Multilevel Issues in Supply Chain Management

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Summary:
This study focuses on possible contributions of the multilevel approach to research in supply chain management. Supply chains consist of multiple organizations comprising different departments with people who are interacting inside and across organizations. Factors at different levels may thus influence chain performance in different ways. What is more, the multilevel approach recognizes that concepts may have different or similar meanings at different levels. Finally, the multilevel approach makes nested data structures, for instance data of ten purchasers nested in a purchasing department, more apparent and analyzable. A multilevel approach to SCM may contribute to this field in at least three ways: (1) conceptually/theoretically, (2) in a methodological sense and (3) in an analytical way. In this paper we will elaborate on these issues and we will apply them to our own research on human behavior in supply chains.

Keywords:
Supply Chain Management, Multilevel Theory, Organizational Behavior

1 Introduction

Long before a multilevel approach became popular in organizational studies, it was used in educational research to help find answers to questions such as ‘does it matter to which school I send my child?’, ‘what is the impact of class size on the performance of individual pupils?’, or ‘what is the impact of the didactical style of a teacher on the learning outcomes of individual students?’ (see, for example, Burstein, 1980; Cronbach & Webb, 1979; Raudenbush & Bryk, 1986; for an overview, see Hox, 2002). It was clear that the performance of individual pupils was not only dependent on characteristics of these pupils themselves, such as, for example, intelligence, but also depended on the class or school they were in. This actually means that the performance of individual pupils from the same school and/or class, at least partly, depends on their shared context. From a statistical point of view this means that the results of students within the same class and school are not independent, which is an assumption to apply traditional ways of analyzing and explaining the variance of variables, such as school success. Multilevel analysis does not hold this assumption and takes the interdependence of observations into account.

Later on, a multilevel approach was used to find answers to organizational questions, such as ‘what impact does being in a team have on individual motivation?’ or ‘what is the impact of reward policies on individual motivation?’ (for an overview, see Klein & Kozlowski, 2000). The goal of this contribution is to extend the application area of multilevel methodology to the field of supply chain management (SCM). For illustrative purposes we will focus on the area in which we do research ourselves, i.e. behavioral issues in supply chain management. In several places we will include examples that we have borrowed from a case study that we recently conducted in a large manufacturing firm.

As stated above, a multilevel approach has consequences for the way in which empirical material should be analyzed. However, the implications of a multilevel approach are more far-reaching than only these analytical consequences. It also affects theory building, the design of the study, the definition of concepts and the composition of measurement instruments (e.g. Chan, 1998; Klein & Kozlowski, 2000). Therefore, multilevel research brings with it several critical issues and considerations. The following three issues (e.g. Hox, 2002; Klein & Kozlowski, 2000; Snijders & Bosker, 1999) have especially been signposted as key issues in multilevel research, i.e. (1) the specification of levels and their interrelations, (2) constructs at different levels and measurement issues, and (3) data structures and analysis. In this paper we will highlight these three issues. However, before doing this we will briefly introduce our research subject, i.e. behavioral issues in SCM and the case study we will use for illustrative purposes.

2 Behavioral Issues in Supply Chain Management

Research suggests that close collaboration within supply chains leads to improved performance, for example reductions in capital investments, improvements in conformance quality, risk reduction (Lado et al., in Johnston et al, 2004) and improved process technology adoption (Johnston & Linton, in Johnston et al., 2004). However, in current supply chain research little attention seems to be paid to the way collaboration takes place and to the behavior of people that might stimulate or hinder collaboration. The scant research that does exist seems to focus on concepts such as trust or commitment without paying much attention to the people involved who actually expose this behavior. We want to study how different chain types initiate human behavior that is beneficial or disadvantageous for supply chain performance. For example, the behavior of purchasing managers might be disadvantageous when purchasing managers are rewarded for getting the best price out of suppliers, thereby hindering the development of longstanding relationships (Beth et al., 2003).

In our study we distinguish two chain types: innovation-oriented chains and cost-oriented chains (Darr & Talmud, 2003; Lamming et al., 2000; Randall et al., 2003). Innovation-oriented chains create unique products and are characterized by the ability to coordinate technological developments (Kumpe & Bolwijn, 1994). Activities are non-routine and non-repetitive and are often performed in multidisciplinary teams that are well equipped with far-reaching power. Cost-oriented chain types are distinguished by large-scale facilities, long production lead times, large batch sizes, low product variety, standard procedures and routine tasks (Randall, 2003; Kumpe & Bolwijn, 1994). Buyers and sellers in innovation-oriented chains will experience uncertainty regarding product design and product application and will have to interact in order to arrive at shared ideas about the product and eventually its development (Darr & Talmud, 2003). Darr & Talmud (2003) proved that interaction in the sales process of innovation-oriented chains primarily occurs between technical experts on the work floor, without the brokerage of distributors or sales representatives. However, in cost-oriented chains, properties of the product were clear and the sales process was arranged in formal sales contracts at the strategic level of sellers' and buyers' organizations. A lot less interaction was needed in order to exchange the product, and interaction primarily occurred by means of formal forms and letters and strict protocols based on clauses in the sales contract.

We expect that these differences between innovation-oriented chains and cost-oriented chains influence the level at which behavioral issues predominantly influence chain performance, as well as influence the direction of behavior within firms that are involved (either bottom-up or top-down). In line with Darr & Talmud (2003) we suppose that innovation-oriented chains' interaction between supply chain partners will mainly take place at the operational level and that consequently, performance will be influenced by human behavior at the operational

level. On the other hand, based on Darr & Talmud (2003) it is expected that interaction within cost-oriented chains will predominantly occur at the strategic level and that therefore human behavior will influence performance at the strategic level. Furthermore, we expect that in innovation-oriented chains, behavior at the operational level affects decisions at higher levels, much more than the other way around. In other words, behavioral issues between suppliers and buyers at the operational level will influence decisions at the tactical and strategic level of buyer's and seller's organizations. For example, if a buying assistant in an innovation-oriented chain is rewarded for buying at high speed, this will affect the decisions of the supplier's technical experts and will hence influence strategic decisions regarding the supplier's product development process. Contrastingly, we expect that in cost-oriented chains, strategic decisions will influence behavior at the operational level. Figure 1 presents our multilevel view of on the one hand the interactions between buyers and suppliers and thus the levels at which behavioral issues influence performance (horizontal arrows), and on the other hand the cross-level processes within firms that evolve out of the interactions between buyer and supplier (vertical arrows). Of course, in most situations interaction occurs on other levels as well, and there might be both top-down as well as bottom-up processes at the same time, but these will be less dominant and are therefore presented with gray dashed arrows. In the next three sections dealing with the before-mentioned three multilevel issues, we will refer to this conceptual model.

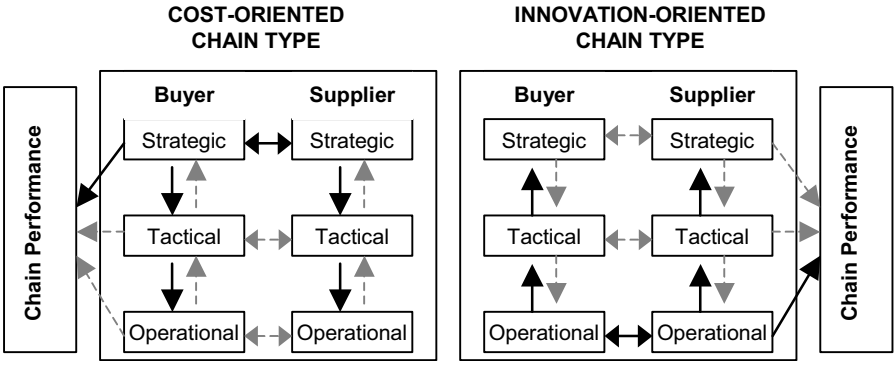

Figure 1: Multilevel Model of Supply Chain Management in Two Chain Types

Our mini case study involves a large manufacturer with a substantial supplier base and clients all over the world. We chose to study this company because it comprises two supply chains: a cost-oriented chain where mature products are manufactured and an innovation-oriented chain where new products are developed. We are in an early stage of studying these chains and we will now only report on data gathered in the cost-oriented chain. Within the cost-oriented chain we conducted

five semi-structured interviews with managers involved in supply chain management. These managers were asked to indicate how human behavior played a role and influenced chain performance. In the following sections we will provide examples from this mini-case, and for each multilevel issue we will specify to what extent this issue played a role in the mini case and in what way.

3 The Specification of Levels and Their Interrelatedness

Supply chains essentially consist of several firms with people cooperating across boundaries. These people behave, act and make decisions within various levels of the supply chain. At the strategic level, for example, purchasing management specifies goals and develops differentiated strategies towards their supply market (Kraljic, 1983). At a tactical level, a senior buyer will implement these strategies, select the right suppliers, negotiate, and draw up supply arrangements. These decisions are made within the goals and policies set at the strategic level, and therefore are nested therein. At the operational level of the supply chain, a materials planner or buying assistant place their specific orders with certain delivery times. Again, such decisions will be framed within the higher level arrangements.

In our case study, supply chain coordination is arranged at the strategic and tactical level with the use of long-term contracts. In these contracts the approximate amount of material delivered and at which price, is affirmed. In the case of large suppliers, the plant manager is the first one to have contact with a supplier. Senior buyers (at the tactical level) wait for the plant manager's approval to start the negotiation process and to draw up contracts. After these contracts have been arranged, interaction with suppliers will mainly occur at the operational level by procurement assistants. The purchasing manager made clear that procurement assistants act within the bounded space of the strict contract clauses. They are not allowed to make slight price changes, or to negotiate about product specifications. If procurement assistants signal any problems then they have to communicate these with the senior buyers at the tactical level. The senior buyers will then have contact with the supplier and will try to solve the problems.

It becomes clear that in this chain, important decisions are taken at the strategic level and that these decisions reduce the space people at lower levels have to operate freely. The relationship between this manufacturer and its suppliers is mainly influenced by interaction at the strategic and tactical level and by top-down processes between these levels and the operational level.

The different levels at which SCM actually takes place has not received specific attention from many researchers in the field of SCM. Most often, researchers do not specify their level of interest or they mix up different levels (Klein et al., 2000). A large part of SCM research primarily considers issues on the macro level, such as the actions of an entire supply network (e.g. Uzzi, 1997) or, the way characteristics of the supply relationship influence the outcomes of the supply relationship (e.g. Wilson, 1995, in Klein et al., 2000). A moderate amount of SCM research is focused on the micro level and deals with phenomena such as trust (e.g. Johnston, 2004; Zaheer et al. 1998) and personal ties (e.g. Ford et al., 1986). There is of course a premise that macro-level SCM practices influence the attributes and behavior of the individual worker, and that in turn, micro level variables contribute to higher-level variables. For instance, individual performance will contribute to supply chain performance, and supply chain cooperation may emerge from the activities of the individual workers. However, multilevel research in the field of SCM that exclusively focuses on the link between the different levels is scarce, whereas it is exactly this link between different levels that could add to our understanding of supply chain performance. The multilevel approach explicitly recognizes that micro phenomena are embedded in macro contexts and that macro contexts often originate from interactions of microelements (Kozlowski & Klein, 2000). According to Koslowski & Klein (2000), a multilevel model must indicate how variables at multiple levels influence each other. Thus, in our study, in order to get to know how human behavior influences the performance of a chain, we have to know at which decision-making levels (strategic, tactical or operational) chain performance is influenced by behavior, and how these different levels are related to each other. Levels can be related to each other either top-down or bottom-up.

In top-down processes, lower levels are influenced by higher-level factors, which form the context for lower level variables. For instance, arrangements made between supply chain partners at the strategic level will certainly influence the day-to-day buying behavior of buying assistants at operational levels. If at the strategic level it is decided that efficiency and cost reduction are important indicators for deliveries in the chain, you wouldn't expect buying assistants to discuss new product development possibilities.

In bottom-up processes, lower level actions affect higher-level phenomena. Many group and organizational phenomena are formed by the behavior, cognition and characteristics of individuals who interact (Kozlowski & Klein, 2000). The interaction of individuals gives rise to a collective behavior pattern, e.g. group norms, which transcends the individuals who produced it. These collective behavior patterns form the basis for collective phenomena (Morgeson & Hofmann, 1999). For instance, if material planners increasingly have to deal with a sequence of missed delivery dates, a set of rules and procedures to deal with malfunctioning suppliers will emerge. Or, to take another example, buying assistants may signal that another supplier delivers at a lower price and inform their senior buyer, thus influ-

encing the choice of suppliers at the tactical level. As a final example: When a team of buying assistants is trained on communication effectiveness, this might influence the higher-level construct of overall procurement performance.

In our conceptual model (Figure 1) we distinguish three decision-making levels with cross-level processes between them; one of these levels dominantly influences chain performance, i.e. the strategic level in a cost-oriented chain type and the operational level in the innovation-oriented chain type. Additionally, it is reasonable to believe that in the different decision-making levels, different people are involved. Day-to-day operational decisions will often be made by buying or procurement assistants, whereas tactical decisions are more likely to be taken by senior purchasers and the strategic decisions by purchasing or procurement managers. It is important that constructs are measured at the appropriate level of theoretical and analytical interest. In our research it is not only important to know at which level chain performance is influenced by human behavior, but also whether top-down processes or bottom-up processes are dominant. This will influence the way data is gathered and more importantly, where it is gathered. If it becomes clear that the relationship between buyer and supplier is mainly coordinated by means of formal contracts at a strategic level and there is little interaction involved at other levels, then it will be more useful to gather data among the people involved at the strategic level, for instance a purchasing manager or a materials manager. Contrastingly, if the relationship is coordinated by means of day to day cooperation between technicians, then it is reasonable that human behavior will mainly influence chain performance at the operational level, thus information might best be gathered at that level. In the next section we will further discuss these measurement issues.

4 Construct at Different Levels and Measurement Issues

The multilevel approach acknowledges that concepts may have different meaning at different levels. Thus, the same SCM concept may have a different meaning depending on the level a researcher is focusing on. Concepts such as performance, trust or power may have a different meaning for people involved at the strategic level as compared with people involved at the operational level. On the strategic level, for example, performance may refer to chain effectiveness, profit or turnover, while at the operational level it may refer to on time deliveries of a supplier. This immediately makes clear that constructs in SCM research may refer to completely different variables depending on the level that is considered (e.g., chain effectiveness vs. on time delivery). What is more, Boyer & McDermott (1999) make clear that the perceptions of people regarding operations strategy differ between different levels of a firm. Employees at the operational level, for instance,

exposed significant manufacturing priorities different from those found by their managers at the strategic level.

While talking with the managers involved in our case study, it became evident that trust was given quite a different meaning depending on the decision-level being discussed. At a strategic level it was mentioned twice that in order to trust supplier organizations or, the other way around, to win the trust of client organizations, there had to be made some significant adaptations. For example, in order to increase the cooperation with a large and important buyer organization, the manufacturing organization of our case study, had to make large flexibility enhancements. On the strategic level, it was promised that in high seasons production capacity would be fully used to serve this client organization. The supply chain manager indicated that this was a matter of winning trust and that otherwise cooperation would be difficult to arrange. At the operational level, totally other trust issues seemed to play a role. At this level, communication skills and knowing your contact person personally were indicated to be essential in order to win trust and to get things done. The materials manager offered an example of a very critical situation in which a supplier had to be asked to deliver a large quantity of extra material on a very short notice. Although he was aware of the current capacity situation at the supplier's plant, the procurement assistant nevertheless phoned his counterpart within the supplying organization. The procurement assistant was very familiar with his contact person and started to talk about family issues and other personal subjects. After a while, the procurement assistant dared to ask for the extra delivery and he was told that the extra material would be delivered within the requested lead-time.

The above examples point out how one construct, in this case trust, can have different meanings depending on the level the researcher is focusing. At the strategic level trust was defined as 'buying in a relationship': trust was developed by proving that the organization was willing to make some important strategic adaptations. However, interviewing the materials manager it became clear that trust was of a totally other meaning at the operational level where day-to-day decisions were made, although trust was regarded equally important at that level as well. Communication skills, knowing and even liking each other, were indicated as important aspects of trust.

We will further stress the issue that constructs have different meanings at different levels by using the work of Klein & Kowzlowski (2000). They distinguish three basic types of constructs in multilevel modeling: global properties, shared properties, and configural or compositional properties. In the rest of this section we will highlight these three types of constructs, and we will give the implications for empirical research for each of the three constructs.

Global characteristics are directly manifested at the higher level. Examples of such attributes are number of suppliers, size of an organization, the function of a department (e.g. sales), and the physical location of a unit. These attributes can mostly be easily observed and lead to rather objective and reliable data.

In our own study we could argue that the supply chain type, either innovative or cost-oriented, is a global property. In order to distinguish whether a supply chain is more cost-oriented or more innovation-oriented, we can make use of rather objective data. For example, we could look at the investments made by chain partners in innovation projects, the presence and size of a research and development department, or the amount of product variety (Fisher, 1997) in order to decide upon the degree of innovativeness. To determine the degree of cost-orientation of a supply chain, we could look at the length of the product life cycle or the investments made in standardizing and automating work processes.

Global properties are relatively easy to measure because they do not emerge from the behavior and actions of lower-level entities (e.g. individuals). Global properties are observable characteristics of a higher-level phenomenon. Therefore, data concerning such properties can ordinarily be collected from a single source, for example a supervisor or a management information system and, consequently, there is no need to collect data from all the lower level entities (Klein & Kozlowski, 2000).

Shared properties are attributes that stem from the perceptions and attributes of lower level units - mostly individual workers - but it is supposed that these lower units share these attributes (Klein & Kozlowski, 2000), hence there is intra-unit agreement. Shared properties may refer to experiences, attitudes, values, norms, cognitions, or behaviors that are held in common by the members of the organizational unit in question. Corporate identity or group cohesion are well-known examples of a shared characteristic. The more that senior buyers for example perceive themselves to be part of the organization or purchasing department instead of being a single individual, the stronger the organizational identity, and the more cohesive the department. Cohesion or identity can be important properties for supply chain management, because employees are more willing to show cooperative behavior if the ties that bind them are stronger (Mullen & Copper, 1994). To give another example of a shared property, boundary spanners of a buying organization can collectively trust their strategic suppliers. Klein et al. (2000) propose that the perceptions, attitudes and actions of boundary spanners are shared and held in common when the benefits of cooperation with suppliers are clearly positive. When the benefits of cooperation are not clear, then members of the focal organization could differ in their trust in suppliers.

Unlike global properties, shared properties do emerge from the attributes, behavior and actions of individuals. For these types of constructs, employees must be in consensus, for it is essential for the property to be held in common or shared. Chan (1998) refers to a ‘referent-shift consensus model’. This concerns constructs

that are measured at the lower (individual) level, but the construct itself and the wording of items refer to a higher level. Measures of such concepts take the higher level as the point of reference, for example, "In our purchasing department we collectively trust this supplier" and not "I trust this supplier". As stated above, it is assumed that members share perceptions. Hence, in practice there must be sufficient consensus to justify the aggregation of individual perceptions to represent the value of the higher-level variable. When it is certain that intra-unit variance is low, then the mean value of the measure can be assigned to the higher-level construct. A low within-unit variance does not exclude inter-unit variance, and thus, different organizational units may hold different perceptions of a similar concept. If the higher level e.g. refers to a purchasing department or a top-management team, it may well be that the same concepts have different meanings (see, for example, the above mentioned results presented by Boyer & McDermott (1999).

Similar to shared properties, **configural properties** stem from measures at a lower level. In contrast, there is no condition of intra-unit agreement (Klein & Kozlowski, 2000: 217). For instance, if individual employees represent the lower level with attributes like age, skills or personality traits, then it is not supposed that employees share these attributes. An example of a configural property is the performance of a supply chain. The performance of a supply chain cannot easily be attributed to the single organizations and workers involved, because efforts of single organizations and individuals in the chain will merge in a complex way into chain performance. Hence, these properties cannot simply be averaged out (as is the case with shared properties). What matters is the theory that guides the higher-level construct, and which technique is most helpful in capturing configural properties. Kozlowski & Klein (2000) mention a variety of data-combination techniques that can be used: indices of variation, using the minimum or maximum, multidimensional scaling, network analyses, neural nets, systems dynamics, etc. To give an example, in order to measure chain performance, a researcher could use the weakest organization's contributions as a measurement, in the case that it is reasonable to assume that 'the chain is as strong as its weakest link'.

The three property types that we considered in this section are rather static. Chan (1998) has argued that constructs may change over time from one type to another. Collective trust in a supplier may be minimal when a supply relationship has just started, but likely will increase over time, thus changing from a configural construct into a shared construct. The same may be true for norms or supply-related procedures that may primarily be at the individual level when people start working together, but converge into shared constructs when assistant buyers encounter problems upon which they jointly have to react.

5 Data Structures and Analysis

A key feature of nested or hierarchical data structures is that clusters of individual units are contained within higher-level units, for example, procurement assistants within procurement departments, departments within organizations, or organizations within chains. As people may sometimes be nested in higher-level entities, so may other factors be nested as well. All the suppliers of one single firm are nested in that firm. And to give another example, as we have mentioned before, decisions can also be nested: day-to-day decisions regarding procurement are often nested in higher-level time-frames such as tactical contracts with suppliers, regarding price and product volume. These tactical price and volume decisions are likely to be nested in longer time-framed strategic plans in which e.g. cost-reduction or flexible product delivery are the long-term goals. As a consequence, day-to-day decisions cannot be dissociated from tactical and strategic plans, since they will likely be influenced by the long-term plans in which they are nested.

In our mini case study we did not collect quantitative data. However, our qualitative material indicates the presence of nesting phenomena.

The purchasing manager and material manager of this supply chain mentioned a problem, which indicated the existence of a nested data structure. Recently, there were difficulties in the communication processes towards suppliers. The procurement assistants and the senior buyers told the suppliers different stories with respect to dominant performance objectives. Where the senior buyers were focused on price issue, the procurement assistants emphasised the importance of mix and product flexibility. It turned out that procurement assistants had little contact with senior buyers and the other way around. Procurement assistants did merely cooperate with their colleagues from the procurement department and senior buyers mainly cooperated with people from the purchasing department. Procurement assistants and senior buyers had thus developed separately their own set of rules and customs to deal with suppliers, thereby influenced by their own departments differently. This problem was solved by setting up special cooperation structures between senior buyers and procurement assistants apart from the existing departments. This is a nice example how people may well be influenced by higher-level entities in which they are nested. As illustrated, this might even directly influence chain performance.

Nested data structures can be problematic, as they violate a key assumption in statistical testing, namely the assumption that observations are independently sampled from one another. In nested data structures this assumption is likely to be broken, since the ‘clusters’ or ‘groups’ of lower-level units (contained within the higher level units) can be expected to contain more similar responses, attitudes or

behaviors than if the lower-level units would have been sampled randomly (Jones & Duncan, 1998; Snijders & Bosker, 1999). If one has gathered data about all the suppliers of a number of companies, the observations belonging to different suppliers delivering to the same buyer company are not independent, because, at least to some extent, they have the same context. Individuals within the same purchasing department, to give another example, work in the same environment, can potentially influence one another, have the same boss and, consequently, their responses will have communalities. Because the observations are in this way not 'truly' independent of one another, they can be expected to have a group level random error component and thus be auto-correlated (Bryk & Raudenbush, 1992). When relationships between variables are consequently tested using traditional single-level analysis techniques whereby a hierarchical data structure is neglected, there is a risk of 'spurious' significant results (e.g. Snijders & Bosker, 1999). Multilevel analytical techniques explicitly model or take into account the effect of a nested data structure and correct for design effects (Jones & Duncan, 1998; Snijders & Bosker, 1999; Hox, 2002).

In multilevel analytical techniques, regression models are tested that essentially are a multilevel version of the familiar multiple regression model, the distinction being that a multilevel regression model includes a separate equation for each higher-level unit (see Hox, 2002; Snijders & Bosker, 1999). To test multilevel models there is specialized software available such as MLwiN (Goldstein et al., 1998). Multilevel analysis takes place by following a two-step procedure (see Hox, 2002; Snijders & Bosker, 1999). First, a basic model is tested without any explanatory or independent variables. Suppose we are interested in predicting the trust of buyers and material planners in suppliers. If we have gathered data in several firms and we have a data structure with three levels (individual, department, firm), this first step decomposes the variance in trust into variance that should be attributed to the firm, to the department and to the individual employee. The second step involves fitting a second model that elaborates on the basic model by adding predictors. In multilevel analysis it is possible to introduce variables from different levels simultaneously. For example, the chain type may be a variable at the firm level, the presence of specific planning software may be a variable at the department level, and skills are at the individual employee level. Of course, this second step depends on the theoretical model one wants to test. For a further reading on the procedures of multilevel analysis we refer to Hox (2002).

6 Summary and Conclusion

In this paper we have focused on three situations in SCM research in which the multilevel approach might prove useful. First, supply chains consist of multiple levels that are linked by cross-level processes. In order to learn something about the performance of supply chains, these multiple level structures and processes should be conceptualized and included in a theoretical SCM research model. Second, the meaning of constructs such as trust, performance, or power can shift depending on the level that is considered. The multilevel approach takes this into account and distinguishes three construct types that vary in meaning and affect the way empirical research is conducted. Third, supply chains are nested systems. The behavior of people or the day-to-day decisions cannot be seen apart from the context in which they occur. Multilevel analysis explicitly models these nested data structures and takes the statistical effects of these structures into account.

By using our own research on human behavior in chains as an example, we have tried to show that SCM research may benefit substantially by integrating or, at the very least, recognizing multilevel structures and processes. Of course, it is hardly possible to incorporate all the issues addressed in one research model, nor do we intend to do so. However, by presenting the effects of human behavior on supply chain performance as a multilevel phenomenon, we have identified several difficulties that arise when building SCM models. We believe that awareness of multilevel issues and the usage of a multilevel approach will considerably contribute to theory building and empirical research in SCM.

7 References

Beth, S., Burt, D. N., Copacino, W., Gopal, C., Lee, H. L., Lynch, R. P., Morris, S. (2003): Supply Chain Challenges: Building Relationships, in: Harvard Business Review, 81(7): 64-73.

Boyer, K. K., McDermott, C. (1999): Strategic Consensus in Operations Strategy, in: Journal of Operations Management, 17(3): 289-305.

Bryk, A. S., Raudenbush, S. W. (1992): Hierarchical Linear Models, Sage, Newbury Park, CA.

Burstein, L. (1980): The Analysis of Multilevel Data in Educational Research in Evaluation, in: Review of Research in Education, 8(1): 158-233.

Chan, D. (1998): Functional Relations among Constructs in the Same Content Domain at Different Levels of Analysis: a Typology of Composition Models, in: Journal of Applied Psychology, 83(2): 234-246.

Cronbach, L. J., Webb, N. (1979): Between Class and Within Class Effects in a Reported Aptitude by Treatment Interaction, in: Journal of Educational Psychology, 67(6): 717-724.

Darr, A., Talmud, I. (2003): The Structure of Knowledge and Seller-Buyer Networks in Markets for Emergent Technologies, in: Organization Studies, 24(3): 443-461.

Fisher, M. L. (1997): What is the Right Supply Chain for your Product?, in: Harvard Business Review, 75(2): 105-117.

Ford, D., Hakansson, H., Johanson, J. (1986): How Do Companies Interact?, in: Industrial Marketing and Purchasing, 1(1): 26-41.

Goldstein, H., Rasbash, J., Plewis, I., Draper, D., Browne, W., Yang, M., Woodhouse, G., Healy, M. (1998): A User's Guide to MlwiN, Version 1.0.: January.

Hox, J. J. (2002): Multilevel Analysis: Techniques and Applications, Lawrence Erlbaum, Mahwah.

Johnston, D. A., McCutcheon, D. M., Stuart, F. I., Kerwood, H. (2004): Effects of Supplier Trust on Performance of Cooperative Supplier Relationships, in: Journal of Operations Management, 22(1): 23-28.

Jones, K., Duncan, C. (1998): Modelling Context and Heterogeneity: Applying Multilevel Models, in: Scarbrough, E., Tannenbaum, E. (eds.): Research Strategies in the Social Sciences, Oxford University Press, New York.

Klein, K. J., Palmer, S. L., Conn, A. B. (2000): Interorganizational Relationships: a Multilevel Perspective, in: Klein, K. J., Kozlowski, W. J. (eds.): Multilevel Theory, Research, and Methods in Organizations: Foundations, Extensions and New Directions, Jossey-Bass, San Francisco: p. 267-307.

Klein, K. J., Kozlowski, W. J. (2000): From Micro to Meso: Critical Steps in Conceptualizing and Conducting Multilevel Research, in: Organizational Research Methods, 3(3): 211-236.

Kozlowski, S. W. J., Klein, K. J. (2000): A Multilevel Approach to Theory and Research in Organizations: Contextual, Temporal, and Emergent Processes, in: Klein, K. J., Kozlowski, W. J. (eds.): Multilevel Theory, Research, and Methods in Organizations: Foundations, Extensions and New Directions, Jossey-Bass, San Francisco: p. 3-90.

Kraljic, P. (1983): Purchasing Must Become Supply Management, in: Harvard Business Review, 61(5): 109-117.

Kumpe, T., Bolwijn, P. T. (1994): Toward the Innovative Firm: Challenge for R&D Management, in: Research Technology Management, 37(1): 38-45.

Lamming, R., Johnsen, T., Zheng, J., Harland, C. M. (2000): An Initial Classification of Supply Networks, in: International Journal of Operations & Production Management, 20(6): 675-691.

Morgeson, F. P., Hofmann, D. A. (1999): The Structure and Function of Collective Constructs: Implications for Multilevel Research and Theory Development, in: Academy of Management Review, 24(2), 249-265.

Mullen, B., Copper, C. (1994): The Relation between Group Cohesiveness and Performance: An Integration, in: Psychological Bulletin, 115(2): 210-227.

Radenbush, S. W., Bryk, A. S. (1986): A Hierarchical Model of Studying School Effects, in: Sociology of Education, 59(1): 1-17.

Randall, T. R., Morgan, R. M., Morton, A. R. (2003): Efficient Versus Responsive Supply Chain Choice: an Empirical Examination of Influential Factors, in: Journal of Product Innovation Management, 20(6): 430-443.

Snijders, T. A. B. Bosker, R. J. (1999): Multilevel Analysis: an Introduction to Basic and Advanced Modelling, Sage Publications, London.

Uzzi, B. (1997): Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness, in: Administrative Science Quarterly, 42(1): 35-67.

Zaheer, A., McEvily, B., Perrone, V. (1998): Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance, in: Organization Science, 9(2), 141-159.