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Antecedents for the Adoption and Execution of Supply Chain Management

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Abstract

Purpose: The purpose of this paper is to develop a conceptual model that includes drivers of supply chain management (SCM) adoption and execution identified in the literature, provide a set of measurement scales that operationalise constructs within this model, empirically verify a hierarchical order of antecedents that affects the adoption and execution of SCM, and assist management by providing a focus on those SCM conditions and processes that need to be prioritised to increase successful SCM adoption and execution.

Design: The conceptual model is tested empirically through a survey of 174 senior supply chain managers representing the biggest organisations within a central European country.

Findings: Using structural equation modelling the hypothesised hierarchical order of three proposed antecedents are verified: 'internal SCM conditions' that affect 'joint or external SCM conditions' which in turn influences collaborative 'SCM-related processes'. Firms that adopt these steps should enjoy a rigorous and appropriate road to the full execution of SCM.

Research limitations: The survey results reflect the views of large organisations in a country-specific supply chain setting.

Practical implications: The findings provide a hierarchical focus for financial, personnel and management initiatives to increase integration within a supply chain and improve competitiveness.

Originality/value: The major contribution of this paper is that it provides empirical proof of the antecedents that affect the adoption and execution of SCM.

Keywords: Supply chain management, integration, antecedents, execution

Classification: Research paper

1. Introduction

The concept of supply chain management (SCM) was introduced in the early 1980s (Harland, 1996). Since then, a substantial body of academic knowledge has been developed on this very broad topic. SCM is understood to be a set of practices for managing and coordinating the transformational activities from raw material suppliers to ultimate customers (Heikkilä, 2002). It has also been viewed as an organisational response by companies to pressures in their environment (Cravens *et al.*, 1996). Finally, SCM considered is a long-term oriented, inter-firm arrangement or alliance, involving intermediate or hybrid cooperative relationships (Das, 2006; Grant and Baden-Fuller, 2004).

Economic theory defines supply chains as multistage and multidirectional systems of autonomous decision makers. The set-up and management of such systems is the result of a social negotiation process among the interested parties regarding specific norms and standards (Halldorsson *et al.*, 2007). As a result, close cooperation evolves as economically independent but otherwise mutually connected business entities seek to harmonise their individual courses of action. Such cooperation is based on strategically oriented trust alliances and is the result of an efficient division of labour and specialisation (Grant and Baden-Fuller, 2004; Das, 2006).

SCM therefore proceeds and develops through the systematic and strategic coordination of business functions and tactics within and across businesses, with an overall goal of improving the long-term profitability of all involved (Mentzer *et al.*, 2001). It thereby integrates demand and supply management within and between companies (CSCMP, 2010).

Supply chains have of course long existed; for example the silk and spice caravans in the ancient world. However, in an organisational context SCM is a fairly recent phenomenon.

Forrester noted in the mid-twentieth century that “management is on the verge of a major breakthrough in understanding how industrial company success depends on the interactions between the flows of information, materials, money, manpower, and capital equipment” (1958, p. 37). Yet, if management was ready to ‘breakthrough’ over fifty years ago, why did Mentzer *et al.* (2001) question the prevalence of SCM within firms at the start of the twenty-first century? Despite claimed benefits, SCM execution appears to have lagged expectations.

Questions such as ‘how does a firm and its management prepare to embrace (*i.e.* adopt) and implement (*i.e.* execute) SCM if it doesn’t already do so?’ or ‘what are the barriers SCM faces and benefits it provides?’ have not been satisfactorily addressed in SCM research (Stock *et al.*, 2010). Based on this research gap we argue there a need to understand the antecedents required to adopt and execute SCM in order to academically and managerially comprehend the issues that must be considered and organised.

The aim of this paper is therefore to consider the antecedents and their relationships in the adoption and execution of SCM. The main finding comes in the identification that enterprises considering adopting SCM or inter-organisational integration *i.e.* having to look inwards first and prepare the organisation for SCM. While seeming intuitively obvious, this process has previously not been empirically confirmed. The value of this paper is that it represents the first attempt in measuring SCM adoption and execution; thereby providing an empirically validated measurement instrument. We thus provide both an academic and managerial contribution: We develop a conceptual model that includes drivers of SCM adoption and execution, provide a set of measurement scales that operationalise constructs within the model, empirically verify a hierarchical order of antecedents that affects the adoption and execution of SCM and assist practitioners by providing a focus on those SCM conditions and

processes that need to be prioritised to increase SCM adoption and execution. In summary, we combine the consideration of antecedents as well as processes related to establishing SCM.

This paper consists of eight sections. After these introductory remarks we present and discuss how the existing literature has considered the issue of SCM adoption and execution. Subsequently, we identify direct and indirect antecedents of SCM adoption and execution in existing frameworks and propose a conceptual path model and related hypotheses. The empirical methodology that tests this conceptual model is then presented followed by our findings. The paper concludes by identifying the academic contribution and managerial implications, before addressing the limitations of the findings and avenues for further research.

2. Issues in the Supply Chain Management Literature

Embarking on a literature review of SCM is fraught with difficulty. On the one hand the broad approach to SCM encourages a rich and lively debate, but on the other hand leads to a fragmented literature with overlapping constructs and difficulty in producing consistent and generalisable findings (*e.g.* Stuart, 1997). SCM is both multidisciplinary and multifunctional and thus the domain of SCM research is fragmented, having been studied and commented upon from a wide range of academic disciplines and diverse theoretical perspectives (Cousins *et al.*, 2006; Storey *et al.*, 2006). There has been an ‘explosion’ of SCM interest across disciplines and journals, but multiple broad streams of research are developing relatively independently of each other and are not often comparable (Charvet *et al.*, 2008). The diverse nature of SCM literature results from two factors (Lejeune and Yakova, 2005); it is at a confluence of many disciplines and also comprises different inbound and outbound entities operating at various stages in the supply chain.

Croom *et al.* (2000) identified eleven subject areas considered core in the SCM literature. Their approach was adopted here in reviewing the literature to capture theoretical perspectives related to the research aims of this paper and found several overarching issues that inform this study.

First, many scholars have discussed the lack of a robust theoretical foundation in SCM or indeed a commonly-understood and applied definition. Several attempts have been made to address this challenge with varying degrees of success. However, there appears to be no universally-agreed unified theory of SCM (Halldórsson *et al.*, 2007). The development of SCM has been largely practitioner-led, with theory (such as it is) largely following practice (Voss *et al.*, 2002). The practical experience upon which this theory is based is often confined to a relatively small number of key industry sectors such as consumer goods retailing, computer assembling and automobile manufacturing (Kotzab and Otto, 2004; Burgess *et al.*, 2006).

Second, there is evidence that the effective execution of SCM can result in improvements in the performance of firms. A study of almost 200 firms by Li *et al.* (2006) concluded that higher levels of SCM practice can lead to an enhanced competitive advantage and improved firm performance. Similarly, Frohlich and Westbrook (2001) investigated over 300 global manufacturers and found that firms with the widest supplier and customer integration had the highest rates of firm performance improvement. This is significant given the centrality of integration in SCM philosophy (Harland, 1996).

However, Fabbe-Costes and Jahre (2008), in reviewing almost 40 academic articles on the subject of supply chain integration, noted that while over half of the articles concluded that integration has a positive effect on firm performance, caution is advised as there are a variety of empirical bases and research designs across the studies. Similarly, Storey *et al.* argued that “while there is an emerging body of theory which ostensibly offers a relatively coherent and compelling prescriptive narrative, predominant practice is at considerable odds with this conceptualisation” (2006, p. 755). This is confirmed by Fabbe-Costes and Jahre who note that “integration is more rhetoric than reality, that it might be more difficult in practice than in theory” (2007, p. 848).

Third, firms have not succeeded in implementing and mastering SCM (Chen and Paulraj, 2004). Turning the concept into practice is not easy and it has so far received more ‘lip service’ than accomplishment, except in a few leading edge companies (Leenders *et al.*, 2002). The incorporation of SCM into the overall business planning process is not widely practiced (Carter and Narasimhan, 1994). Supply chain theory suggests that the chain should be managed from end-to-end, but Storey *et al.* (2006) found very little evidence for this notion.

Finally, Storey *et al.* (2006) raise doubts about claims that SCM advocates make regarding the ‘discipline’ of SCM and argue that the SCM literature tends “to move rather imperceptibly between description, prescription and trend identification” (p. 757). This results in normative tension between the *is* and the *ought*: “the rhetoric of managerial folklore tells managers to feel that they should take a broad, integrative approach and ‘manage the whole chain’, and this often clouds practitioner reports, with both overstatement and yet profound cynicism” (New, 1997, p. 16).

Researchers in the area of SCM commonly agree on the positive effects of SCM on an organisation's performance. This is mainly due to the power enjoyed from the integration of business processes internally and externally. However, this agreement lacks empirical support as most research provides mostly anecdotal evidence. A substantive theoretical base for the establishment and execution of SCM is therefore lacking. There is a dearth of evidence in relation to the extent to which SCM – as defined in the academic literature – is implemented or even understood in practice. The literature does however provide some notions on the foundation of SCM based on conceptual models. These are examined in the next section.

3. The Foundation of Supply Chain Management: Evaluation of Extant Frameworks

The requirement for a firm to adopt and execute SCM stems from the marketplace, which expects both product and service customisation and optimal utilisation of resources in a global environment (Corbett *et al.*, 1999; Christopher, 2000; Cousins and Menguc, 2006). The environment provides many organisations with an incentive to establish a value-added network, where complex inter-firm relationship management, collaboration and coordination takes place in the areas of product design, production, supplier selection and marketing (Cravens *et al.*, 1996; Das, 2006; Cousins and Lawson, 2007).

However, with a few exceptions —Tarn *et al.* (2002) and Sridharan *et al.* (2005) — there has been a lack of research dealing with the question of how to achieve SCM within a firm, *i.e.* the adoption and execution of SCM. There are some frameworks in the literature which we now consider to determine commonality of constructs and underlying variables. Our intention from this exercise is to develop a theoretically-sound model addressing this adoption and execution gap. The literature was reviewed to determine the constitutional or antecedent elements of SCM adoption and execution. The hierarchical order in which these constitutional

elements need to appear in a firm was also identified despite there being a lack of empirical evidence in the existing research.

Ten different frames of reference were identified developed by Bechtel and Jayaram (1997), Cooper *et al.* (1997), Lambert *et al.* (1998), Fawcett and Magnan (2001), Mentzer *et al.* (2001), Ho *et al.* (2002), Tan *et al.* (2002), Chen and Poulraj (2004), Cigolini *et al.* (2004), and Kotzab *et al.* (2006). Despite differences among these papers, all were constructed upon a basic idea that there are organisational and technical preconditions or antecedents for adopting joint business processes leading to the execution of SCM, both internally and with customers and suppliers. Table 1 compares these ten frameworks across the three dimensions of SCM: execution of SCM, the adoption of SCM processes, and antecedent SCM conditions.

Insert Table 1 here

Table 1 suggests that the elements found in the various frames support the classifications of Harland (1996) and Harland *et al.* (1999), namely that the level of integration amongst supply chain activities operates at four levels:

- Internal level; only those activities which are entirely internal to the focal company.
- Dyadic level; single two-party relationships between, for example, supplier and manufacturer or manufacturer and distributor/retailer.
- Chain level; a set of dyadic relationships including a supplier, a supplier's supplier, a customer and a customer's customer.

- Network level; a wider network of operations.

SCM is thus considered as the integration of a firm's business processes, with the objective of replacing a single isolated operational unit with a whole supply chain spanning raw material suppliers to the ultimate customer (Frohlich and Westbrook, 2001; Heikkilä, 2002). Integration occurs in a forward as well as a backward direction (Cousins and Menguc, 2006). The aim of SCM business processes is to add customer value and to optimise the whole entity, instead of single parts (Cooper and Ellram, 1993; Cooper *et al.*, 1997; Heikkilä, 2002). It is such business process integration that allows companies to exploit the advantages of SCM and thus achieve better performance by lowering costs and increasing profits and customer satisfaction (De Treville *et al.*, 2004; Skjøtt-Larsen *et al.*, 2005; Mitra and Singhal, 2008; Martinez-Sanchez *et al.*, 2009).

We summarise the common denominators of all the frameworks examined in a conceptual model that consists of four latent constructs: 1) internal SCM conditions, 2) joint or external SCM conditions, 3) adoption of SCM-related processes and 4) execution of SCM.

SCM conditions are fundamental requirements for the adoption of SCM-related processes and the execution of SCM. They can be separated into internal and external or joint SCM conditions as shown in Table 2.

Insert Table 2 here

Internal SCM conditions are requirements for adopting SCM-related processes and executing SCM *inside* the organisation. They represent a commitment and dedication of human and financial resources, top management support, internal visions and goals, the staff's technical expertise, internal IT systems, guidelines for information exchange, education, the set-up of internal project groups and processes as well as integration behaviour (Bechtel and Jayaram, 1997; Cooper *et al.*, 1997; Stuart, 1997; Lambert *et al.*, 1998; Fawcett and Magnan, 2001; Mentzer *et al.*, 2001; Grant and Baden-Fuller, 2004; Cigolini *et al.*, 2004; Das, 2006; Cousins and Lawson, 2007; Martinez-Sanchez *et al.*, 2009).

Joint or external SCM conditions are requirements for adopting SCM-related processes and SCM execution *between* organisations and *in cooperation* with partners in the supply chain. They include shared performance measurement, planning and controlling systems, shared vision and goals, organisational structure, joint project groups, systems perspective, trust, long-term-oriented relationships, power, shared profits and risks, mutual dependency, shared information on inventory status, shared information on forecasts, shared information on product development, organisational culture and equivalent management methods (Lambert *et al.*, 1998; Ho *et al.*, 2001; Mentzer *et al.*, 2001; Tan *et al.*, 2002; Chen and Poulraj, 2004; Harland *et al.*, 2004; Cousins and Lawson, 2007; Das, 2006; Martinez-Sanchez *et al.*, 2009).

SCM-related processes are those business practices that integrate or coordinate different key business areas within the firm and between a firm's suppliers and customers. They generate a flow of products, services and related information and create value for customers as well as improving the total performance of the chain (Fawcett and Magnan, 2001; Narasimhan and Das, 2001; Das *et al.*, 2006; Martinez-Sanchez *et al.*, 2009). These processes can be subdivided into eight areas: 1) customer relationship management, 2) customer service

management, 3) demand management, 4) order fulfilment, 5) manufacturing flow management, 6) supplier relationship management, 7) product development and commercialisation and 8) returns management (Cravens *et al.*, 1996; Cooper *et al.*, 1997; Croxton *et al.*, 2001; Lambert *et al.*, 2005). Included in these processes are dimensions related to the customer and downstream and upstream product and information flows.

SCM execution within organisations is understood as the firm's internal and external integration of business processes with suppliers and customers to create value and to improve the total performance of the chain (Cravens *et al.*, 1996; Cooper *et al.*, 1997; Lambert *et al.*, 1998).

Having established this framework for the antecedent conditions or elements in the adoption and execution of SCM, we now turn to developing our conceptual model and postulating related hypotheses, including proposed hierarchical levels, for empirical testing.

4. Conceptual Model and Research Hypotheses

The interrelation between the internal and the joint conditions suggests that 'homework' needs to be done internally in a company before concentrating on the external integration of business processes with suppliers and customers (Lambert, 2004). A comparison of different expectation levels between supply chain actors and partners regarding external integration performance has to be considered, as most SCM projects fail due to unbalanced output expectations (Lambert and Kneymeyer, 2004). Lambert and Kneymeyer (2004) also presented the construct of organisational behaviour as a strategic component of SCM, including variables of culture, power and human resources. These prerequisites, which are needed to connect organisations within a network, were also considered by Mentzer *et al.* (2001). This

issue of intra- and inter-company connectivity leads to the notion that SCM-related processes are affected by internal and joint conditions or antecedents (Lambert *et al.*, 2005). This is in line with Grandori and Soda (1995) and Grandori (1997) and their stated importance for communication, rules and procedures as well as incentive systems for setting up inter-organisational networks. Therefore, we hypothesise that:

H₁: Internal SCM conditions positively impact joint SCM conditions.

The lack of top management support, the inability to share information, a resistance to change, a lack of training and skills, a lack of process orientation, inflexible systems and processes, a lack of internal controlling systems, and no guidelines for information exchange are considered barriers that hinder the integration of business processes (Fawcett and Magnan, 2001; Narasimhan and Das, 2001; Droge *et al.*, 2004; Das *et al.*, 2006). To overcome these barriers, Bechtel and Jayaram (1997), Cooper *et al.* (1997) and Mentzer *et al.* (2001) suggest that firms should adopt internal education to develop a vision and to dedicate financial and human resources. For Droge *et al.* (2004), these are enablers for joint business processes and, following Lambert (1994), have to be operationalised first. Dyer and Nobeoka's (2000) development of knowledge-sharing processes between an organisation and its key suppliers, and Ebers and Grandiori's (1997) suggestion of how to configure flows of resources and information, concur with this position. Thus, we hypothesise that:

H₂: Internal SCM conditions positively impact the adoption of SCM-related processes.

H₃: Joint SCM conditions positively impact the adoption of SCM-related processes.

Joint conditions reflect a supply chain orientation that should lead to cooperation amongst three or more contiguous companies (Mentzer *et al.*, 2001). Lambert *et al.* (2005) characterise this as the intra-company and inter-company connectedness that drives the degree of inter-organisational interaction. It has also been shown by Auroja *et al.* (1999), Lamming (1993) and Sako (1992) that joint team working, sharing knowledge and expertise are indicative and necessary for managing inter-organisational relationships. Thus, we hypothesise that:

H₄: Internal SCM conditions positively impact the execution of SCM.

H₅: Joint SCM conditions positively impact the execution of SCM.

SCM is executed by integrating corporate functions using business processes within and across companies (Lambert *et al.*, 2005). This integration dimension is of strategic importance for managing supply chains (Frohlich and Westbrook, 2001). There are differences between no integration and a broad and narrow arc of integration between a focal company and its upstream and downstream stages. This arc of integration depends on the level of utilizing integrative processes internally and externally. Strategic alignment literature (*e.g.* Cousins and Menguc, 2006; Cousins and Lawson, 2007) notes that effective business process integration requires the joint alignment efforts of at least two actors leading to long-term, sustainable relationships, and gains arising from joint activities such as joint product development and integration of business processes. Thus, we hypothesise that:

H₆: The adoption of SCM-related processes positively impacts the execution of SCM

Figure 1 presents the conceptual model built upon the four major constituents or constructs:

internal conditions, joint conditions, adoption of SCM processes and SCM execution, together with the hypotheses developed above.

Insert Figure 1 here

The overall research objective was to obtain a clearer understanding about which of the various condition and process-related variables have major significant impacts – indicated respectively by γ parameters and hypotheses (H_1 – H_6) – on the degree of SCM execution in companies. A path model with the four constructs or latent variables was developed as depicted in Figure 1. ξ_1 (internal SCM conditions), ξ_2 (joint SCM conditions) and ξ_3 (adoption of SCM-related processes) can be regarded as exogenous or independent variables affecting the endogenous or dependent variable η_1 (execution of SCM). The arrows and the positive signs indicate the proposed direction of direct effects. Building on Lambert (2004), the intuitive model path would include γ_{21} , γ_{32} and γ_{13} . However, the model also indicates that the execution of SCM may also be affected indirectly and independently by the two types of SCM conditions and therefore includes the proposed effects γ_{31} and γ_{32} .

Finally, as noted above, internal and joint SCM conditions are antecedents of the adoption of SCM-related processes, which in turn affect the level of execution of SCM. Following New (1997) and New and Payne (1995), the development of the six hypotheses for testing also takes into account possible bypassing effects on SCM execution as represented by γ_{11} and γ_{12} . To test the model an empirical study was designed; the research methodology is discussed next.

5. Methodology

The methodology followed Churchill's (1979) two-stage development and validation of latent or unobservable and manifest or measurable constructs. This rigorous approach is suitable where phenomena are under-researched, as in this study, and is supported by two other, similar frameworks: Spector (1992) and Dunn *et al.* (1994). Content and substantive validity were checked via three qualitative interviews with experts from supply chain academia and practice. All the latent constructs are multi-faceted and were operationalised by a set of three or more indicators or manifest variables (see the Appendix for the item measures and the related literature).

The survey population consisted of 790 large Austrian companies in the retail and manufacturing sectors (ÖNACE classification C to G); *i.e.* they have revenues greater than EUR 40 million and employees numbering more than 200. A random sample of 200 companies was drawn from this population and within those companies, senior managers responsible for logistics and SCM and representing one company in the sample, were identified and contacted personally. A self-administered questionnaire was sent to them after agreement in the pre-notification contact. This approach conformed to Dillman's (2007) tailored design method to ensure high response rates.

Due to the exhaustive pre-notification process 174 usable questionnaires were received, which represents a response rate of 87%. Most respondents (38.5%) represented manufacturing companies, followed by trading companies (29.3%). The rest represented the service, building and energy sectors. In terms of location within their respective supply chains (multiple responses were of course possible), 33.6% were suppliers followed by 28.7% wholesalers,

20.2% original equipment manufacturers (OEMs), 10.9% retailers and 7.1% logistics service providers.

Most respondents (44.9%) represented logistics and supply chain management departments in their organisations, while other departments represented included marketing and sales (8%), procurement (7.5%) and general management (13.8%). The average employment duration of respondents with their company was 12 years (standard deviation $\sigma = 11.6$). The average duration of the relationship of the organisation with their suppliers and customers was about 22.1 years ($\sigma = 20.4$).

Covariance-based structural equation modelling was used to test the model; comprehensive overviews of this analysis method can be found in Byrne (2001) and Shah and Goldstein (2006). First, bivariate correlations between all the indicators of each construct were calculated. All sets of indicators showed a high (Spearman's) ρ -value of around 0.85, suggesting redundancy among some indicators. Redundant indicators were merged by calculating mean values (see the Appendix) and were thus combined into composite variables (Kline, 2005); this reduced the number of indicators for the four constructs reduced from 36 to 19. This procedure resulted in a marginal loss of information, but substantially enhanced the parsimony of the model.

As a basic prerequisite, the local fit of the four measurement models were tested, *i.e.* the measurement validity and the global fit of the analyzed model and the degree of congruency between the proposed model and the empirical data. Suggestions from Churchill (1979) and Bagozzi and Yi (1988) were followed and confirmatory factor analyses for each of the measurement models were calculated. All constructs showed good internal consistency with

Cronbach's or coefficient α around or above 0.70 (Fornell and Larcker, 1981). Indices showing the constructs' composite reliability ($\rho > 0.60$; AVE > 0.50) and discriminant validity (FLR < 1.0) also meet the recommended cut-off criteria (Bagozzi and Yi, 1988; Fornell and Larcker, 1981). Consequently, the local fit of the measurement models was regarded as satisfactory; all local fit measures are reported in the Appendix. Findings from the model testing are now discussed.

6. Findings

The global fit of the four latent constructs was tested by calculating and interpreting indices showing the absolute, incremental and parsimonious fit of each model (Anderson and Gerbing, 1988; Hu and Bentler, 1998, 1999). The modelling results are shown in Table 3. The caption at the bottom of the table includes the values of the single fit measures, which again meet recommended requirements. We thus consider the empirical data satisfactorily fits the proposed model.

Insert Table 3 here

The significant direct effects for the execution of SCM are shown in Table 3. The effects or standardised coefficients with significant t -values ($p < 0.05$) indicate whether the postulated hypotheses are accepted. The effect size or impact represented by the absolute value of the standardised path coefficients (γ) is interpreted according to recommendations by Cohen (1988), where the impacts of factors are compared with each other. Values of less than 0.10 indicate low or marginal effects, values around 0.30 can be regarded as typical or medium

effects and values above 0.50 are considered to be high or substantial.

As a result three hypotheses, H₁, H₃, and H₅ are *supported* and the three related constructs are regarded as antecedents determining the level of execution of SCM in a direct way. The most substantial effect can be found between internal SCM conditions and joint SCM conditions (γ_{21}). Neither of these two exogenous factors directly affect the execution of SCM to a considerable degree since γ_{11} and γ_{12} show no significant *t*-values ($p > .05$); thus hypotheses H₄ and H₆ are *not supported*. Joint SCM conditions have a direct effect on the adoption of SCM-related processes, which is also regarded as substantial (γ_{32}). However, internal SCM conditions play no direct role major role in adoption (γ_{31} ; $p > .05$); thus hypothesis H₂ is *not supported*. Finally, SCM-related processes turned out to be the only direct determinant of SCM execution having a direct and significant impact (γ_{13}).

By additionally considering the indirect effects, *i.e.* effects mediated by either/or the factors ξ_2 and ξ_3 , we found that all total effects, *i.e.* the sum of the direct and indirect effects on the execution of SCM, are significant. The internal SCM conditions, mediated by the joint conditions and the adoption of SCM-related processes, have the highest and thus most substantial impact on SCM execution. The joint conditions mediated by the adoption of SCM-related processes also show a considerable total effect on SCM execution. This leads to a final conclusion that SCM conditions, although of no direct relevance, affect the overall execution of SCM very substantially.

The squared multiple correlation values (r^2), which indicate the extent to which the variances of the factors ξ_2 , ξ_3 and η_1 are explained by the proposed influencing constructs, were considerable. The r^2 -values are above 0.50 for both the joint SCM conditions ($r^2 = 0.778$) and

the execution of SCM ($r^2=0.531$), so more than 50% of the variance is explained by the influencing factors. However, more than 32% ($r^2=0.325$) of the variance of the adoption of SCM-related processes is accounted for by the influencing factors.

In summary, the model as postulated and tested is parsimonious and robust, allowing conclusions to be drawn.

7. Conclusions

In this paper, three constructs were identified at the firm level: internal conditions, joint or external conditions, and the adoption of SCM-related processes, that in turn affect a fourth construct of SCM execution. A conceptual model incorporating all four constructs was developed and tested in a quantitative empirical study. The model was developed from several extant frameworks in the literature and represents an initial attempt at identifying, setting-out and testing the various constructs and underlying variables and their hierarchical order.

The empirical findings confirmed the adoption of SCM-related processes as the core antecedent directly affecting SCM execution, thus supporting work of Lambert (2004). However, SCM conditions set up either internally or jointly play no significant role in changing the level of SCM execution directly, thus refuting notions of Cousins and Menguc (2006) and Das *et al.* (2006).

Joint or external SCM conditions, comprising both transactional- and relationship-related characteristics for supply chain partnerships, can be considered a second-order antecedent but a crucial prerequisite for adopting SCM-related processes. This finding is in-line with Droge *et al.* (2004) and Lambert (2004). In contrast, internal SCM conditions do not influence the

adoption of SCM-related processes, but considerably and directly affect joint SCM conditions. This supports Mentzer *et al.* (2001) and Lambert (2004) regarding the necessity to ‘do the SCM homework’ first before entering into a supply chain partnership.

The results thus reveal a clear hierarchy of antecedents and thus our recommendations to organisations and managers intent on commencing SCM, and thus SCM partnerships, are to: 1) develop the organisation’s own internal SCM conditions; then 2) work with external partners on developing joint SCM conditions both downstream (customers) and upstream (suppliers); before 3) adopting SCM-related processes thereby executing SCM and adopting a supply chain orientation.

This process supports our intuitively-proposed path model. While some might ask ‘so what is new’ we note that this model and its constituent elements have not been clearly identified or promoted previously in the wide and sometimes disparate literature regarding SCM. Thus, the theoretical and conceptual contribution from this work has been to properly identify, isolate and test these four constructs to determine this process flow. Firms adopting these steps in turn should thus be setting out on and following a rigorous and appropriate road to full SCM execution.

From a practical point of view, the results stress the importance for supply chain members to ‘get their house in order’ before thinking of or intensifying supply chain partnerships. Such a internal supply chain ‘readiness’ includes sufficient provision of human and financial resources as well as adequate IT-systems to facilitate and master SCM-relationships and data exchange. Further, the results also suggest providing proper information exchange guidelines and establishing internal SCM objectives that are crucial to enhancing the total level of SCM

adoption and execution internally. Finally, ‘soft’ factors such as senior management support for and the propensity ‘to do’ supply chain management and the internal integration may be considered attributes to enhance the adoption and execution of SCM.

8. Limitations and Further Research

As with all research studies there are some limitations to this work. Firstly, the dependent construct of SCM execution and the independent construct of SCM adoption are explained only to a partial degree by the two independent constructs of internal and external conditions. This suggests that further research should extend the model to include other influencing factors reflecting ‘soft’ dimensions of supply chain partnerships, such as trust or power (Grant, 2005).

Secondly, the survey results reflect the views of large organisations in the Austrian market. Further research should extend the view towards smaller players and test the model with respect to their role in SCM partnerships, and also replicating the study in other countries and supply chain settings. Such research would help confirm the ‘chain of effects’ identified in our results.

Thirdly, a quantitative approach was applied in accordance with the research objectives and questions. Taking into account the shortcomings of survey approaches in general, a more in-depth view may be obtained by investigating actual cases of the SCM execution. The quantitative results can be used as a basis (*i.e.* interview or discussion outline) for further in-depth qualitative research intending to triangulate and confirm or adapt the proposed model for particular kinds of supply chain partnerships.

Lastly, we exclusively investigated the effects between latent constructs according to our research aims and hypotheses. By conducting an importance performance analysis, as suggested by Johnson and Gustaffson (2000), the impact and relevance of each manifest variable behind our factors could also be tested.

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Appendix

Insert Appendix here

Figure 1: Conceptual model

Caption:

ξ_n , exogenous factors; η_1 , endogenous factor; γ_n , proposed effects, also indicated by the arrows and arrows heads; x_n, y_n , indicators, can be seen from the appendix;

Table 1: Comparison of generic SCM frameworks

Author(s)	Execution of SCM	SCM-related processes	SCM-related conditions
(I) Bechtel and Jayaram (1997)	<ul style="list-style-type: none"> -- Chain of functions -- Integration of processes -- Flows of material and related information Coordination of functions between ultimate suppliers, focal company and ultimate customers -- Value adding for total chain -- Relational factors 	<ul style="list-style-type: none"> -- Content areas <ul style="list-style-type: none"> - Design - Acquisition - Storage - Manufacturing - Warehousing - Distribution - Installation - Recycling - Customer 	<ul style="list-style-type: none"> -- Process area Planning <ul style="list-style-type: none"> - TQM – inter-organisational relationships, processes, procedures, tools, skills, organisational structure - Systems thinking - Cost analysis/Modelling - Reengineering -- Process area Execution <ul style="list-style-type: none"> - Top management support - Financial resources - Technical expertise - Staff to utilise -- Process area IT <ul style="list-style-type: none"> - Data storage - Decision Support Tools - Information transfer -- Process area inter-organisational structure measurement
(II) Cooper <i>et al.</i> (1997)	<ul style="list-style-type: none"> -- Integration of processes -- Flows of material, services and related information -- Coordination of functions between ultimate suppliers, focal company and ultimate customers -- Value adding for total chain 	<ul style="list-style-type: none"> -- Business Processes <ul style="list-style-type: none"> - Customer Relationship Management - Customer Service Management - Demand Management - Order Fulfillment - Manufacturing Flow Management - Procurement Product Development and Commercialisation - Returns 	<ul style="list-style-type: none"> -- Network Structure <ul style="list-style-type: none"> - Horizontal and vertical structure of the chain - The focal company's horizontal position -- Management Components <ul style="list-style-type: none"> - Physical and technical components – planning and control methods; work flow/activity structure; organisational structure; communication and information flow facility structure; product flow facility structure - Managerial and behavioural components – management methods; power and leadership structure; risk and reward structure; culture and attitude

(III) Lambert <i>et al.</i> (1998)	-- Network Structure <ul style="list-style-type: none"> - Horizontal and vertical structure of the chain - The focal company's horizontal position - Process links across the supply chain -- Management Components <ul style="list-style-type: none"> - Physical and technical components – planning and control methods; work flow/activity structure; organisational structure; communication and information flow facility structure; product flow facility structure - Managerial and behavioral components – management methods; power and leadership structure; risk and reward structure; culture and attitude 	-- Integration of key business processes -- Flows of material, services and related information -- Coordination of functions between ultimate suppliers, focal company and ultimate customers -- Value adding for total chain	-- Business Processes <ul style="list-style-type: none"> - Customer Relationship Management - Customer Service Management - Demand Management - Order Fulfilment - Manufacturing Flow Management - Supplier Relationship Management - Product Development and Commercialisation - Returns Management
(IV) Fawcett and Magnan (2001)	-- Collaborative effort of multiple channel members to design, implement and manage seamless value-added processes -- Meet real needs of the end customer -- Integration of people and technological resources	-- Implementation challenges <ul style="list-style-type: none"> - Lack of top management support - Non-aligned strategic and operating philosophies - Inability or unwillingness to share information - Lack of trust among supply chain members - Unwillingness to share risks and rewards - Inflexible organisational systems and processes - Cross-functional conflicts and “turf” protection - Inconsistent/inadequate performance measures - Resistance to change - Lack of training for new mindset/skills 	-- Strategic management initiative <ul style="list-style-type: none"> - Cross-functional process change - Performance Measurement - Alliance design - Information Systems - Alignment Mechanisms - People environment
(V) Mentzer <i>et al.</i> (2001)	-- Coordination of functions between ultimate suppliers, focal company and ultimate customers -- Value adding for total chain	-- Supply Chain Orientation <ul style="list-style-type: none"> - View of the coordination of a supply chain from a system perspective -- Antecedents <ul style="list-style-type: none"> - Trust 	-- Functional Scope <ul style="list-style-type: none"> - Marketing - Sales - Research and Development - Forecasting

		<ul style="list-style-type: none"> - Commitment - Interdependence - Organisational compatibility - Vision and key processes - Leadership - Top management support 	<ul style="list-style-type: none"> - Production - Purchasing - Logistics - Information Systems - Finance - Customer Service
		<ul style="list-style-type: none"> -- Organisational scope <ul style="list-style-type: none"> - Integrated behavior - Sharing information - Shared risks and rewards - Cooperation - Similar customer service, goals and focus - Integration of key processes - Long-term relationships 	
(VI) Ho <i>et al.</i> (2002)	<ul style="list-style-type: none"> -- Management and integration of business processes across the supply chain -- Value creation -- Collaboration 	<ul style="list-style-type: none"> -- Commitment -- Joint actions/practices -- Inter-organisational relationships -- Inter-organisational economic behaviour -- Inter-organisational cooperation -- Trust -- Power -- Voluntary reciprocal engagement 	<ul style="list-style-type: none"> -- Deliveries synchronisation -- Integrated production planning, -- Shared production forecasts joint EDI access/networks -- Packaging congruence -- Kanban procurement approach
(VII) Tan <i>et al.</i> (2002)	<ul style="list-style-type: none"> -- Linking of all elements from the stage of raw material through to end users -- Total integration of all business entities -- Encompassing organisational boundaries 	<ul style="list-style-type: none"> -- Commitment -- Joint goal optimisation and efficiency 	<ul style="list-style-type: none"> -- Supply Chain Management practices <ul style="list-style-type: none"> - Integration - Information sharing - Customer service management - Geographical proximity - Supply chain characteristics - JIT-capability -- Supplier evaluation practices <ul style="list-style-type: none"> - Product and delivery assessment - Capacity assessment - Information assessment
(VIII) Chen and Poulraj (2004)	<ul style="list-style-type: none"> -- Development of collaborative advantage -- Strategic vertical integration -- Internal and external integration of business processes 	<ul style="list-style-type: none"> -- Critical elements <ul style="list-style-type: none"> - Trust and commitment - Long term relations - Cross-functional teams - Communication 	<ul style="list-style-type: none"> -- Strategic purchasing -- Supply Management <ul style="list-style-type: none"> - Supplier selection - Supplier involvement - Supplier certification

			<ul style="list-style-type: none"> - Supplier base reduction -- Logistics integration -- Supply network coordination
(IX) Cigolini <i>et al.</i> (2004)	<ul style="list-style-type: none"> -- Process-oriented management approach to sourcing, producing and delivering goods and services -- Cooperation and coordination of various actors in a chain -- Moving costs up- and downstream, increase overall chain's profitability 	<ul style="list-style-type: none"> -- Supply chain Information tools <ul style="list-style-type: none"> - Online connections (EDI, Internet, etc.) for inter-company data transfer - Automated identification systems (barcodes, scanners, RFID, etc.) - Integrated databases - Direct knowledge of end demand -- Supply chain coordination and control tools <ul style="list-style-type: none"> - Supply Chain performance metrics system - Vendor rating systems - Supply chain cost accounting system -- Supply chain organisation tools <ul style="list-style-type: none"> - Cross-firm incentive system - Cooperation through interface management 	<ul style="list-style-type: none"> -- Supply chain techniques related to the configuration of the chain <ul style="list-style-type: none"> - Design for SCM - Warehouse network design - Transportation fleet design - Retailing system design - Facilities network design -- Supply chain techniques related to the management of the chain <ul style="list-style-type: none"> - JIT – Supply system - Logistics category management - Distribution alliances - DRP - Transport optimisation - VMI - Reserving upstream capacity or stock - Reordering policies - BPR - Group purchasing
(X) Kotzab <i>et al.</i> (2006)	<ul style="list-style-type: none"> Total internal integration of business processes Total integration of business processes with suppliers Total integration of business processes with customers 	<ul style="list-style-type: none"> - Internal SCM conditions <ul style="list-style-type: none"> - Resource based conditions - Integration based conditions - Joint SCM conditions <ul style="list-style-type: none"> - Decision based conditions - Negotiation based conditions - Mutuality and information based conditions - Organisational match based conditions 	<ul style="list-style-type: none"> -- Market oriented SCM-activities <ul style="list-style-type: none"> - Product development and commercialisation - Returns - CRM - Procurement -- Logistics oriented SCM-activities <ul style="list-style-type: none"> - Order Fulfilment - Demand Management -Administrative processes

Table 2: Classification of antecedent conditions for adopting and executing SCM within organisations

Internal SCM conditions (in alphabetical order)	Publications									
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)
Commitment and dedication of resources					X	X	X	X	X	X
Coordinated view									X	
Cross-functional teams				X				X	X	X
Guidelines for information transfer	X				X					X
Interdependency				X		X			X	
Internal vision and goals									X	X
Inter-organisational behavior	X	X	X			X			X	
IT-systems	X				X					
Planning and control methods	X	X	X	X	X					X
Staff's technical expertise/skills	X			X						X
Top Management support	X	X	X	X					X	X
Willingness to share information		X	X	X					X	
External or joint SCM conditions (in alphabetical order)										
Aligned strategic and operated philosophies				X						
Communication		X	X					X		
Culture and attitude		X	X							X
Inter-organisational/long-term relationships		X	X						X	
Joint actions/practices					X	X				X
Joint goal optimisation							X			X
Leadership		X	X							X
Management methods		X	X	X						
Organisational structure and compatibility	X	X	X	X					X	
Power						X				X
Product flow facility			X		X					
Risk and reward structure/sharing risks		X	X	X	X					X
Systems thinking	X			X					X	X
Trust				X		X		X	X	X

Caption: (I), Bechtel and Jayaram (1997); (II), Cooper *et al.* (1997); (III), Lambert *et al.* (1998); (IV), Fawcett and Magnan (2001); (V), Mentzer *et al.* (2001); (VI), Ho *et al.* (2002); (VII), Tan *et al.* (2002); (VIII), Chen and Poulraj (2004); (IX), Cigolini *et al.* (2004); (X), Kotzab *et al.* (2006)

Table 3: Antecedents of SCM adoption and execution

Exogenous factors	Effects on factors														
	The execution of SCM (η_1)				SCM-related processes (ξ_3)				External or Joint SCM conditions (ξ_2)						
	Direct effects (γ_n)	Med	Indirect effects	Total effects	Direct effects (γ_n)	Med	Indirect effects	Total effects	Direct effects (γ_n)	Med	Indirect effects	Total effects			
Internal SCM conditions (ξ_1)	γ_{11}	.252	{ ξ_2, ξ_3 }	.356	.608***	γ_{31}	-.139	{ ξ_2 }	.606***	.467***	γ_{21}	.881***	{-}	--	.881***
External SCM conditions (ξ_2)	γ_{12}	.189	{ ξ_3 }	.280	.469**	γ_{32}	.688**	{-}	--	.688**	--	--	{-}	--	--
SCM-related processes (ξ_3)	γ_{13}	.406***	{-}	--	.406***	--	--	{-}	--	--	--	--	{-}	--	--

Notions: Table shows direct, indirect and total standardised effects (regression weights); global fit measures (recommended cut-off values in brackets): absolute fit measure: Root Mean Square Error of Approximation (<.08) =.062; incremental fit measures: Tucker-Lewis Coefficient/Comparative Fit Index (>.9/>.9)=.938/.947; parsimony fit measures: Normed χ^2 (CMIN/df) (<3)=1.655; degrees of freedom (df)=146;
Caption: Med, mediators; *, t -values significant at $p<.05$ level (**, $p<.01$; ***, $p<.001$); --, no (in)direct effect proposed or n/a;

Appendix

Factor Indicator (“to what degree...”)	Measures/Indices		Literature
	μ (σ)	ρ/α AVE	
SCM conditions [Requirements which are the fundamental for originating SCM-related processes and the execution of SCM]			
Internal SCM conditions (ξ_1)			
x_{11} ...are personnel / human resources made available for SCM issues? ^{†(I)}	3.04 (1.14)	.92/.92	Lambert <i>et al.</i> (1998)
x_{12} ...are financial resources made available for SCM issues? ^{†(I)}	2.87 (1.14)	.69	Cooper <i>et al.</i> (1997)
x_{13} ...does top-management of your company support SCM issues? ^{†(II)}	2.87 (1.15)		Cigolini <i>et al.</i> (2001)
x_{14} ...were internal goals set up before SCM projects were launched? ^{†(II)}	3.13 (1.23)		Mentzer <i>et al.</i> (2001)
x_{15} ...are employees able to use IT-systems for SCM issues? ^{†(III)}	3.40 (1.29)		Fawcett and Magnan (2001)
x_{16} ...does your company have IT-systems capable of processing data from other SCM partners? ^{†(III)}	3.12 (1.30)		Bechtel and Jayaram (1997)
x_{17} ...is there an agreement on guidelines with respect to the exchange of information with other companies in the supply chain? ^{†(III)}	2.85 (1.3)		
x_{18} ...are employees trained in order to contribute to SCM-projects? ^{†(IV)}	2.92 (1.14)		
x_{19} ...does your company have project groups consisting of people from different functional areas? ^{†(VI)}	3.26 (1.28)		
x_{110} ...is there the necessary expertise in your company to set up and maintain supply chain relationships? ^{†(V)}	3.49 (.95)		
x_{111} ...your company is willing to integrate with other supply chain members? ^{†(V)}	3.36 (1.10)		
External or joint SCM conditions (ξ_2)			
x_{21} ...is there collaborative agreement on the evaluation of supply chain processes with other supply chain members? ^{†(VI)}	2.86 (1.21)	.88/.88 .57	Ho <i>et al.</i> (2001) Wisner <i>et al.</i> (2002)
x_{22} ...is there an agreement on collaborative goals with other supply chain members? ^{†(VI)}	2.95 (1.21)		Chen and Poulraj (2004)
x_{23} ...are there supply chain project groups in place with other supply chain members? ^{†(VI)}	2.55 (1.22)		Mentzer <i>et al.</i> (2001)
x_{24} ...is your company aware that its decisions may affect other supply chain members? ^{†(VII)}	3.52 (1.10)		Lambert <i>et al.</i> (1998)
x_{25} ...is your company willing to trust other supply chain members? ^{†(VII)}	3.11 (1.08)		
x_{26} ...does your company have long term relationships with other supply chain members? ^{†(VII)}	3.63 (1.11)		
x_{27} ...is there an equal distribution of power among all members in your supply chain? ^{†(VIII)}	2.59 (.90)		
x_{28} ...is the distribution of risks and benefits even between your company and other members in your supply chain? ^{†(VIII)}	2.65 (.92)		
x_{29} ...is there mutual dependency between your company and other members in your supply chain?	3.19 (1.14)		
x_{210} ...does your company exchange information regarding stock levels with other supply chain members? ^{†(IX)}	2.87 (1.35)		
x_{211} ...does your company exchange forecasting information with other supply chain members? ^{†(IX)}	2.96 (1.30)		
x_{212} ...does your company exchange product development information with other supply chain members? ^{†(IX)}	2.61 (1.27)		
x_{213} ...is your corporate culture similar to other supply chain members? ^{†(X)}	2.65 (1.02)		
x_{214} ...is your corporate decision-making similar to other supply chain members? ^{†(X)}	2.43 (.95)		

Latent Dimension		Measures/Indices		Literature
Indicator (“to what degree...”)		μ (σ)	ρ/α AVE	
SCM-related processes (ξ_3) [processes which integrate or coordinate different key business areas within the firm and between a firm’s suppliers and customers and create customer value]				
x_{31}	...is your company capable of processing orders according to agreement with customers in terms of quantities and times? $\dagger(XI)$	4.23 (.77)	.75/.74 .51	Lambert <i>et al.</i> (1997; 1998),
x_{32}	...is your company capable of forecasting future customer demand? $\dagger(XI)$	3.37 (.94)		
x_{33}	...is your company capable of adapting production capacity according to customer demand? $\dagger(XI)$	3.59 (1.09)		
x_{34}	...is your company capable of informing customers about the current status of their orders? $\dagger(XI)$	4.02 (1.02)		
x_{35}	...is your company capable of intergrating key accounts and suppliers into the product development process?	3.27 (1.17)		
x_{36}	...is your company capable of dealing with returns and returned packaging?	3.87 (1.00)		
x_{37}	...is your company capable of intergrating key accounts in the development and implementation of marketing programs?	3.16 (1.21)		
x_{38}	...is your company capable of building up multiple cooperations with important, strategic suppliers?	3.75 (1.02)		
The execution of SCM (η_1) [The firm’s internal and external integration of business processes with suppliers and customers which generates a flow of products, services and related information]				
y_{11}	...has your company integrated sourcing, logistics, marketing, product development and other areas with your suppliers?	2.84 (1.11)	.79/.78 .56	Cooper <i>et al.</i> (1997) Lambert <i>et al.</i> (1998) Frohlich and Westbrook (2001)
y_{12}	...has your company integrated sourcing, logistics, marketing, product development and other areas with your customers?	2.73 (1.19)		
y_{13}	...has your company internally integrated its sourcing, logistics, marketing, product development and other areas?	3.29 (1.09)		
Caption: x , y , indicator or manifest variable; ξ , η , factor or latent (endogenous) variable: μ , mean value; σ , standard deviation; α , Cronbach’s Alpha; ρ , composite reliability; AVE, Average Variance Extracted; $\dagger(I-XI)$, summarised by calculating mean values because of high correlation between indicators (Spearman’s ρ -value $>.85$) and in order to decrease the degree of redundant information between indicators and increase of the parsimony of the model (Kline, 2005); Notions: Ratings based on a 5-point scale, verbally and numerically anchored (1, to a very low degree; 5, to a very high degree); Cut-off values for measurement validity: $\alpha>.7$; $\rho>.6$; AVE $>.5$ (Fornell and Larcker, 1981; Bagozzi and Yi, 1988); sample size: n=174;				