worse, much of what is presented as dyadic supply chain management research actually asks a single respondent about the other side’s perceptions. Items such as, “Our customers value their relationship with our firm,” or “We provide sufficient information to our suppliers” are far too common. Even in SCM research that claims to capture a dyad, the emphasis is often primarily on either the buyer’s or seller’s perspective (Svensson, 2006).

Despite the limitations of single source survey research (Ketchen et al. 2018), we full recognize the serious challenges faced when executing survey research that captures multiple sources of rich, appropriate data (Montabon et al. 2018; Krause, et al. 2018), especially when the phenomena of interest are polyadic in nature. Yet we believe that empirical survey research in SCM should evolve towards the next stage of maturity and empirical rigor. Accordingly, we present guidelines for researchers, authors and reviewers to consider in both the design and communication of empirical SCM research.

GUIDELINES

The following sections detail the general guidelines we will use during our tenure as editors and outline ways that survey designs for supply chain research can be strengthened. We position these as guidelines, not rules, because of our belief that design is both situational and a blend of art and science.

In developing our perspective, we built upon the thoughtful commentaries provided by our AEs. In inviting pairs of AEs (who were invited to add a third person to their team),

we intentionally selected a broad range of opinions about these issues. The results are interesting and informative, as well as representative of the range of perspectives of authors who submit to *JSCM*. Even the commentaries that are most supportive of using a single key informant (e.g. Montabon, et al., 2018 and Krause, et al., 2018) suggest this design is problematic, and Ketchen, et al. (2018) state that using a single source to assess a polyadic construct is never appropriate. Using the theoretical foundation and research question to drive the research design is a key component of Ketchen et al.'s (2018) theoretical calibration, Krause et al.'s (2018) focus on alignment and Montabon, et al.'s (2018) standards. Kull et al.'s (2018) commentary on SMEs provides an example of the sort of justification we expect of authors who are making the point that a single respondent or source is the best choice for a certain context.

In general, however, the best way to deal with common method bias is to design the research so that it includes multiple respondents (Ketokivi & Schroeder, 2004; MacKenzie & Podsakoff, 2012). Similarly, the best way to understand a polyadic construct is to collect data from all of the involved sources. However, practical considerations sometimes preclude these approaches. We provide a brief overview of some alternatives that may help researchers to address these issues. In each case, however, the researchers are responsible for justifying how their approaches adequately address the problems described above.

Use of an Appropriate Design

Consistent with Ketchen, et al.'s and Krause, et al.'s (2018) commentaries, we believe that theory should ultimately drive empirical research and that the specific research question should determine the best design for a study. For example, consider research on supply

chain trust. At the individual level of analysis, behavioral research might focus on an individual buyer's trust in a supplier and how it impacts the buyer's decision-making. A Type 1 design would be the best choice, since both the independent and dependent variables are a single manager's perceptions. In another example at the level of an individual firm, consider a research question that focuses on trust between the marketing and manufacturing functions within a firm and how it impacts internal integration. For this example, a Type 4 design, using respondents from both the marketing and manufacturing functions would be appropriate. Similarly, trust is often a critical construct in research on relationships that cross organizational boundaries (typically buyers and suppliers); this type of research also requires a Type 4 design, with responses from both buyers and suppliers.

Type 1 designs assume that a key informant can address all items knowledgably, but are still vulnerable to common method bias. Therefore, we argue that a Type 1 design is rarely appropriate. However, there are some exceptions, including research that explores individual decision-making within a supply chain or settings where only monadic constructs that are under the respondents' control are addressed.

Kull, et al.'s (2018) commentary argues for the acceptability of a Type 1 design when studying small and medium enterprises (SMEs). They make the point that it is much more likely that a single key informant exists in a very small firm, where top managers are asked to wear many hats. In addition, constructs such as internal integration or coordination across functions, which would be polyadic in a larger firm, are likely monadic in a small firm, where a single decision maker is responsible for many supply chain functions. In addition, secondary data on small firms is unlikely to exist. Kull, et al. (2018) also note the prevalence of SMEs in supply chains, making the point that, if we ignore SMEs because

of our inability to obtain multiple respondents or sources, we are ignoring much of what goes on in real supply chains. These are compelling arguments for the use of a Type 1 research design. We highlight this as the sort of justification that we expect from authors submitting papers employing a Type 1 design. Although it is the authors' responsibility to justify the use of this design, we are open to strong arguments and logical support for their choice of design.

Moving forward, we will generally anticipate a Type 4 design for research questions that address polyadic constructs. If the research question crosses functional or organizational boundaries, a multiple source approach will generally be needed. However, Type 1, 2, and 3 designs may still sometimes be appropriate, with some qualifications. Although it is impossible to assess the validity of responses using these designs, researchers may be able to justify their use. Montabon, et al. (2018), while acknowledging that single respondents or sources are sometimes unavoidable, describe ways to minimize the associated biases through mixed methods, triangulation with secondary data and multiple source subsamples. Similarly, Krause, et al. (2018) recommend pretests of all types and additional sources of data for polyadic constructs. They note the importance of establishing measurement equivalence for constructs that cross boundaries in their use.

Further, for initial research on a groundbreaking topic, a Type 1 or 2 approach may be justifiable as being the only way to take a first step. We are more likely to make exceptions to the need for multiple respondents or sources when the research question is novel and important, the level of analysis is local to the respondent, or the dependent and a majority of the independent variables are monadic constructs that are measured objectively. Consistent with the recommendations of Krause, et al. (2018) and Ketchen, et

al.'s (2018) commentaries and with our focus on being flexible about unusual situations, we are more likely to make exceptions for research in novel contexts or hard to reach organizations.

In conclusion, a Type 4 design is the most appropriate design for many supply chain management research questions. Type 1 designs have a limited place, mainly for behavioral questions with dependent variables that measure an individual's perceptions or in contexts like SMEs, where getting additional data would be difficult or impossible. Type 2 designs, while the most common in our experience, are also the least appropriate.

Finally, we remind authors of the necessity to justify their research design, as described by Montabon, et al. (2018). It is incumbent upon researchers who employ single respondents to thoroughly justify this choice, based on theory, empirical evidence and context. Authors need to show why theirs is a special case and that the issues we have outlined should be overlooked. This must be based on theory and the state of knowledge in the literature - not only by citing other papers that have used a similar design. Table 2 outlines the sort of thought process that we, as co-editors, go through when evaluating submissions, providing a guideline to when researchers will need to put substantial effort into justification of their research design.

Insert Table 2 About Here

Design, Not control

There are two approaches to dealing with the method bias that is inherent in the use of single respondents (MacKenzie & Podsakoff, 2012). The first is to minimize the effect through careful research design, while the second is to control for common method bias after the data has been collected. The best approach is generally to avoid the use of single

respondents by dealing with these issues during the design phase of the research. However, if the use of single respondents is unavoidable, Harman's test is weak and not especially useful. Other statistical methods to control common method bias such as partial correlation (Podsakoff & Organ, 1986), are also generally problematic and only indicate if a problem exists; they do nothing to fix it (Ketokivi & Guide, 2015). Rather, design approaches that obtain the independent and dependent variable measures from different sources or other types of statistical approaches are preferable. However, the use of multiple respondents is almost always superior (MacKenzie & Podsakoff, 2012), since "no simple statistical procedure adequately eliminates the problem of same source variance (Podsakoff & Organ, 1986, p. 538)."

If a single key informant design can't be avoided, then careful selection of the key informants is a must (Montabon, et al., 2018). Some biases and sources of respondent inaccuracies are related to individual roles held by respondents in their organization, including both perceptual biases and knowledge of specific information (Huber & Power, 1985). There may also be cognitive biases related to position. In the human resource management arena, Huselid and Becker (2000) describe the difference in expected responses for a survey asking for assessment of organization-wide HR practices sent to vice presidents of HR vs. a group whose titles include vice presidents for training and development, employee staffing, labor relations or compensation and benefits. Given that managerial experiences and roles influence their cognitions, mixing managers with many different roles or from many different industries will conflate random and systematic bias. Single industry studies, or studies which can control for industry via large sub-samples, where all of the respondents have the same responsibilities, are preferable to multiple

industry studies with a mix of managerial responsibilities. Similarly, all respondents should have about the same level of experience.

Podsakoff, et al. (2003) suggest several alternative measurement design approaches to help minimize biases associated with a single respondent. Temporal, proximal or psychological separation of measurement of the dependent and independent variables can help separate the independent and dependent variables in the minds of the respondents. Temporal separation inserts a time lag between measurement of independent and dependent variables from the same respondent. With proximal separation, respondents assess the independent and dependent variables under different conditions, for example using different media (face-to-face interview, paper-and-pencil survey, online survey) or in different locations (Podsakoff & Organ, 1986). Psychological separation can be achieved through creation of a cover story that makes it appear that the measurement of the independent variables is not related to measurement of the dependent variables. Separation through one or more of these means reduces biases in the retrieval stage of the response process, eliminating the saliency of any contextually provided retrieval cues (Podsakoff, et al., 2003). Thus, it reduces respondents' ability and motivation to use their previous responses to fill in gaps or infer missing details. Further, it reduces biases in the response reporting and editing stages through reducing the consistency motif and demand characteristics (Table 1). While separation approaches won't eliminate the common method bias associated with the use of a single respondent, they may help to reduce it.

If there is no alternative to using a single respondent, then it is important to ask questions that will reliably obtain the required information, including alignment of the level of questions with the level that the respondents can understand, ensuring that respondents

have appropriate experience to link key terms to relevant concepts, refraining from asking respondents about their motives, avoiding complex or abstract questions without clear examples, using clear, concise language and only asking about information that is within respondents' span of control (MacKenzie & Podsakoff, 2012).

Pure objective measures are more likely to yield very similar responses, whether single or multiple respondents are used (Van Bruggen, et al., 2002). Similarly, "quasi-objective" measures appear to be subjective, but are measured objectively. For example, power is sometimes measured with a quasi-objective measure like the percent of sales that occur through a specific dealer. Objective and quasi-objective measures, when verified with the "true" score for the measure, are usually reliable with single respondents (Blindenbach-Driessen, et al, 2010). However, reports of respondents' idiosyncratic judgments about an organizational variable are quite unreliable, since no true score exists, therefore, single respondents should be avoided for this type of data (Van Bruggen, et al., 2002).

Another solution is to shift the research question (Roh, et al., 2013) so that it focuses on monadic constructs, rather than polyadic. For example, in response to the limited number of complete dyads that Anderson, et al. (2010) obtained, they shifted their research question to align with a monadic perspective by looking at the focal firm's perception of the partner firm's influence. Thus, they shifted from a Type 2 to a Type 1 approach by changing their research question. Similarly, Ketchen, et al.'s (2018) supply chain decomposition approach breaks a supply chain into smaller components for data analysis, thereby getting closer to "where the action is." In doing so, the phenomenon under study moves closer to what a key informant can be reasonably expected to understand. Their

outcome refinement approach shifts to more granular outcomes that pinpoint expected effects, rather than using more global outcome measures, making them more accessible to key informants.

Some is Better than None

As Table 2 indicates, there are special cases for survey research that does not meet the standards of a Type 4 design. For instance, because of the numerous challenges associated with obtaining data from multiple sources, researchers sometimes end up with multiple sources of data for only some constructs. In other words, although their goal was to obtain multiple sources of data, there were some missing respondents, so that only half of the dyad is represented for some pairs. Similarly, secondary sources of data may be available for some but not all responses. Partial data can be useful as a form of triangulation (Kaufmann & Saw, 2013), using data from the partial responses (missing one side) for hypothesis testing, while using the full data as a confirmatory source or validation sample. While this doesn't completely eliminate respondent bias, it can provide a way to salvage a data collection effort that was well designed, but did not work out as well as intended.

CONCLUSIONS

As described by Montabon, et al. (2018) and Krause, et al. (2018), there is no silver bullet for research design; all research methods have some flaws. Our purpose was to focus on one issue with survey design, doing a deep dive into respondent selection in order to identify problems and recommend solutions. Our point is not to condemn survey research, but rather to offer suggestions to move survey research related to supply chain management to a higher level, making the results more valuable to theory and practice.

The process of designing a research project is a series of interlocking choices (McGrath, 1981), where researchers deal with a set of dilemmas and tradeoffs in order to design the best possible way to address a theoretical research question. There is a balance between the limitations of a method, such as survey research, and the value of the results that it yields (Montabon, et al., 2018). We have described these dilemmas and tradeoffs, as well as offering some potential ways to mitigate trade-offs.

We have shared this discussion for three reasons. First, it captures the diversity of views within the *JSCM* community. Second, we would like to be as precise as possible as to where we stand as editors. We have hopefully been clear that explicit boundaries are not our aim and that research design is always evolving and situational. But we also hope that we have been clear to authors about the thought process that we go through in doing a preliminary assessment of an article that has been submitted to *JSCM*, in order to make the decision about whether it will be sent out for review or not. We strive to protect reviewers' and AEs' time by only sending them submissions that meet our minimum quality standards, in order that they are better able to devote the kind of time and effort required to provide developmental feedback for the authors. Finally, our ultimate goal is for the research that *JSCM* publishes to have an impact on theory and practice; evolution of our research designs will help make that happen.

Table 1
Sources of Systematic Error

Source	Description	Effect
Respondents' Personal	Characteristics, Traits and Biases	
Consistency Motif	Respondents strive to maintain consistency between their cognitions and attitudes (Podsakoff, et al., 2003; Podsakoff & Organ, 1986).	Can produce relationships at different levels than they exist in real life. Confirming cases may be given disproportionate weight and may be more likely to be recalled.
Illusory Correlation	Respondent make assumptions about the co-occurrence of events (Podsakoff, et al., 2003).	Can introduce systematic distortions in correlations.
Implicit Theories	Based on illusory correlation, respondents develop personal theories that affect their coding and recall behaviors (Podsakoff, et al., 2003).	Can introduce artifactual covariation, in addition to true relationship.
Social Desirability	Respondents' need for social approval and acceptance causes culturally acceptable and appropriate responses. Respondents' tendency to present themselves in a favorable light (Podsakoff, et al., 2003; Huber & Power, 1985; Podsakoff & Organ, 1986).	Can mask true relationship between variables, produce spurious relationships, suppress or hide true relationships or moderate the nature of the relationship. Upward shift in the distribution of responses is common. The magnitude of the inaccuracy will increase when a respondent believes that divulging certain information could have an adverse effect on their career.
Leniency Bias	Tendency to rate those who respondent know well higher than they should be rated (Podsakoff, et al., 2003).	Can produce spurious correlations.
Acquiescence Bias	Tendency to agree with attitude statements, regardless of their content (Podsakoff, et al., 2003).	Can heighten correlations among similarly-worded items, cause spurious correlations and artifactual variance, in

Source	Description	Effect
		addition to true variance.
Negative Affectivity	Pervasive individual differences in negative emotionality; respondent view themselves and their work situation in generally negative terms (Podsakoff, et al., 2003).	Can account for systematic variance in relationships different from their true score values.
Positive Affectivity	Pervasive individual differences in positive emotionality; respondent view themselves and their work situation in generally positive terms (Podsakoff, et al., 2003).	Can account for systematic variance in relationships different from their true score values.
Transient Mood State	Can be affected by a number of events, such as an interaction with a disgruntled customer, receiving a compliment from the boss, a bad day at the office, concerns about downsizing, hunger, prior conversations, personal situation at home, etc. (Podsakoff, et al., 2003; Podsakoff & Organ, 1986)	Can produce artificial covariance in self-reported measures.
Satisficing	When difficulty in generating a response is high, respondent may be less thorough in question comprehension, memory retrieval, judgment and response selection, expending less effort (MacKenzie & Podsakoff, 2012).	Stylistic responses, such as selecting the first reasonable response from a list accepting assertions in the questions or selecting a safe response (such as the neutral choice).
Response Order Effects	Tendency to select the first or last response alternative, often due to satisficing (MacKenzie & Podsakoff, 2012).	Stylistic responses
Law of Small Numbers	Respondents judge a small number of observations to be more representative than they actually are (Tversky & Kahneman, 1974).	Systematic bias in favor of smaller sets of observation
Vividness	Over-response to more vivid information, allowing it to play a larger role in shaping opinions than its objective content justifies (Tversky & Kahneman, 1974).	Systematic bias in favor of more vivid information
Hindsight Bias	Respondents retrospectively see an event as having been inevitable, regardless of their predictions before the event (Tversky & Kahneman, 1974).	Can mask true relationships between variables
Attributional Bias	Respondents attribute outcomes to appealing (but often	Systematic bias in favor of event and

Source	Description	Effect
	inappropriate) causes, including attributing favorable outcomes to the actions of themselves and their associates and attributing unfavorable outcomes to uncontrollable factors (Tversky & Kahneman, 1974).	outcomes under respondents' control
Lack of Knowledge	Task demands create information overload, especially with respondents who lack full information (Huber & Power, 1985).	Respondents may provide second-hand information or use their imagination to fill in the gaps.
Organizational Sources		
Organizational Role	The organizational role of a respondent may influence his or her interpretation of the past; respondents' strategy awareness is positively related to the hierarchical level of the respondent (Golden, 1992).	Systematic bias related to access to information associated with respondents' roles
Tenure with Organization	The respondent's tenure in an organization may influence his or her interpretation of the past; newcomers may view events through a different lens than old-timers or may have access to different information.	Systematic bias related to respondents' tenure in an organization
Complexity of the Organization	The complexity of an organization may influence access to information and depth of the knowledge that is available.	Systematic bias related to perspective or availability of information
Size of the Organization	The size of an organization may influence access to information and depth of the knowledge that is available.	Systematic bias related to perspective or availability of information
Uncertainty of Internal Environment	The uncertainty of the internal environment may influence respondents' perceptions of internal cause and effect or ease with which information can be obtained.	Systematic bias related to variability of internal information
Uncertainty of External Environment	The uncertainty of the external environment may influence respondents' perceptions of external cause and effect or ease with which information can be obtained.	Systematic bias related to variability of external information

Issue	Authors are Responsible for Justifying Use of a Single Source	A Single Source is Probably Acceptable
Research question	Focus of the research is on replication of previous research or theory testing.	Research is the first to address an important or emerging research question
Context	The context of the research has been previously studied and is well understood.	Research is the first in this context.
Level of analysis	The level of analysis is a supply chain or network.	The level of analysis is individuals or a single function within an organization.
Organizations	The organizations studied are large multinational, multidivisional organizations.	The organizations are small and medium enterprises (SMEs).
Dependent variable	The dependent variable is a perceptual measure of an organizational or supply chain outcome.	The dependent variable is an objective measure of an outcome that is local to the respondent
Independent variables	Polyadic; theory predicts that the constructs are likely to be perceived differently by different respondents.	Monadic; theory predicts that all respondent will perceive the constructs in the same way.

Table 2. Editorial thought process about using single respondents or sources

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