

The Human Factor in SCM

Introducing a Meta-theory of Behavioral Supply Chain Management

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Purpose – To advance SCM by describing the current state of behavioral supply chain management (BSCM) research and paving the way for future contributions by developing a meta-theory for this important field.

Design/methodology/approach – The results are generated by applying the systematic literature review (SLR) methodology and an iterative theory-building approach involving a panel of academics.

Findings – This review provides a comprehensive overview of the BSCM research landscape. Additionally, a meta-theory of BSCM is presented that encompasses all central elements of the research field and introduces the concept of emergence to the field of BSCM. Furthermore, four promising future research opportunities are formulated.

Research limitations/implications – The critical discussions and the formulated research opportunities will help scholars in positioning their research to enhance its contribution.

Practical implications – Results from this research indicate that supply chain decisions benefit from explicit consideration for cognitive and social phenomena.

Originality/value – This review is the first to provide a comprehensive overview of the field of BSCM research and facilitates BSCM in advancing further.

Keywords: Supply chain management (SCM), behavioral research, psychology, humans in supply chains, systematic literature review

Introduction

Many studies within supply chain management (SCM) research have taken a positivist perspective, promoting theoretical optimal solutions and best practices (Sweeney, 2013), while substantial empirical evidence exists that people in supply chains behave differently than theory predicts. Numerous examples underline the assertion that research on SCM has often overlooked the effect of human behavior (Tokar, 2010). In practice, theoretical optimal contracts or universal negotiation strategies rarely exist. In this context, Kalkancı *et al.* (2014) showed that simpler contracts – despite being theoretically suboptimal – are commonly preferred in practice, and Wallenburg *et al.* (2011) and Ribbink and Grimm (2014) found that cultural differences have a significant impact on trust and its effect in supply chain business interactions.

The underlying reason for this discrepancy between theory and practice is that “human and behavioural components (the soft-wiring)” (Sweeney, 2013, p. 73) play at least an equally important role as the hard facts of SCM, such as processes, technologies and measurement systems. Understanding that humans do not act purely rationally, that they care about others and are influenced by their cultural background (Loch and Wu, 2005) relates to the importance of people’s behaviors in supply chains. Managing the behavioral dimension explicitly should be a central theme in any supply chain (Huo *et al.*, 2015). However, behavioral supply chain management (BSCM) “is still at its infancy” (Donohue and Siemsen, 2011, p. 8) and, so far, presents a small niche when compared to the extensive breadth of the entire discipline of SCM.

Recently, this imbalance of the SCM research agenda became evident through a study by Wieland *et al.* (2016). Involving more than 100 academics from the discipline of SCM research, they revealed that the “people dimension of SCM” is the most underrepresented research topic when comparing topics that *will* become and topics that *should* become important (Wieland *et*

al., 2016). Changing this is one of the strategic objectives of the *International Journal of Physical Distribution & Logistics Management* (Ellinger and Chapman, 2016). This paper contributes to this desired development by strengthening the young field of BSCM by means of three research objectives.

The overall aim of this research is to foster the position of BSCM within the broad discipline of SCM research. As previous research has not clearly defined and structured the area of BSCM (Donohue and Siemsen, 2011), the *first research objective* is to map the current state of research in BSCM, particularly with regard to its structure, the applied research methods and the underlying topics that are studied from a behavioral perspective. The *second research objective* is to investigate which common themes and meta-structures exist within BSCM. By that logic, this research objective calls for a meta-theory that not only describes the current state of research but serves as a source from which to derive future research opportunities. Combining the insights from the first two research objectives, the *third research objective* is to explicitly outline the most promising opportunities for future research in BSCM.

As a starting point, it is necessary to explicitly define the scope of BSCM, with respect to both the behavioral aspect and SCM. Regarding the behavioral aspect, the definition by Croson *et al.* (2013) is useful. Following their definition, behavioral research views people in at least one of the following ways: (1) people are motivated beyond monetary payoffs, (2) people's behavior depends on mechanisms that are not (always) conscious to them or their behavior is not planned on purpose and/or (3) people's behavior does not always lead to the optimal solution (i.e., the rational equilibrium in the given context). Additionally, the research must be embedded in the SCM context. This is also how this study draws the line between the neighboring fields of behavioral operations management and BSCM.

Regarding the definition of SCM, one of the most widely accepted core characteristics is that SCM is about the “coordination and integration, and [...] harmonization of operations among supply chain members” (Frankel *et al.*, 2008, p. 3). Following Frankel *et al.* (2008) and adhering to the seminal definitions of Mentzer *et al.* (2001) and Stock and Boyer (2009), SCM can be related to the management of relations between and across business functions, within and across organizational boundaries. Hence, for research to be relevant to this study, either at least two actors need to be involved (i.e. an explicit relational focus on dyads or beyond) or the behavior of a focal actor in the supply chain directly affects the exchange relationships. The latter case includes for example inventory decision making (e.g. Schweitzer and Cachon, 2000; Tokar *et al.*, 2016; Tokar *et al.*, 2014) and judgmental forecasting (e.g. Eroglu and Knemeyer, 2010; Moritz *et al.*, 2014). These for example are core activities in supply chains that have a direct impact on orders to a supplier and inventory levels which in turn affect customer service.

The remainder of this article is organized as follows: First, the applied methodology for identifying and selecting literature as well as for its analysis and synthesis is outlined. Afterwards, results are presented in the order of the introduced research objectives: Current state of research, meta-theory and research opportunities.

Methodology

As BSCM involves a fragmented landscape of research streams and spans the boundaries of different disciplines, articles related to this topic have appeared in a relatively dispersed set of journals. Therefore, to fulfill the research objectives, the systematic literature review (SLR) methodology was applied, which has been recommended to be used for rigorously mapping out the current state of research (Durach *et al.*, 2014), as contributions are searched, analyzed and synthesized based on a pre-determined explicit procedure (Pilbeam *et al.*, 2012). This procedure

ensures a transparent and objective research approach that covers studies across the entire research domain. Based on guidelines from the general management (Briner *et al.*, 2009; Denyer and Tranfield, 2009; Tranfield *et al.*, 2003) and SCM literature (Durach *et al.*, 2014), the following methodological steps were taken.

Preparation for literature search

Before the literature search is conducted, it needs to be explicitly defined which criteria should be met for literature to be included in the review (Durach *et al.*, 2014). Here, a key prerequisite was that the literature matches the definition of BSCM as outlined above. Further inclusion and exclusion criteria are outlined in Table 1, which includes both content-related criteria with the purpose to identify studies relevant to the research question and quality-related criteria with the purpose to ensure a certain level of quality (Tranfield *et al.*, 2003).

-----Insert Table 1 Approximately Here-----

To reflect the diversity in publication outlets that typically cover BSCM-related research, it was decided to follow an inclusive approach (Denyer and Tranfield, 2009) without restricting the search to a predefined set of journals. Instead, widely recognized journal rankings were applied with a rather low threshold to ensure a minimum quality level (JCR impact factor 1.0 or higher, and, in cases when journals were not listed by JCR, ABS category 3 or higher, as recommended by the British Research Excellence Framework).

Search for literature

Following the recommendation to involve database experts (Durach *et al.*, 2014; Wong *et al.*, 2012), librarians from three different universities were involved when developing a search strategy to meet the interdisciplinary and heterogeneous character of the BSCM field.

Eventually, search strings (Delbufalo, 2012; Pilbeam *et al.*, 2012; Wong *et al.*, 2012) were combined with a semi-automated citation analysis and finally a manual cross-check in five central SCM journals. Bias was reduced by involving a group of seven academics who have made major contributions in the field of BSCM. Those were asked to provide a set of seminal articles that any literature review in BSCM should incorporate. After applying the content-related inclusion criteria, this step led to a key sample of 22 relevant articles that were then used to iteratively optimize the search string. The requirement was to retrieve a high number of articles from this key sample while simultaneously keeping the number of irrelevant hits low (Duff, 1996).

For the article search based on search strings, two full-text databases were used: Business Source Complete (BSC by EBSCO) and ABI/Informs (by Proquest). The search strings (Table 2) were constructed by identifying central terms and potential synonyms in BSCM by analyzing publication titles, abstracts, and author-supplied keywords as well as attributed descriptors of each article from the key sample (Duff, 1996).

Applying the search strings to both full-text databases, searching articles published until end of 2015, prompted 2,752 hits with 1,507 entries from BSC and 1,245 from ABI/Informs. Accounting for the fact that 865 articles were registered in both databases, 1,887 non-redundant articles were retrieved via the search strings.

-----*Insert Table 2 Approximately Here*-----

A complementary way of identifying further articles is to conduct a citation analysis that searches forward (for citations by other articles) and backward (for references) from a distinct sample of literature (Briner *et al.*, 2009). As not all journal articles are listed in full-text databases (Adriaanse and Rensleigh, 2013), a citation analysis closes the gaps in the adjacent

literature of the target field and complements an articles search based on search strings. For that purpose, the most central articles from the key sample were selected as the starting point for forward and backward searches. The analysis was carried out by means of the Scopus citation database and yielded 112 additional articles, resulting in a final sample of 1,999 potentially relevant articles.

Selection of pertinent literature

The application of the minimum quality criterion marked the beginning of the selection process. 1,360 articles passed this step. Subsequently, a coding sheet was used to assess the articles regarding the content-related inclusion criteria. This was carried out independently by two researchers to reduce the potential bias that might arise during this process (Durach *et al.*, 2014). The two researchers studied each abstract of the sample and, when no clear decision could be derived from the abstract, the researches reverted to the full text. Decisions were rather inclusive in order to ensure that no potentially relevant article was excluded.

Only with 2.3% of the reviewed articles, disagreements remained. A Cohen's κ value (Cohen, 1960) of 0.96 suggests almost perfect inter-rater reliability (Landis and Koch, 1977) and hence indicates high quality of the selection process. For the 2.3% disagreement cases, an additional expert scholar was included to resolve the issues. Of the 1,360 articles, 142 actually studied BSCM. Eventually, the search strategy was validated by means of a manual cross-check that went back to 2003 from when on at least two BSCM articles were published per year (see Figure 1 below). First, the manual cross-check was conducted in the most important SCM outlets – adhering to Sachan and Datta (2005) and Cantor *et al.* (2011): *International Journal of Logistics Management [IJLM]*, *International Journal of Physical Distribution & Logistics Management [IJPDLM]*, *Journal of Business Logistics [JBL]*, *Journal of Supply Chain Management [JSCM]*,

and *Supply Chain Management: An International Journal [SCMIJ]*. Second, the manual cross-check was extended to further journals with a high number of BSCM publications (see Table 4 below): *Decision Sciences [DS]*, *International Journal of Production Economics [IJPE]*, *International Journal of Production Research [IJPR]*, *Journal of Operations Management [JOM]*, *Management Science [MS]*, *Manufacturing & Service Operations Management [MSOM]*, and *Production & Operations Management [POM]*. This led to the final sample of this study with 199 BSCM articles.

Analysis and synthesis of literature

Following Denyer and Tranfield (2009), multiple independent reviewers were involved in the analysis in order to produce “robust data”. Also, the analysis ought to be thoroughly aligned with the purpose of the review (Denyer and Tranfield, 2009). Therefore, the initially introduced research objectives determined which data from the articles was analyzed and synthesized by means of which particular approach (Durach *et al.*, 2015).

Research objective 1: Current state of research. Starting with a transparent view on the chronological evolvement of the field provides important background information for the subsequent analysis. As an important second step for deepening the understanding of the current state of research and for mapping out the structure of the BSCM field, the final sample of articles was compared to common frameworks about SCM and behavioral research. With this approach, a two-dimensional framework was developed in an iterative process, involving a panel of eight academics and practitioners. First, independently from the article sample, overarching SCM and behavioral research categories were derived from the seminal literature. Second, each panel member was asked to classify a subset of the articles according to the research categories in the framework. Disagreements on how to classify an article or deviations in understanding the

research categories were judged to necessitate further refinement of the framework. Such refinement was conducted iteratively until consensus in the panel was reached. Following the involvement of the panel, each article was independently coded by at least two of the authors in order to map out the current state of research in reference to the framework. Disagreements were solved through discussion and, if necessary, through the involvement of a third coder (Denk *et al.*, 2012).

The analysis of the research methods was conducted according to predefined categories (Table 3) that were derived from the previous reviews in BSCM and SCM (cf. Croson *et al.*, 2013; Pilbeam *et al.*, 2012; Sachan and Datta, 2005), while research topics were analyzed in an explorative manner. After one author had classified each article, another author independently classified a sub-sample. Due to this logic, topics were first identified in an unstructured manner. Subsequently, in an approach inspired by the Q-sort technique (Ellingsen *et al.*, 2010), the identified topics were grouped into categories. As an additional cross-check, leading academics in the field of BSCM were asked to review these preliminary analysis results. Taking their opinions and concerns under consideration, the topics were revised until a multiple exclusive and consistent picture was achieved.

-----Insert Table 3 Approximately Here-----

Research objective 2: Meta-theory. This research objective calls for a creative and forward-thinking approach going beyond mere description, hereby aiming to generate something more than the sum of its parts, as outlined by Denyer and Tranfield (2009) (i.e. the “explanatory” principle). By integrating and juxtaposing the hitherto generated (descriptive) results (Durach *et al.*, 2014) and clustering the articles from different perspectives in several discussion rounds between the authors and numerous other scholars, new insights were generated. During this

process, the authors disengaged from analyzing each article independently but focused on the identification of common structures and elements within BSCM from a broader perspective. This led to the development of a meta-theory.

Research objective 3: Research opportunities. Fulfilling this third research objective was a logical extension of the preceding research objectives. Again, a panel of academics was involved in multiple discussion rounds on identifying prevailing research gaps in light of the descriptive results and meta-theory. Yet, as the surge of all identified research opportunities would have gone beyond the scope of this paper, the authors had to focus on the most promising ideas.

Results

Current state of research

Chronological evolvement of the field. Publications are widespread across 38 journals, which fortifies the decision not to restrict the review to a predefined set of outlets. Yet, only twelve of these 38 journals (*DS, IJLM, IJPDLM, IJPE, IJPR, JBL, JOM, JSCM, MS, MSOM, POM, SCMIJ*) contributed with four or more articles (Table 4). Together, they provide 80.9% of the articles reviewed. All other articles are subsumed under *other* in the following.

-----Insert Table 4 Approximately Here-----

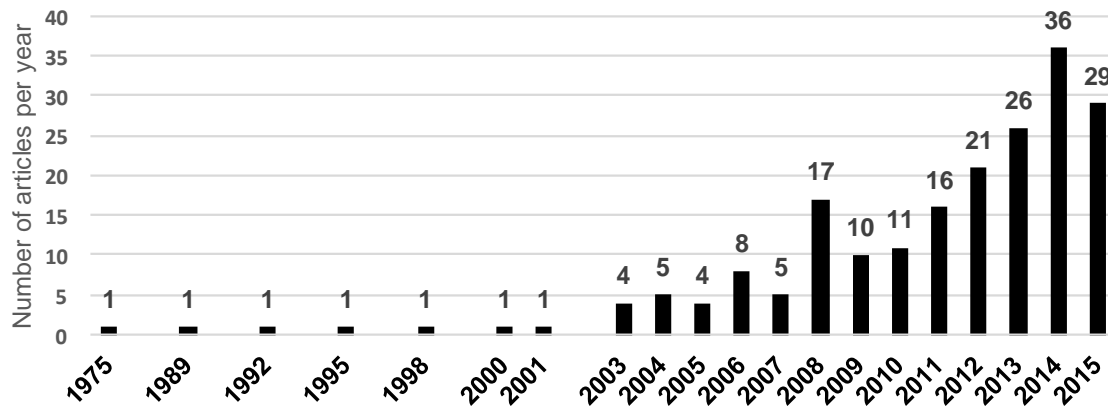


Figure 1 – Number of publications over time

The field started growing about a decade ago (Figure 1), which falls in line with the publication of rather general but heavily cited articles, such as Boudreau *et al.* (2003), Loch and Wu (2005), Bendoly *et al.* (2006), Gino and Pisano (2008) and Bendoly *et al.* (2010). According to Google Scholar, each of these studies has been cited more than 100 times so far. Despite focusing more on operations management than on SCM, these publications also inspired and drove the development of the BSCM field.

Structure of the BSCM area. The generated two-dimensional framework (Figure 2) delineates the potential breadth of BSCM research: The horizontal dimension covers the behavioral research categories. Here, the matrix falls into the two parallel sub-dimensions of cognitive psychological research and social psychological research (Gino and Pisano, 2008), under which the behavioral research categories are subsumed, hereby building on the work by DeLamater *et al.* (2014), Gino and Pisano (2008) and Loch and Wu (2005). However, as cognitive and social psychological factors can be used in the same research, the matrix allows for categorizing articles in more than one sub-dimension.

The vertical dimension covers the SCM research categories in two parallel sub-dimensions. The first dimension refers to the applied levels of decision making in SCM (operational, tactical

and strategic) (Simchi-Levi *et al.*, 2008; Tokar, 2010). The second one encompasses the scope of analysis of SCM (firm, dyad, chain, and network) (Giunipero *et al.*, 2008; Sachan and Datta, 2005). These research categories were chosen as they are widely accepted in the area of SCM research and commonly applied by other SCM literature reviews.











		Behavioral research categories									
		Cognitive psychological research				Social psychological research					
											
		Information acquisition	Information processing	Perception of future outcome	Handling of feedback	The impact of one individual on another's behavior and beliefs	The impact of a group on a member's behavior and beliefs	The impact of a member on a group's behavior and beliefs	The impact of one group on another group's activities and structure	The impact of a social context on groups and individuals	
SCM research categories	Level of decision making	Operational	4	71	19	17	15	7	4	1	9
	Level of decision making	Tactical	4	46	22	12	50	11	7	3	13
		Strategic	3	27	13	3	33	13	8	6	19
	Scope of analysis	Firm level	1	33	11	2	0	2	2	0	7
		Dyadic level	5	36	15	10	45	6	4	3	16
		Chain level	4	22	5	5	5	2	3	0	1
		Network level	0	4	2	2	9	9	2	3	2

Figure 2 – BSCM research framework including numbers of contribution per category

Allocating each of the 199 articles to the corresponding research categories reveals the current state of research and serves as an important basis for identifying research niches and new research opportunities. Unlike the level of analysis in SCM, the other three sub-dimensions (decision making in SCM as well as cognitive and social behavioral research) are not mutually exclusive which allowed for multiple coding within and across dimensions. Hence, an article can contribute to more than one research category in these dimensions.

Based on the analysis from the behavioral perspective, it can be noted that there are few contributions that span the boundary between cognitive and social psychological research. Calculating the ratio of articles that apply both lenses in parallel (29 articles) and the size of the final article sample (199 articles), reveals that only 15% of the articles span that boundary.

Comparing both lenses against each other reveals that cognitive psychological research is slightly more prominent. Here, the focus lies on how humans process information in various SCM contexts (second column) followed by the perception of future outcome (third column), while cognitive aspects in the area of information acquisition and the handling of feedback received relatively little attention.

A similarly tilted picture can be observed within the social psychological categories. While most articles fall into the inter-individual category followed by a smaller number of articles that study the impact of the social context, there is little research on the role of groups. Here it is important to note that, for most of the social psychological articles dealing with how organizations (e.g. suppliers, logistics providers) interact with each other, organizations were regarded as individuals as long as the article neglected the inner social structures of the organization. Havila *et al.* (2004) substantiate this coding principle, as relationships between organizations are defined similarly to the way sociologists define interactions between individuals.

Also within the SCM research categories, the distribution of articles is tilted. Particularly the tactical level of decision making is in the focus of many studies. Interestingly, most of the articles on the operational level relate to the cognitive psychological lens (mostly information processing). On the contrary, tactical and particularly strategic BSCM issues are rather linked with contributions on the social psychological level. A possible explanation is that individual decision making is primary associated with day-to-day actions, as every human subject makes thousands of decisions every day, while (social) relations matter more in the long term.

With respect to their scope of analysis in SCM, most articles focus on the firm or dyadic level, followed by the chain level. Only a small fraction of the articles investigates behavioral issues on

the network level. This result is consistent with previous literature reviews in SCM (cf. Giunipero *et al.*, 2008).

Applied research methods. Figure 3 summarizes the distribution of research methods across the 199 analyzed articles. Those articles with a single methodological approach most often apply laboratory experiments (37% of the articles, neglecting multi-method laboratory experiments). Laboratory experiments have long since been the prevailing method in behavioral research (Boudreau *et al.*, 2003; Donohue and Siemsen, 2011), as they allow for controlling and manipulating behavioral variables with the aim of establishing causality, of which neither surveys nor OR-modeling approaches are capable (Deck and Smith, 2013). Surveys (including statistical sampling) are the second most often applied single research method followed by case studies (detailed further into to those based on a grounded theory (GT) approach).

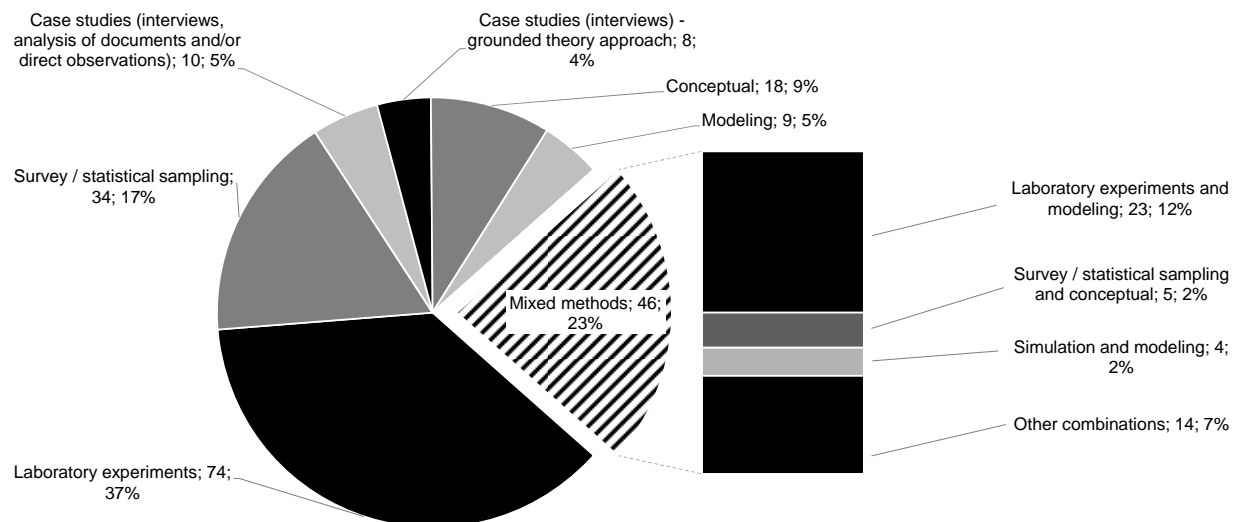


Figure 3 – Distribution of research methods in BSCM

Similarly, within the subset of articles that make use of multiple research methods (23% of the articles), laboratory experiments were used most often. However, it is noteworthy that almost all experiments in mixed methods were combined with OR-modeling approaches. That is because OR-models do not easily capture behavioral factors. Instead, modeling is mostly used as

a technique to provide a reference point of the rational equilibrium against which experimental results can be compared (as for example in Gurnani *et al.*, 2014).

BSCM topics. During the analysis, nine distinct topic fields were identified. It has to be noted that each article could contribute to more than one topic field. Due to this interleaved picture and the large number of different topics, not every article and its topics can be discussed individually. Therefore, Table 5 provides a structured overview of the topic fields and creates additional value by interrelating topics and research methods. Interestingly, the first three predominant topic fields (*SCM relationships*, *inventory and capacity decision making* and *procurement and purchasing*) relate to 86% of the articles (twelve articles addressed two fields). This skew and the rather heterogeneous distribution of applied methods across the topic fields are a reflection of the young character of BSCM. However, it also underlines the existing space for several further contributions, referring to topic fields that received less or even no attention at all.

-----Insert Table 5 Approximately Here-----

A meta-theory of BSCM

The meta-theory, presented in the following, deviates from the traditional analytical theory building approach, which explicitly introduces defined constructs. In contrast, this meta-theory represents a systems approach (Gammelgaard, 2004) with universal cause–effect relations that become explicit when applying the theory in a specific context. The authors followed the broad understanding provided by Suddaby (2015, p. 1) of the term theory as “a way of imposing conceptual order on the empirical complexity of the phenomenal world. [...] Ultimately, theories reflect, in highly abstract terms, the organization of a discipline’s knowledge base.” The new meta-theory is both empirically based as well as a “means of knowledge abstraction” (Suddaby, 2015, p. 2). As a result of following Suddaby (2015), this meta-theory is empirically based, as

some of its parts are already based on valid and reliable empirical knowledge that emanated from contributions in BSCM, yet, it goes beyond merely summarizing empirically proven concepts via the application of a forward-thinking process. In that vein, the applied theory building approach also encompassed “the interpretation of past masters, through parsing canonical text” (Suddaby, 2015, p. 2).

At the meta-level, BSCM encompasses four interlinked core elements (Figure 4): the behavioral context (1), psychological factors as behavioral antecedents (2), moderators (3) and behavioral outcomes (4). The conjunction between these four core elements theorizes the underlying paradigm of BSCM that can be understood as the common denominator of the field.

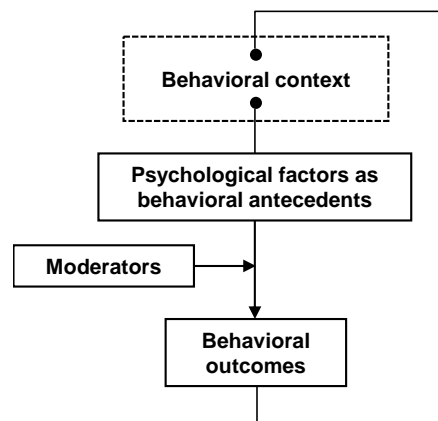


Figure 4 – Meta-theory

Foundational to BSCM is the question of how different psychological factors manifest within the specific context. Depending on this question, the resulting behaviors may take different forms and lead to different outcomes. Therefore, specifying the behavioral context (1) is a useful step for any BSCM research. It can either refer to different types of actors or to different types of relationships between actors. This is essential for identifying and understanding how and from where individual or group behavior originates.

Within BSCM, these origins of behavior, the behavioral antecedents (2), are psychological in character and are inevitably anchored to human nature. While the psychological factors, such as

perceptions and beliefs, are the root cause of every behavioral phenomenon in forms that are static and cannot be changed via managerial action, their ultimate effect, the behavioral outcomes (4), are impacted by moderators (3). Highly relevant to the managerial perspective, moderators are potentially manageable factors, as for example certain rules and procedures that impact behavioral outcomes.

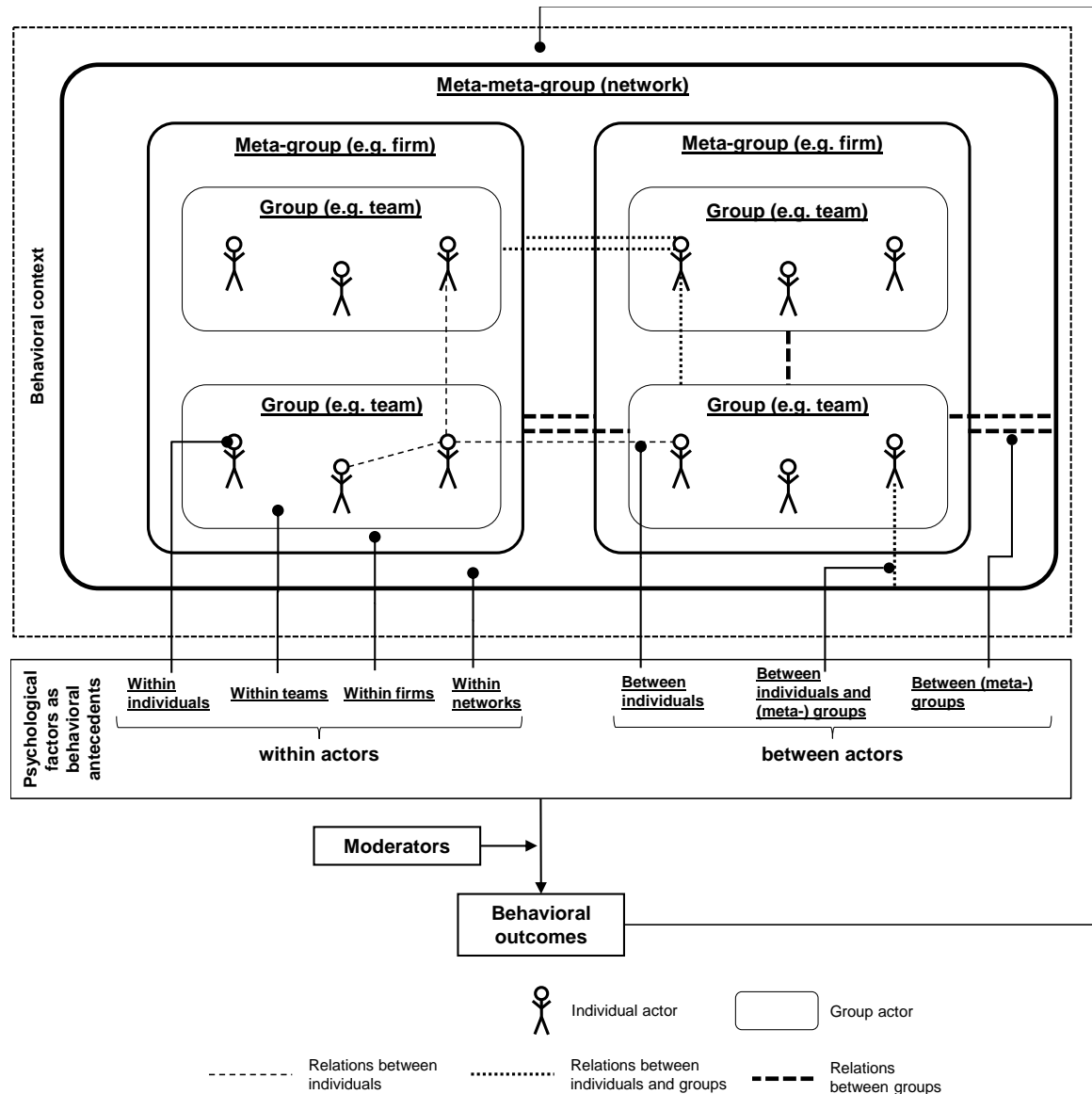


Figure 5 - Behavioral context and its psychological factors

The outcomes in BSCM go beyond standalone behavioral phenomena as viewed in psychology. The interest of BSCM lies in context-specific phenomena that affect the supply

chain. In that sense, the behavioral outcomes in BSCM can be referred back to the same context from which the psychological factors as antecedents of behavior originated (closed-loop approach). Overall, the meta-theory has a modular character as each of the four elements encompasses a large set of items that can be combined in multiple different ways. At the same time, the meta-theory is evolving as over time new relevant behavioral antecedents, moderators, and outcomes are likely to be identified.

Behavioral context. BSCM research examines both individual actors as well as group actors such as teams and firms (which could be described as meta-group actors) or networks of firms (which, in the same terminology, could be described as meta-meta-group actors). In parallel, BSCM research addresses the relations between these actors (between individuals, between individuals and groups and between groups). As depicted in Figure 5, seemingly equal relationships have to be distinguished. For example, the relationship between individuals will differ depending on whether the individuals are (a) members of the same group or one or more individuals are members of a different group (b) within the same firm or (c) within a different firm. Distinguishing in a similar way is also necessary for relations between individuals and groups (4 different cases) and between groups (5 different cases), as also displayed in the Figure.

On the contrary, traditional SCM research mostly addresses the (inter-)organizational level (Gligor and Holcomb, 2013) and neglects both the role of individuals in relations and the notion of multi-level systems (Carter *et al.*, 2015). The multi-level view is a vital benefit of integrating the behavioral perspective into traditional SCM research, as it provides additional impetus that is required to “develop richer and more insightful multilevel theories; and [...] to advance as a discipline,” as called for by (Carter *et al.*, 2015, p. 99).

Psychological factors as behavioral antecedents. The multiple levels of the behavioral context allow for a concrete and tangible description of what *drives* behavior and, in that sense, facilitate answering the question, “What are the factors that are responsible for the way individuals and groups in supply chains behave?” The root causes of the behavior lie in psychological factors that are inherent either to the various actors or to the different kinds of relations within the behavioral context. Hence, the multi-level structure of the behavioral context also serves as a classification for these psychological factors. These fall into the within-actor perspective (within individual, within team, within firm and within network) and the between-actors perspective (between individuals, between individuals and (meta-)groups and between (meta-)groups).

In order to understand how the various psychological factors on the different levels relate to each other and from whence they originate, this theory introduces the concept of emergence to the field of BSCM. Emergence plays an important role in numerous disciplines ranging from philosophy to biology (Russell *et al.*, 2014), and it is surprising that it has not yet made its way into BSCM research. Its central argument is that a higher-level phenomenon is nested in lower-level phenomena, but that the higher-level phenomenon may be more than the mere sum of the related lower-level phenomena (Fulmer and Ostroff, 2016). While the concept of emergence has not been explicitly applied in articles from the field of BSCM, similar trains of thought are found in related articles. Brass *et al.* (2004, p. 802) note: “Many of the variables that explain the formation of interpersonal and interunit networks explain the creation of inter-organizational networks as well. This is not surprising, since inter-organizational relations are often initially created by boundary spanners.” Hence, by the logic of emergence, each of the identified psychological factors on higher levels originates from the lowest level; i.e. from within

individuals and from relations between individuals (Figure 6). In this context, the meso-level theory approach constitutes an ideal vehicle to formalize the concept of emergence (cf. Elsner, 2010). Routed in the Greek language, the term “meso” can be translated as “in between”. By that logic, the meso-level theory approach integrates variable from both micro- and macro-levels with the purpose to formalize and explain their relationship.

Within the current BSCM literature, the psychological factors that serve as behavioral antecedents can be classified into five flows that represent how underlying phenomena develop towards higher levels via emergence. Three of them originate from within individuals, while the other two originate from relations between individuals. Combining these five flows with the structure of the behavioral context reveals 18 distinct psychological factors as displayed in Figure 6. Within actors, the first emergent flow originates from individual perceptions, values and beliefs and emerges into group culture at the team, firm and network levels. This corresponds to the more general literature on organizational culture in which, for example, Deshpande and Webster Jr (1989, p. 4) define organizational culture as the pattern of “shared values and beliefs.”

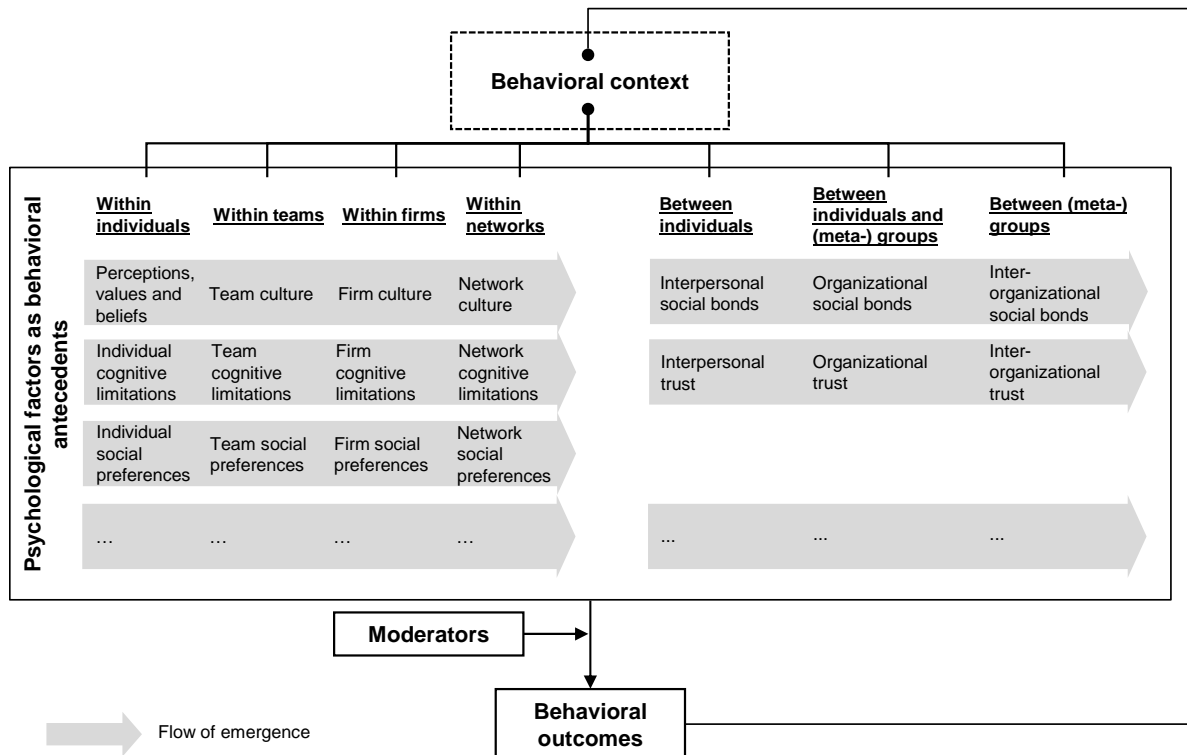


Figure 6 – Psychological factors as behavioral antecedents

The second emergent flow within actors is centered on cognitive limitations, which are inherent to individuals but do not vanish when these individuals work together in groups. Wu and Katok (2006), who study the order decisions of teams, provide an excellent example of how this lower-level antecedent of individual cognitive limitations still plays a role on the higher team level. Their research also underscores that a higher-level phenomenon is not simply the sum of its parts, as team decisions can be substantially better than individual decisions.

The third flow of psychological factors pertains to the concept of social preferences. Even though social preferences are a social psychology phenomenon, their origin lies within the individual actor and can even be referred to as people's "*intrinsic* [...]" preference[s]" (Loch and Wu, 2008, p. 1836; emphasis added). At this point, this theory deviates from the dominant understanding of social preferences as a mutual phenomenon *between* individuals "when two or more individuals interact" (Donohue and Siemsen, 2011, p. 5), because social preferences exist

as distinct psychological factors *within* groups. Also teams, firms or even networks exhibit social preferences for other groups and for individuals. According to the concept of emergence, these social preferences may differ from the average of all individual social preferences. Still, group social preferences have so far not been explicitly formulated and addressed within BSCM.

Between actors, the first flow of psychological factors pertains to the relation itself. Many BSCM articles share a common interest in the “nature and intensity” (Hartmann and Herb, 2014, p. 248) of the relation between actors. Subjects of interest are, for example, the amount of effort invested in the relation, the duration and common history of the relation (Hyndman *et al.*, 2014) or the informal understandings (embedded in psychological contracts) about reciprocal behavior between individuals (Parker and Russell, 2004). Bundling the various terms, this meta-theory refers to them as social bonds. This view is consistent with other work that defines social bonds as “investments of time and energy that produce positive inter-personal relationships between actors” (Ramström, 2008, p. 504). Ramström (2008) also emphasizes that bonds take their origin from relations between individuals and emerge into organizational and inter-organizational bonds. On a related note, Gligor and Autry (2012) found that inter-organizational communication processes can be enhanced by the personal relationships between boundary-spanning employees. Establishing and investing inter-organizational bonds on the individual level should therefore be a primary concern of supply chain managers who wish to strengthen the relation with other firms in the supply chain (Gligor and Autry, 2012).

While social bonds represent a broad and general description of the underlying psychological factors inherent to relations, trust as the trigger of the second flow of psychological factors deserves to be mapped out separately, as it is subject to many BSCM articles. Still, some may argue that trust is rather an outcome of social bonds and not the trigger of a distinct flow of its

own. Refuting this argument, BSCM does not study trust as a means in itself but focuses on SCM-specific outcomes, driven by trust. For example, Özer *et al.* (2014) study the effect of trust on the integration of demand and supply. Just as with social bonds, trust begins at the inter-individual level and also occurs as organizational and inter-organizational trust (Whipple *et al.*, 2013). Following this thought, Hill *et al.* (2009) study trust in a buyer–supplier relationship by explicitly collecting data at the individual level (boundary-spanning employees), then analyzing and synthesizing it in order to derive implications for the inter-organizational level.

Eventually, it must be noted that the concept of emergence does not object the retroactive effect that higher-level psychological factors may have on psychological factors on the lower-level. An illustrative example is the effect of culture. It emerges from the level of individual perceptions, values and beliefs, but also shapes how these perceptions, values and beliefs develop within each individual that is part of that particular group. To facilitate clarity of the meta-theory's illustration in Figure 6, this retroactive influence is not mapped out explicitly.

Moderators: Regarding the connection between the psychological factors as the root causes of behavior and the behavioral outcome, the literature has identified and examined various moderators. The intensity to which these moderators are present will alter the cause–effect relation between psychological factors and behavioral outcomes. Yet, in the BSCM literature, moderators play a minor role compared to the other elements of this meta-theory. This offers room for future research to complement and extend the existing understanding of moderators.

Extending the strategic framework of Ward *et al.* (1996), moderators relevant to BSCM may be categorized as environmental, structural, or procedural (Figure 7). Particularly, the latter two categories are relevant to the managerial perspective, as they encompass moderators that may be

actively controlled by managers. In contrast, environmental moderators are viewed as given and not controllable.

So far, two environmental moderators have been explicitly addressed in the BSCM literature. The first moderator, homophily (i.e. experienced similarity in business contexts, Autry *et al.*, 2014) is studied from different angles. For example, Ribbink and Grimm (2014) explore how (similar or diverging) national cultures in a dyadic context moderate the impact of trust on joint profits and Lioukas and Reuer (2015) argue that similarity in organizational cultures can shape perceptions and expectations within the exchange relationship. The second environmental moderator is the market condition in which the supply chain is embedded. Typical examples for this moderator are uncertainty in supply (Ancarani *et al.*, 2013) and uncertainty in demand (Serman, 1989).

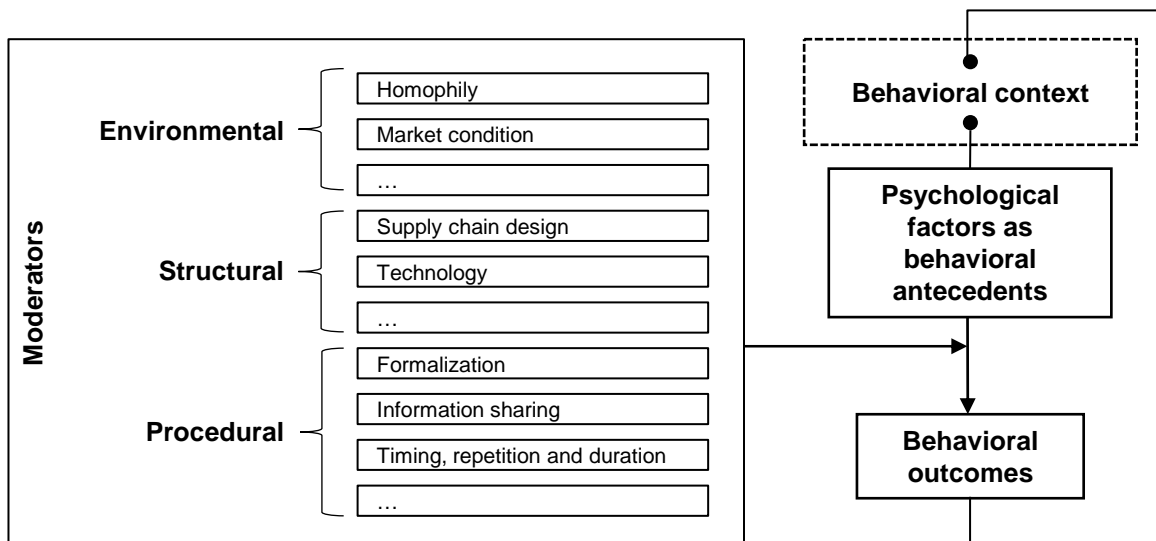


Figure 7 – Moderators

The second category, the structural moderators, refers to the selection of actors and technological elements and their arrangement in the companies and the supply chain as a whole. In this regard, several studies indicate that supply chain design has a moderating effect. For example, Cantor and Katok (2012) argue that a four-stage supply chain may be too difficult for

individuals to process and hence suggest reducing the number of echelons involved in a serial supply chain in order to elicit the desired behaviors. As a second structural moderator, the applied technology plays an important role. This moderator is particularly relevant to communication between actors as, for example, the impact of trust in the context of supplier selections depends on the chosen communication channel (e.g. face-to-face, email, internet reverse auctions) (Huang *et al.*, 2008).

Procedural aspects, as a third category, comprises three moderators: formalization (like compensation schemes, cf. Ebrahim-Khanjari *et al.*, 2012, or contracts, cf. Kalkanci *et al.*, 2011), information sharing (c.f. Zhao and Zhao, 2015) as well as timing (i.e. when an event occurs), repetition and duration. Regarding the latter moderator, for example Eckerd *et al.* (2013) point out that breaches in the early state of a relationships have a less severe psychological effects than in a matured relationship.

Behavioral outcome: So far, the BSCM literature has focused on four behavioral outcomes: (1) relationship effectiveness, (2) customer satisfaction, (3) integration of demand and supply, and (4) overall supply chain performance. These may be linked back to the behavioral context, which leads to a closed-loop approach within this meta-theory. As, however, the exchange relationship constitutes the ultimate object of interest in SCM (as outlined in the introduction), a central notion of this meta-theory is that the outcome must have implications for relations between at least two individuals and/or groups (Figure 8).

Relationship effectiveness (1) can be the outcome in BSCM research at all three levels of the behavioral context. For example, with regard to relationships between individuals, Holma (2012) studies how social bonds and dedicated contacts impact the effectiveness of interpersonal relationships. Tangpong *et al.* (2010) investigate the effectiveness of relational exchanges

between a buyer and a supplier on the organizational level. A third example that covers the hybrid case (relations between individuals and groups) but focuses on customer satisfaction can be seen in Peinkofer *et al.* (2015), who show that an end-customer experiencing a stock-out of price-promoted products is less dissatisfied with the supplier compared to when shopping products without price promotion. Customer satisfaction, as the second behavioral outcome variable, has been investigated within BSCM in the context of business-to-customer (B2C) relations (i.e., between individuals and groups) and business-to-business (B2B) relations (i.e., between groups).

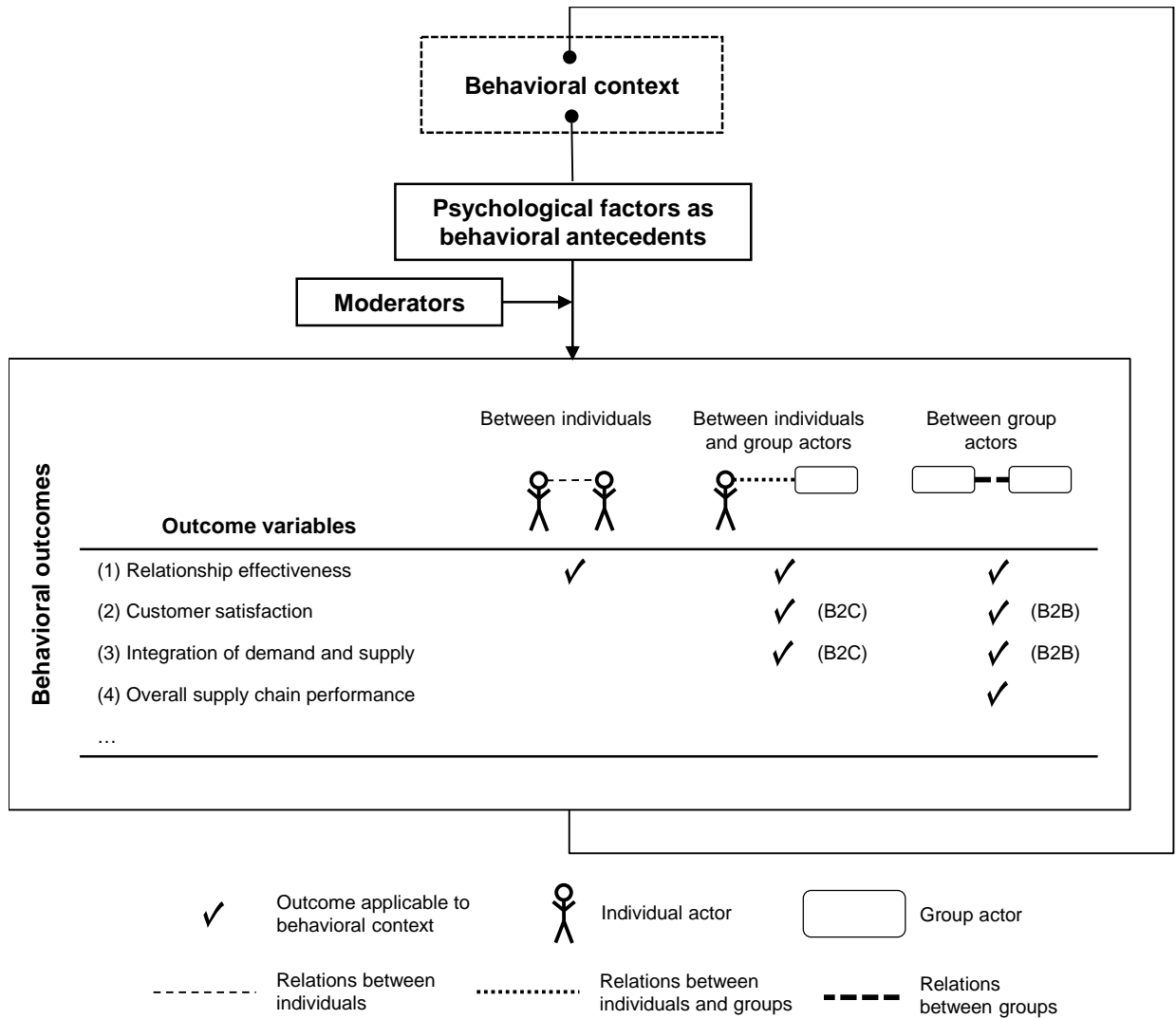


Figure 8 – Behavioral outcomes in the scope of the behavioral context

The integration of demand and supply (3) is the most prominent outcome variable of BSCM contributions in the topic field of inventory and capacity decision making. Similarly to customer satisfaction, this outcome is also relevant either on the inter-group-level (e.g. B2B context) or between individuals and group actors (e.g. B2C context). For example, Oliva and Watson (2009) study this outcome variable when examining how to mitigate biases in consensus forecasting in supply chains. Similarly, also overall supply chain performance (4) applies to the inter-group-level only. Besides supply chain efficiency and effectiveness (e.g. Tsanos *et al.*, 2014; Wu, 2013), further outcomes are also subsumed under this rather general variable, such as risk

minimization (cf. Gurnani *et al.*, 2014, who compared single sourcing against multiple sourcing from a behavioral perspective) or the distribution of joint profits (cf. Ribbink and Grimm, 2014, who develop a theory on the impact of national culture in this regard).

In addition to the introduced behavioral outcomes, it is likely that further potentially relevant outcome variables exist. Each outcome variable that has been investigated in traditional SCM research could also be studied through the lenses of BSCM. Additionally, it must be said that not each article is explicit about the ultimate outcome of the research undertaking. Therefore, this meta-theory also seeks to encourage future BSCM contributions to be more precise about how exactly their findings matter to SCM.

Research opportunities

The description of the current state of research as well as the introduced meta-theory has indicated numerous research gaps in BSCM. Some of these gaps have been more obvious and have already been shortly discussed above. However, in order to provide an even stronger impetus for the positive development of the field of BSCM research, the four research opportunities, considered by the authors as most important and innovative, will be outlined as follows.

Research opportunity 1: Integrating cognitive and social psychological research. In the real world, it is not a matter of choice whether cognitive or social psychological dynamics apply. Whenever individuals interact, different psychological factors become relevant *in addition* to the biases and errors of individual decision making (Donohue and Siemsen, 2011). Therefore, value can be added to SCM by spanning the apparent boundary between cognitive and social psychology. For example, Özer *et al.* (2014) explore cognitive information processing in parallel to trust formation when examining how supply chain members from different countries of origin

(China and the United States) exchange forecast information. They find that the amount of trust, exhibited during the exchange process, depends on the cultural background, while cognitive biases remain stable across the two different cultures. This nicely illustrates that combining both psychological lenses in one study deepens the generated insights. Similarly, Kalkancı *et al.* (2014) draw on both bounded rationality and social preferences when studying how to design contracts from a behavioral perspective. Their study reveals that suppliers exhibit greater bounded rational behavior when interacting with human buyers compared to interacting with computerized buyers and that fairness concerns do not fully disappear when interacting with computerized buyers. These two examples underscore the finding that inner-human processes and interactions inevitably belong together, which is why future research on BSCM should more often apply both lenses in parallel.

Research opportunity 2: Applying a holistic view to decision making and problem solving. Whenever people make decisions or solve problems, their activities involve multiple steps like “the acquisition, processing, and interpretation of information from different sources” (Gino and Pisano, 2008, p. 682). Hence, cognitive activities ought to be viewed holistically. Given the strong focus on the information processing part in past BSCM research, this leads to a call for more research on how information is acquired and on the role of feedback and the perception of future outcomes. Also, in this regard (similar to *research opportunity 1*), future research should take a more inclusive approach by integrating the multiple steps of decision making and problem solving. Among many others Ancarani *et al.* (2013) made valuable contributions to better understand information processing with respect to the bullwhip effect. However, relatively few insights exist on how information acquisition affects the outcome of ordering decisions. For example, it could be worthwhile to investigate the role of framing (i.e. how input information is

presented) or information avoidance (i.e. peoples' tendency to neglect information that might cause mental dissonance) in this regard.

Research opportunity 3: Strengthening the concept of emergence and applying meso-level theory approaches. More research is necessary that strives to trace the cause–effect paths of supply chain phenomena to the lowest level from which they emerge. The meta-theory introduced here places emphasis on individual human actors. Even social preferences originate from within each individual before emerging into behavioral group phenomena on the team, firm or network level. This view is well formulated by Gligor and Holcomb (2013, p. 328), who point to an unmet “need for research examining interfirm relationships at a micro/individual level, rather than the traditionally adopted firm-to-firm view, in order to account for the social/relational elements of firm-level relationships”.

The concept of emergence also calls also for explicit reasoning when referring to phenomena on the organizational level. Interestingly, many of the social psychological studies that intend to make a contribution on the organizational level generate their findings empirically on the individual level (e.g. by means of in-between human subject experiments), but then generalize their results to be applied in the context of firm-to-firm relationships. Examples of studies that investigate buyer–supplier relationships in this way include Joshi and Arnold (1998) and Kalkanı *et al.* (2014). Their research undoubtedly makes a very substantial contribution, but it also illustrates that the concept of emergence seems to be taken for granted in some cases in which it could be beneficial to better understand how behavior between groups is impacted by individual preferences and behaviors between the individuals that are part of these groups, particularly with respect to the organizational context. Therefore, it requires additional multi-level research (Carter *et al.*, 2015) by means of meso-level theory building approaches (cf.

House *et al.*, 1995). While some BSCM studies already formulate the idea of emergence, though rather implicitly, no explicit application or development of a meso-theory can be found. Future BSCM studies should therefore explicitly formalize the relationship between variables from different micro and macro-levels.

Research opportunity 4: Complementing the meta-theory. The presented meta-theory of BSCM offers various avenues for future extension. The meta-theory was developed by combining findings from the BSCM literature and the authors' own theorization on the basis of identified meta-structures and, thus, goes beyond a mere clustering of the existing literature. This approach leaves room for further research. First, it will be worthwhile to revisit the meta-theory after a certain time to integrate new BSCM knowledge. Also, future BSCM research could focus on elements that are not yet explicitly identified within the meta-theory; e.g. additional moderators or outcome variables. Second, this meta-theory is also intended to inspire and incite the community to think more freely about additional elements or to critically review the meta-theory in its current form and to consider which further higher-level antecedents might exist based on the concept of emergence.

Research opportunity 5: Broaden the scope of inventory and capacity decision making. Given the fact that planning is usually a decomposed process (Stadtler, 2005) with various sub-planning tasks that are carried out by different functions or teams, and individuals (Oliva and Watson, 2011), it is surprising to see the one-sided focus on cognitive effects in the study of inventory and capacity decision making. As decomposed processes naturally come along with collaborative activities that involve more than one actor, the social component is inherent to it. Yet, "the field is still at its infancy in understanding how other-regarding preferences such as fairness and social status impact supply chain interactions" (Donohue and Siemsen, 2011). Therefore, an additional

research opportunity lies in examining the social exchange relationship between individuals that engage in collaborative inventory and capacity decision making processes.

Additionally, the latest developments in the field of big data and predictive analytics have made demand forecasting a highly relevant area of application for automated techniques (Stadtler, 2005; Waller and Fawcett, 2013). With the help of such automated techniques, the demand planning human actor could be replaced by an automated system. Surely, this seems promising: Superior predictive analytics approaches could be capable of delivering higher planning performance and potential social conflicts in the interface between production and demand planning should be resolved. However, little insights exist on whether humans have the “emotional fortitude” (Fawcett and Waller, 2014) to cope with such automated techniques. For example, Schoenherr and Speier-Pero (2015) report that practitioners find predictive analytics overwhelming and difficult to manage. Hence, it requires additional efforts in BSCM to understand the interplay between automated techniques and humans in inventory and capacity decision making processes.

Conclusion

It is certain that BSCM has gained impetus. Still, compared to the extensive theoretical and methodological breadth of the broader SCM discipline, BSCM – recently with no more than 36 publications per year –represents a small niche, although human behavior is indeed a factor in nearly every supply chain setting. Behavioral assumptions and arguments are simply not explicitly stated in traditional SCM research. This is why it needs further effort to support BSCM in becoming more important. This study offers a comprehensive overview of past BSCM research but also provides pathways that support this desired development. The descriptive analysis of the research field, the comprehensive meta-theory and the formulated research

opportunities are helpful in identifying research gaps and providing answers to the pending research questions in this important field. Also, it is hoped that the forward-thinking approach that was applied when developing the meta-theory will help the BSCM field in opening up new perspectives by engaging in new and critical dialogues in order to grow and prosper.

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Note: The full list of the searched and reviewed literature can be obtained from the authors.

Table 1 – Inclusion criteria

Inclusion Criterion	Rationale
Quality	Article was published in a peer-reviewed journal with an impact factor above 1.0 in the Journal Citation Report (JCR) 2015 or if the article is not listed in the JCR 2015, the journal was ranked in the ABS ranking 2015 in the third category or higher.
Content	Article matches the SCM definition of this research.
	Article matches the definition of behavioral research of this paper.
	Article makes a theoretical contribution.

Table 2 – Search strings for data base search

Data base	Search string	Settings
BSC (EBSCO)	(TI Behavio* OR AB Behavio*) AND (TI ("Suppl* Chain*" OR SCM OR "Suppl* Network*" OR Interorganization* OR Inter-Organization* OR Interorganisation* OR Inter-Organisation*) OR AB ("Suppl* Chain*" OR SCM OR "Suppl* Network*" OR Interorganization* OR Inter-Organization* OR Interorganisation* OR Inter-Organisation*) OR DE Supply Chains OR DE Supply Chain Management)	Limit to peer reviewed journals only
ABI/Informs (Proquest)	(TI(Behavio*) OR AB(Behavio*)) AND (TI("Suppl* Chain*" OR SCM OR "Suppl* Network*" OR Interorganization* OR Inter-Organization* OR Interorganisation* OR Inter-Organisation*) OR AB("Suppl* Chain*" OR SCM OR "Suppl* Network*" OR Interorganization* OR Inter-Organization* OR Interorganisation* OR Inter-Organisation*) OR SU(Supply Chains))	Search in expert search

Table 3 – Research method categories

Type	Research method
Non-empirical	<ul style="list-style-type: none"> Conceptual Modeling Simulation
Empirical	<ul style="list-style-type: none"> Archival studies Case studies (interviews) - grounded theory approach Case studies (interviews, analysis of documents and/or direct observations) Laboratory experiments Survey and statistical sampling
Other	<ul style="list-style-type: none"> Mixed methods

Table 4 – Number of publications by journal

Journal	No. of articles	Share
MS	31	15,6%
JOM	26	13,1%
POM	22	11,1%
JBL	16	8,0%
JSCM	16	8,0%
IJPDLM	13	6,5%
DS	8	4,0%
IJPE	8	4,0%
MSOM	8	4,0%
IJLM	5	2,5%
IJPR	4	2,0%
SCMIJ	4	2,0%
Other	38	19,1%
Total	199	100%

Table 5 – Topic fields in BSCM

Topic field	No.	Ratio	Explanation and topic examples	Dominant methods
<i>SCM relationships</i>	79	40%	<ul style="list-style-type: none"> • Research questions can be differentiated by whether the subject of interest refers to relationships on the organizational or individual level • Organizational level: The role of justice in the context of buyer–supplier relationships or the role of trust in forecast in information sharing • Individual level: How to manage personal relations with the aim to create positive business outcomes, the role of long-term relationships or the empirical investigation of social preferences in supply chain transactions 	<ul style="list-style-type: none"> • Laboratory experiments • Survey and statistical sampling • Conceptual • Case studies
<i>Inventory and capacity decision making</i>	70	35%	<ul style="list-style-type: none"> • Suboptimal decisions within focal actor inventory management (e.g. newsvendor problems) and in multi-echelon inventory systems • Reasons for suboptimal decisions are predominantly selected based on cognitive psychology and so far no strategy has been identified that can fully mitigate the corresponding effects 	<ul style="list-style-type: none"> • Laboratory experiments • Mixed methods • Modeling
<i>Procurement and purchasing</i>	34	17%	<ul style="list-style-type: none"> • Buyer–supplier interactions and supplier selection in the context of human decision making such as debiasing strategies or different cultural backgrounds • Auction design: comparison of different auction formats, particularly by investigating whether assumptions derived from positivistic auction theory still hold in the context of human behavior in practice 	<ul style="list-style-type: none"> • Laboratory experiments • Survey and statistical sampling
<i>Contract design</i>	14	7%	<ul style="list-style-type: none"> • Contract design for boundedly rational actors (e.g. complexity vs. simplicity, price schemes) 	<ul style="list-style-type: none"> • Laboratory experiments
<i>Cultural context</i>	12	6%	<ul style="list-style-type: none"> • Complementary to other topic fields, such as buyer–supplier relations, procurement and purchasing or the impact of cultural background on newsvendor problem solving 	<ul style="list-style-type: none"> • Laboratory experiments • Case studies
<i>Agent-system relationships</i>	11	6%	<ul style="list-style-type: none"> • Relations explicitly between individuals and organizational bodies (not under <i>SCM relationships</i>) • How governance shapes individuals, how individuals shape organizations 	<ul style="list-style-type: none"> • Survey and statistical sampling
<i>Consumer behavior</i>	10	5%	<ul style="list-style-type: none"> • Consumer reactions (e.g. reciprocity) to supplier actions or supply chain design 	<ul style="list-style-type: none"> • Laboratory experiments
<i>Outsourcing</i>	7	4%	<ul style="list-style-type: none"> • Outsourcing decision making • Social psychological consequences of outsourcing 	<ul style="list-style-type: none"> • Conceptual
<i>Other</i>	16	8%	<ul style="list-style-type: none"> • Topics of single occurrence, such as risk management, sustainability • Development of overarching frameworks or discussion of behavioral implications beyond single topics 	<ul style="list-style-type: none"> • Conceptual • Laboratory experiments