

Supply Chain Management – A Multidisciplinary Approach for Competitiveness in Volatile Times

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Abstract

Purpose – The purpose of the paper is to investigate how supply chain management (SCM) can help organizations to stay competitive or improve competitiveness. Especially in volatile times this is a key question? What we have seen is volatility through price movements of resources (GSCI-Index changed from 2007 till 2010 by more than 300%), shipments (Baltic dry-Index), currencies (EUR/\$), and earthquakes like Japan or political turmoil like Middle East and North Africa. Understanding as well how Supply Chain Management theory has to change, as it was mainly developed during less volatile times and what impact this has on SCM implementation?

Design/methodology/approach – Quantitative and qualitative, survey based research was carried out with 16 Austrian industry companies. The questions were done by interviews only with SCM or operations professionals. Using interviews has the advantage that more detailed questions can be asked. The questionnaire is semi-structured and covers the areas of customer orientation, supply chain maturity in terms of organization, strategy, practices, processes and performance management, leadership in terms of how SCM-managers get supported by the organization, supply chain, financial performance, customer satisfaction and competitive differentiation. Statistical analysis combined the use of descriptive statistics and factor analysis to see which of the factors has the biggest influence on success.

Findings – Empirical results indicate a strong and positive statistical relationship between supply chain maturity and supply chain performance. The results also suggest that the deliver process maturity has a higher impact on overall performance than the other supply chain processes. Best performers schedule a higher percentage of orders to customer request date and are more likely to deliver the goods on the committed date. Although supply chain strategy has a huge impact on financials – 80% of the SCM-professionals don't know the ROCE or cash to cash cycle of their company – nor did they know the impact of SCM on these financials. The SCM-function gets only in half of the companies full support from top management.

Originality/value – The roots of this difference of SCM are caused by the way how it is implemented, not just as a system theoretical approach but as a multi-faceted approach to holistic management, taking components like leadership, support, SCM-strategy definition into consideration. Seeing SCM as well from a social and psychological perspective and not just from a systems view point is important.

Keywords: Supply Chain Management (SCM), Competitiveness, Volatility

Historical development of SCM

The historical perspectives: In the period from the 1960s to the mid-1970s, corporations had vertical organization structures and optimization of activities was focused mainly on functions. Relationships with vendors were win-lose interactions, and often adversarial. Manufacturing systems were focused on materials requirements planning (MRP).

From 1975 to 1990, corporations were still vertically aligned but several were involved in process mapping and analysis to evaluate their operations. There was a realization by organizations of the benefit of integration of functions such as product design and manufacturing. Various quality initiatives, such as total quality (TQM) [1], and ISO standards for quality measurement were

initiated by many organizations. From 1990 onwards, corporations have been experiencing increasing national and international competition. Strategic alliances between organizations were developing. Organizational structures are starting to align with processes. Manufacturing systems in organizations have been enhanced with information technology tools such as enterprise resource planning (ERP). There has been a growing appreciation in many firms of total cost focus for a product from the source to consumption, as opposed to extracting lowest price from the immediate vendor. There has been also increased reliance on purchased materials and outside processing with a simultaneous reduction in the number of suppliers and greater sharing of information between

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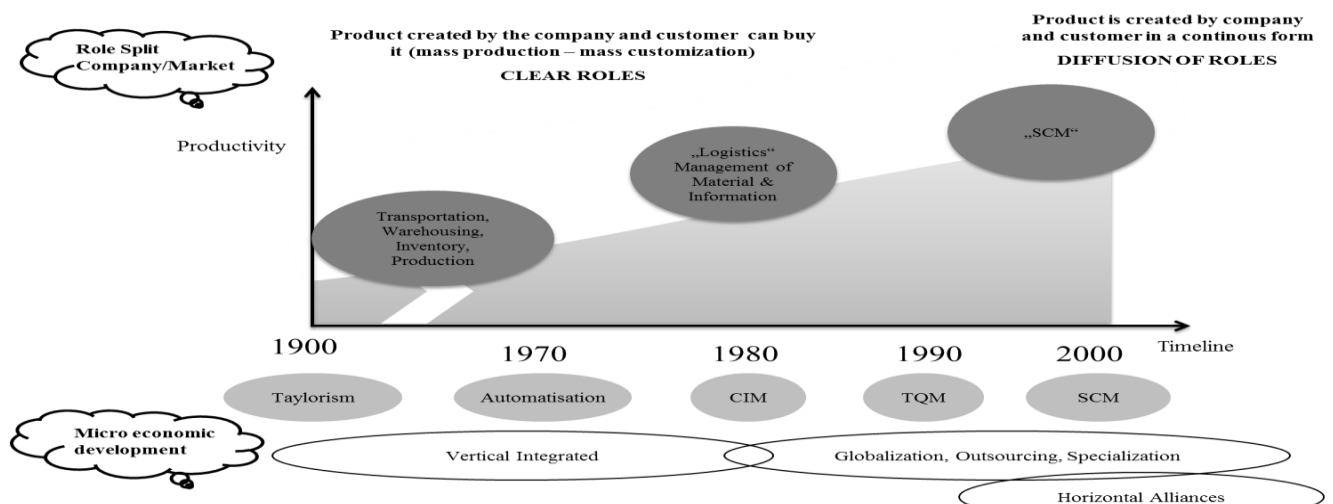
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vendors and customers. A shift from mass production to customized products has taken place. This resulted in greater organizational and process flexibility, as well as a response to competitive pressure by introducing new products more quickly, cheaply and of improved quality. The SCM philosophy has developed along these trends[2]. According to the author, the latest development is a strong increase in complexity due to outsourcing and off-shoring and a dramatic increase of volatility. As one can see in this historical background development, most of the SCM practices developed in a quite stable environment compared to the current turbulence and volatility. Historically, the approach to SCM was to reduce costs through increased control, which in a stable environment certainly improves profitability. In a volatile world, control efforts result in rigidity of supply chain structures and interactions. This rigidity may result in amplifying rather than dampening variability. Thus the greater the variation present in the input parameters, the less effective our control models tend to become. The variability which hurts performance and is related to supply chain design can emanate from a wide range of factors: from the demand side (e.g. shift in customer demand for products), the supply side (e.g. hikes of oil, steel, and gold prices), regulation (e.g. shift in customer perception towards climate), political (e.g. North Africa, East Asia,...), energy costs (electricity and transport costs), financial (e.g. currency hikes and credit crunch), and technology (e.g. shifts in dominant designs, disruptive innovations). In conclusion, based on these factors we need a generic strategy that anticipates turbulence. There is a need to move from a dynamic to a structural flexibility. A new mental model for how to deal with turbulence in the supply chain, by shifting away from a single-minded quest for efficiency towards a balanced view of how to create adaptable supply chain structures, is called for. From the author's perspective, this development is a move from efficiency-based models, to a model able to cope with dynamic distortions (using CPFR, VMI, and information sharing), to a supply chain that is able to adapt structurally as a natural transition.

This shift requires a fundamentally different design (elements are: dual sourcing, asset sharing, separating

base from surge demand, postponement, flexible labor arrangements, rapid manufacture, outsourcing) – a design that embraces rather than fights volatility. As mentioned by Christopher and colleagues, SCM has to move away from controlling variation and strategically change our mindset to embrace volatility and not fight it, because this can provide a temporary competitive advantage[3]. Embracing volatility as something positive and making it a competitive advantage is a key challenge for current and future SCM. This mind shift works only if imposed from the top of the company – meaning SCM as part of strategic management, supported by transformational leadership to make it happen.

The development stages of SCM, based on macro- and micro-economic developments. The x-axis shows the productivity increases and y-axis the timeline. Explaining the figure from left to right, it starts with Taylor: business at that time was mainly vertically integrated, meaning all parts for manufacturing products were in one place, increasing productivity by tailoring work. The roles between producer and customer were very clearly split – the customer could buy what was offered by the company. The next development happened from the 1950s to the 1970s when automation was used to increase productivity. In the 1980s and 1990s, new waves of productivity increase came on stream (CIM = computer integrated manufacturing and TQM = total quality management). In the 1990s, trends like outsourcing and off-shoring were introduced, which led to higher productivity but also to more network complexity and imposed the need to coordinate the flow of material and information across functions and organizations. Due to these developments a new philosophy of management was needed, called supply chain management. A subsequent micro-economic wave that influenced the development of SCM was the development of horizontal alliances, in which competitors start using the same platforms of products to increase productivity, like VW and Ford with the Sharan and Galaxy models. The current and future trends impacting SCM will be a diffusion of roles between company and customer, where the customer has an influence on product design during the ordering process, and which will also require new strategies for supply chain management.



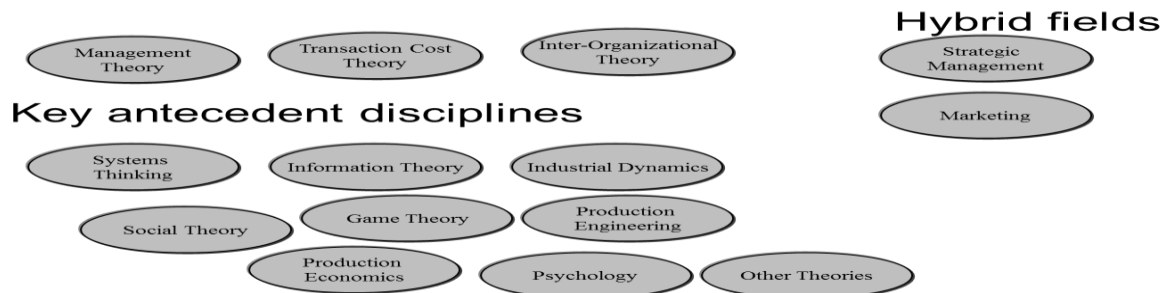
Development stages of SCM, based on macro- and micro-economic developments [4], [5], [6], [7].

SCM – A Multidisciplinary Approach

The author recognizes that developments in our understanding of SCM require a multi-disciplinary approach to address the contrasting antecedents. The importance of transaction cost economics and inter-organizational theory has been recognized by a number of researchers.

The key impact theories on SCM, such as management theory, transaction cost theory and inter-organizational theory and a number of other key antecedent disciplines,

namely systems thinking, information theory, industrial dynamics, production economics, social theory, game theory and production engineering: 11 different subject literatures that have an impact on Supply Chain Management. There are hybrid fields such as strategic management and marketing in which it is apparent that the subject is being explored from a multiplicity of perspectives. A number of antecedent disciplines can be summarized under “leadership topics”.



SCM Influencing Theories - Multidisciplinary View[4]

Therefore researchers need to be aware of complementary studies outside of their own domain of expertise[8]. In the battle over definitions and descriptions, part of the agenda is undoubtedly an attempt to re-position functions and quasi-professions such as operations management, procurement and logistics. Rather than try here to determine the precise construct, the author acknowledges the value of adopting a constructivist approach and explores how relevant actors construe their prime objectives, the scope of their activities, the allocation of responsibilities, the barriers to desired practice and the enablers - descriptive. Looking at this, problems arise when the shift from description to prescription is relatively covert. Some prescriptions stem from observed superior practice in particular domains. This can be valuable, but the author's opinion is that for the discipline to advance, there also needs to be rigorous testing – serious exploration of the causes of failure. The literature develops rather imperceptibly between description, prescription and new trend identifications. One trend was the shift from an “antagonistic” model to a collaborative model[9]. Another trend is the concern with the impacts on various functions such as purchasing[10]. While one would expect that trend analysis implies progress, Hines and Fischer claim that despite all the technology and the new techniques, supply chain performance in many instances has “never been worse[11]”. This leads to a situation in which managers lack a framework for determining which methods are appropriate. This implies that managers tend to adopt far more of a contingent rather than a “best practice” approach [12].

A variety of theories – among them structural inertia theory[13] and threat rigidity theory[14] -- have emerged to explain the frequently observed resistance to organizational transformation. Lewin's force field analysis was, however, the first widely accepted framework for understanding the nature of organizational transformation[15]. Because they freeze an organization in its entrenched behaviour, resisting forces (cultural resistors – social dilemma theory, structural resistors – constituency-based theory) debilitate the strategy-

implementation and organizational-transformation process. Improving the ability to collaborate requires better insight into motives, mechanics, impediments, and desired outcomes of the transformation process at the end[16].

The economic trends of the last five to 10 years such as business globalization, ever more demanding customers, commoditization of products, new entrance into established industries, outsourcing, disintegration and off-shoring of products and services lead to a fundamental increase of complexity, uncertainty and volatility. Whereby volatility, over the past three years, is additionally driven by extreme commodity price volatility, currency volatility and sudden unexpected events like earthquakes, tsunamis, or radical political changes.

SCM as a management philosophy and its implementation are also seen by the author as a fundamental concept to respond to these developments and gain temporary and sustainable competitive advantage.

SCM is a system-theoretical construct, influenced in multiple ways by other disciplines such as accounting, marketing, logistics, operations management, mathematics, systems dynamics, game theory, psychology, behavioral theory and many others. Nevertheless, a core theory is missing due to the fact that this multi-faceted influence led to ever new evolving theories but rather hindered a positivistic approach of the philosophy by testing existing constructs instead of developing new ones. Therefore, a consistent definition is missing.

For this study the author used the definition of Stock and Boyer. They synthesized a consensus definition as a result of a study of 173 definitions. This definition combines the collective thinking and wisdom of numerous individuals with varying perspectives and viewpoints. The constructs of the definition were used in the paper selection for the state-of-the-art models/studies. Supply chain management is no longer just about efficient flow of material, money and information, as defined originally by Oliver and Webber, but instead

about improving the performance of the entire value chain or network with the aim of gaining or maintaining temporary or sustainable competitive advantage. SCM starts with the ability and will to understand and incorporate customer desires, meaning it is oriented to customer priorities (channel and customer requirements). Based on corporate strategy, channel and customer requirements (service and channel strategy), the supply chain requirements can be defined. These requirements now form the basis for supply chain strategy development, covering the customer service strategy, channel strategy, asset network strategy, operations strategy and outsourcing strategy. This means, finally, that integrating and managing heterogeneous resources (customers, suppliers, service partners) with different target and incentive systems from different supply chain members to meet the customer demand (meeting expectations leads to higher customer satisfaction) in the most efficient and effective way is the objective (maximize benefits) of supply chain management. Achieving this requires an aligned set of performance figures, financial and non-financial, to manage and steer successful execution. SCM practices are used to implement SCM strategy, involve interactions among interdependent yet independently owned networks of organizations, and interactions among the employees of the network organizations. This philosophy of management requires trust to build relationships of networks and therefore has to be supported by leadership (top management) to be implemented successfully. According to Peter Senge, because organizational capabilities emerge over time and through learning, the capacity to learn faster than competitors could be a source of sustained competitive advantage[17]. How do supply chains now deliver temporary or sustainable competitive advantage? A firm possesses a sustainable competitive advantage when it has value-creating processes and positions that cannot be duplicated or imitated by other firms that lead to the production of above-normal rents. A sustainable competitive advantage is different from a competitive advantage in that it provides a long-term advantage that is not easily replicated. The processes and positions that engender such a position are not necessarily non-duplicable or inimitable. Supply Chain Management is a capability, difficult to imitate, that connects operational levels where innovation actually occurs with strategic levels, and synchronizes the strategic and operational factors when managing resources strategically (integration). Lack of trust, misalignment of incentives[18], and fear of

opportunism, or of hold up[19] and fear of being locked in to a low-quality supplier, “inter-organization rivalry[20]” and other such obstacles make the coordination of two independent organizations more challenging and may even lead to supply chain failure. For the author, this means leadership and trust are key building blocks for the success of SCM and the level of impact on competitiveness.

In summary, the supply chain management impact on competitiveness is evident according to theory. The key impact factors are:

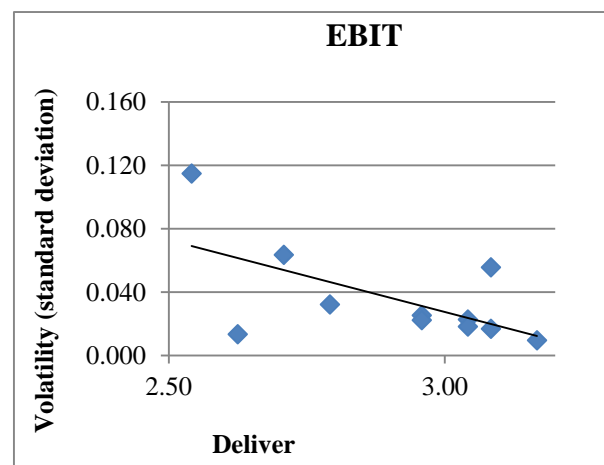
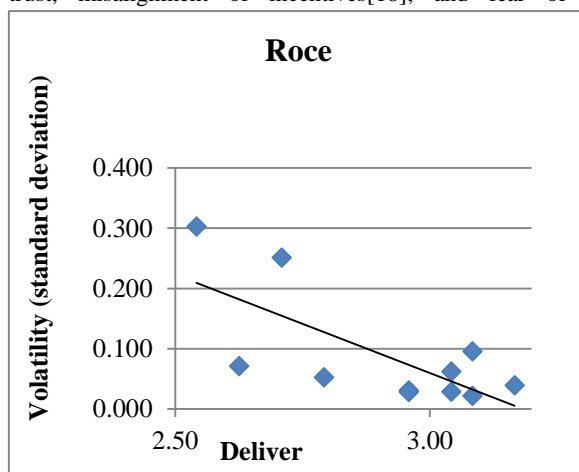
Customer orientation, meaning: is the supply chain design based on corporate strategy and channel requirements? How mature is the organization in terms of supply chain management, meaning, is there a supply chain strategy? Is there a supply chain organization? Do supply chain metrics exist (financial, non-financial)? Do supply chain practices fit with corporate strategy? Are supply chain practices implemented? And how is supply chain management supported by leadership, meaning is supply chain management part of strategic management? Does the company have a supply chain strategy and aligned performance measures across functions (financial and non-financial)? It became evident for the author when studying the current literature that most of the research focuses on inter-organizational relationships, practices and process improvements, and their effects on financial and non-financial performance measures, but only very few studies focus on leadership and social factors necessary for successfully implementing SCM. This was already evaluated by Burges and his literature review, based on 100 articles of referenced journals, in 2006 [21]. Shedding light onto this topic is a key focus of this study – how leadership influences and enhances the SCM impact on a firm’s competitiveness

Empirical result of open benchmarking with the 12 companies (SC expert group)

The model was tested with a group of 12 supply chain managers who are members of the VNL supply chain expert group, prior to the full interview study. The test was performed by interviews based on the questionnaire and with financial results from 2007 to 2010. The financial figures included turnover, working capital, earnings before interest and tax (EBIT), return on capital employed (ROCE). The results were discussed openly in four workshops with the managers.

The focus of this part of the research is on the findings made only with this group of senior managers.

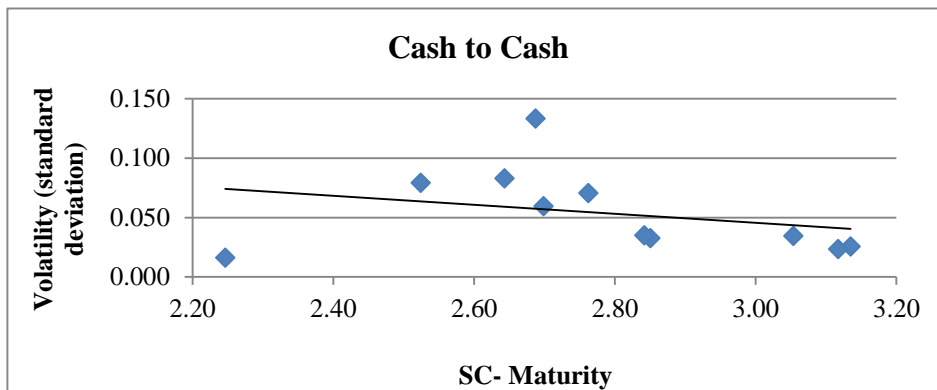
This figures shows statistically the following results.



ROCE & EBIT and Deliver[4]

There is a high negative correlation between ‘SCM maturity/Deliver’ and ‘ROCE and EBIT’. This shows that companies with low maturity in the area of deliver have a higher volatility on results over a three-year period (2007-2010).

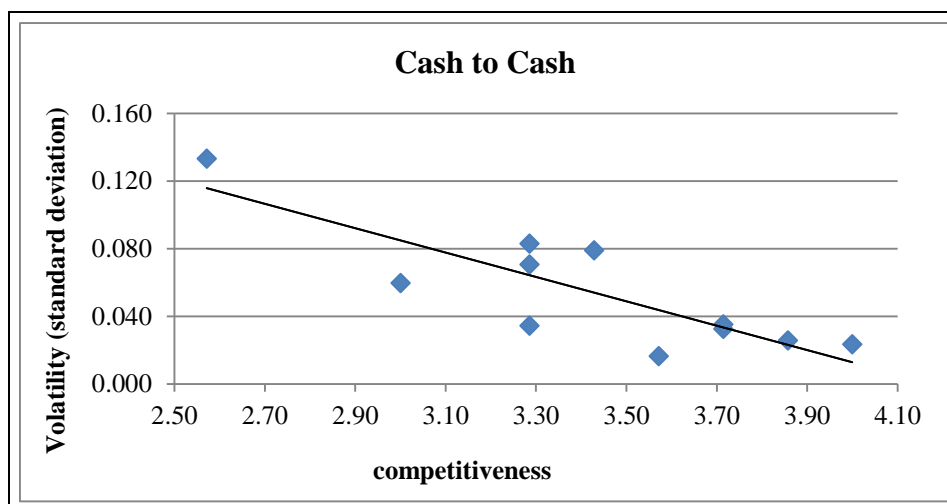
This shows that there is a high negative correlation (-0.6553) between ‘supply chain maturity’ and the volatility of the ‘cash-to-cash cycle’ of a company over the period 2007-2010. This means that more mature companies have less cash-to-cash volatility



Cash-to-Cash Cycle & SC Maturity [4]

This points out that there is also a high negative correlation (-0.8367) between ‘competitiveness’ and the volatility of the ‘cash-to-cash’ cycle of a company. This

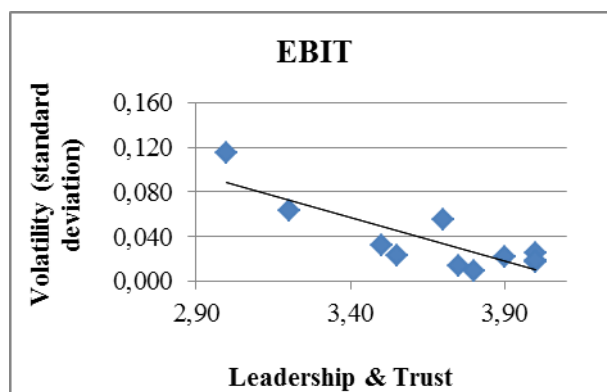
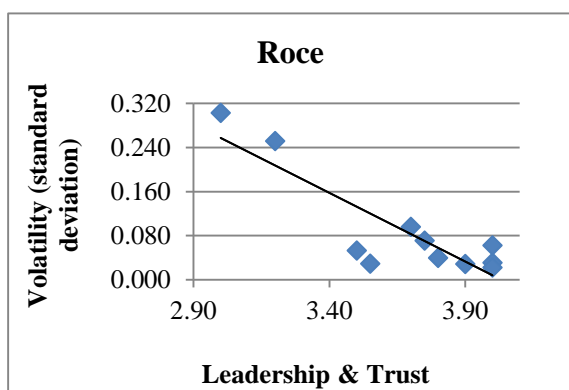
means that companies with higher competitiveness show lower cash-to-cash cycle volatility over the period 2007-2010.



Cash-to-Cash Cycle & competitiveness [4]

The highly negative correlations of ‘leadership & trust’ with the volatility of ‘ROCE’ (-0.8348) and ‘EBIT’ (-

0.8367). This means the higher the scores on ‘leadership & trust’, the lower the ‘ROCE and EBIT’ volatility.



ROCE & EBIT and Leadership & Trust[4]

The discussion of the results with the supply chain managers provided additional insights that companies with higher maturity had more stable results over the three-year period. Customer orientation is higher in companies with higher maturity and these companies also have higher customer satisfaction values (as the figure below shows).

The profile of a highly mature company in terms of supply chain maturity, customer orientation, and customer satisfaction. This company even showed an improvement of EBIT, ROCE and working capital over the three-year period, although turnover was reduced during the crisis period of 2008 and 2009. The figure at the upper left side shows the maturity profile. Based on the questionnaire developed in chapter 3, the SC maturity was evaluated in four stages, where 4 is the highest stage of maturity and 1 is the lowest.

The upper left quarter of the upper left side figure shows the attributes of supply chain strategy, manufacturing strategy, sourcing strategy, and planning strategy, where the highly mature company ranked on 4, even above benchmark, which was defined with the top quartile of companies in the sample. This means the company has a clear and explicit SC strategy and SCM is part of strategic management.

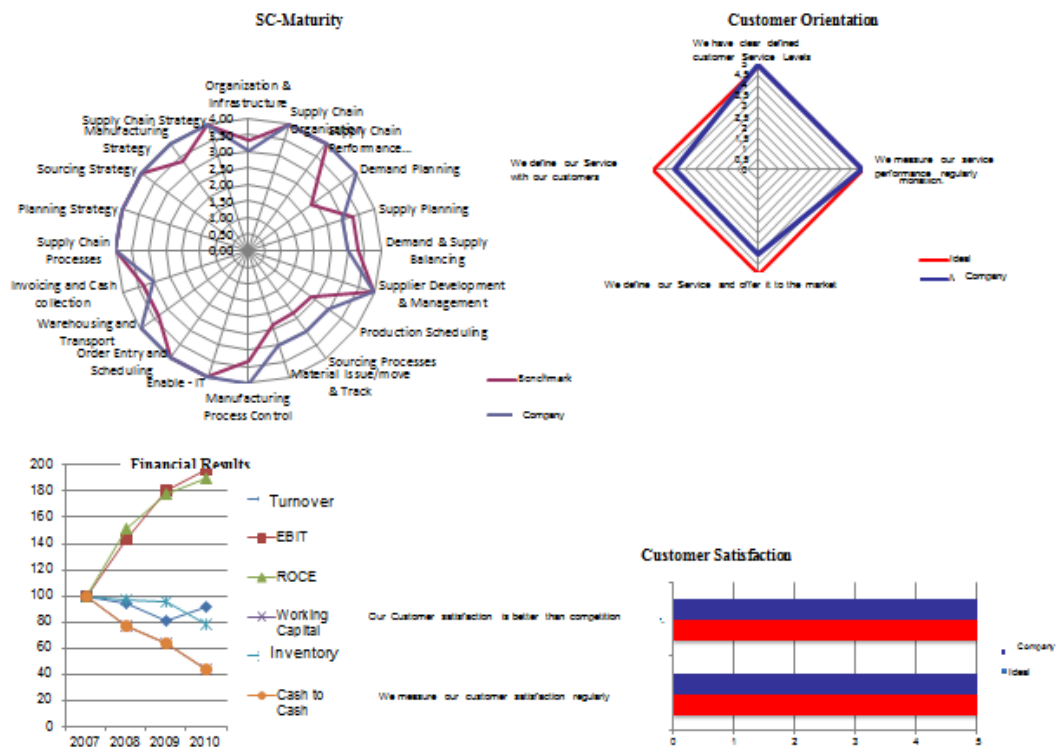
Moving clockwise around this figure, organization and infrastructure and SC organization (strategic view of SCM) are the next attributes. Here again the highly mature company is with stage 3 to 4 values on benchmark.

The next attribute moving clockwise is performance management (strategic view of SCM), where the

company again ranks on level 4. This means the company has an end-to-end measurement system in place to measure and manage SC performance. The next attributes are practice and process attributes (operative view of SCM), such as demand planning, supply planning, demand and supply balancing, supplier development and management, production scheduling, sourcing processes, material issuing, moving and tracking, manufacturing process control, enabling IT support, order entry and scheduling, warehousing and transport, invoicing and cash collection and supply chain processes.

The highly mature company has the right practices to fit the strategy and is in control of good processes integrated end-to-end (from customer to supplier). The high maturity is reflected in the right upper figure of customer orientation – understanding customer needs and capturing them in written service agreements that are measured regularly – which leads to high customer satisfaction shown in the left lower figure.

These elements together with the right leadership and culture, fostering collaboration and integration (compelling vision, SCM as part of strategic management, cross-functional goal and incentive alignment, full appreciation of SCM and trust in supply chain functions and the supply chain manager), lead to lower financial results volatility, shown in the lower left side figure, even during the period from 2007 to 2010 when demand was very volatile. The highly mature company also saw a decline in turnover, but was able to adjust the end-to-end supply chain in a way that led to even higher EBIT, ROCE and lower working capital and cash-to-cash cycle results.



Profile of a highly mature company [4]

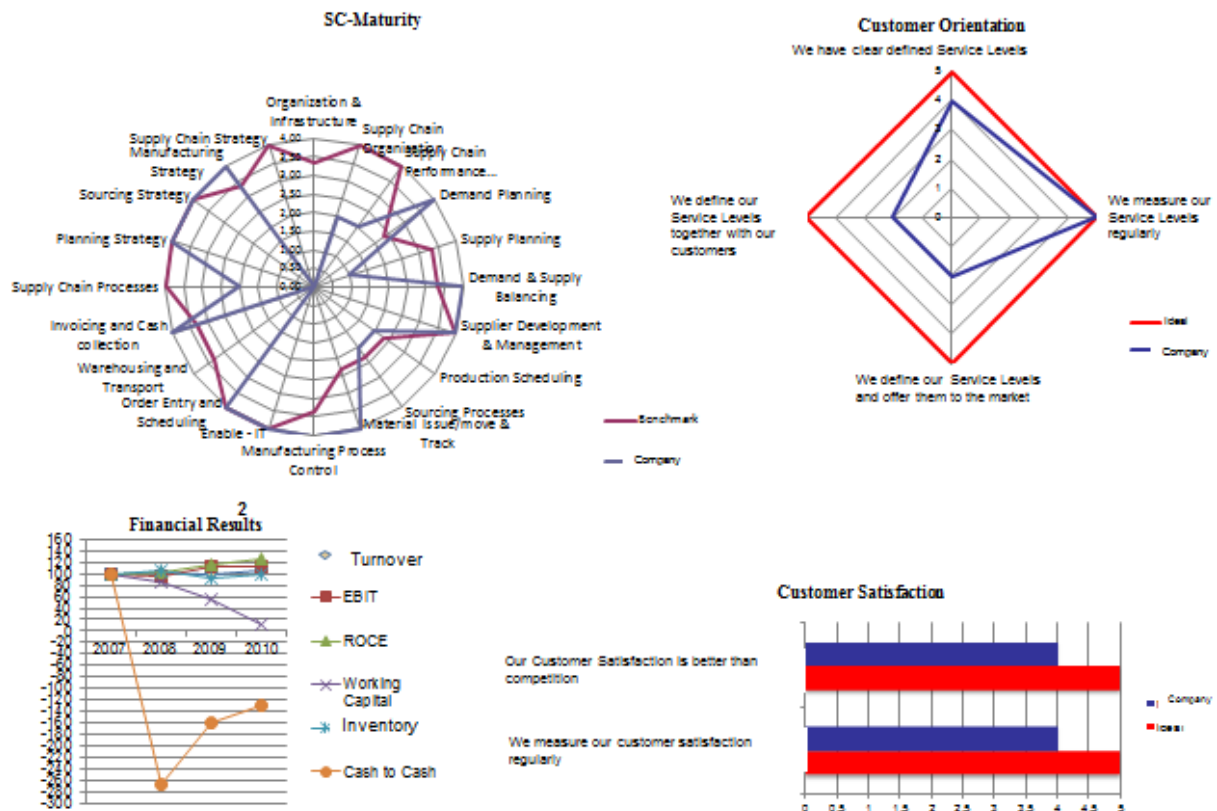
A company of very low maturity in terms of supply chain management, low 'customer orientation' and lower 'customer satisfaction' values, which lead to much higher volatility of results over the three-year period. The upper left quarter of the upper left side figure shows the attributes of supply chain strategy, manufacturing strategy, sourcing strategy, and planning strategy, where the company of low maturity ranked between 1 and 4, in some areas far below benchmark which was defined with the top quartile of companies in the sample. This means the company has no clear or explicit SC strategy and SCM is not part of strategic management.

Moving clockwise around this figure, 'organization and infrastructure' and 'SC organization' (strategic view of SCM) are the next attributes. Here a company of low maturity is with stage 1 or 2 values far below benchmark, meaning there is no SC organization to take care of end-to-end process management, collaboration and alignment. The next attribute moving clockwise is performance management (strategic view of SCM), where the company again ranks only on level 2. This means the company has no end-to-end measurement system in place to measure and manage SC performance. There are some SC performance indicators in place that are measured but not aligned cross-functionally. The next attributes are practice and process attributes (operative view of SCM), such as demand planning, supply planning, demand and supply balancing, supplier development and management, production scheduling, sourcing processes, material issuing, moving & tracking, manufacturing

process control, enabling IT support, order entry and scheduling, warehousing and transport, invoicing and cash collection, and supply chain processes.

The company of low maturity has a missing fit of practices: the SC strategy is missing and it is also not in control of end-to-end (from customer to supplier) processes as they are not integrated. The low maturity is also reflected in the upper right figure of customer orientation. The service levels were defined without customer involvement and they are measured without feedback; this means the effort which is taken may not lead to higher customer satisfaction, as the lower left figure shows, and better returns.

These elements, together with the missing leadership & culture, fostering competition among functions (as a compelling vision is missing and SCM is not part of strategic management, cross-functional goals are indifferent and incentives are not aligned, SCM is seen as a tool for cost reduction and trust in supply chain functions and in the supply chain manager is limited), lead to higher financial results volatility, shown in the lower left figure during the period 2007 to 2010 when demand was very volatile. The company of low maturity has seen a decline in turnover, but was unable to adjust the end-to-end SC, which led to lower EBIT and ROCE and higher working capital and cash-to-cash cycle results. This case description shows the SCM impact on competitiveness, in which the company of low maturity even faced losses and experienced high volatility in the cash-to-cash cycle



Profile of a company of low maturity[4]

This shows that the model can be used for SC analysis of supply chain performance and the financial results impact. Based on the analysis, it is also possible to identify the areas for improvement and their possible impact on financial results. In addition, here the author identified during the discussions among the managers that supply chain strategy as part of strategic management is a key element of successful SCM. This strategic importance also triggers a proper SCM organization with strong cross-functional collaboration among sales, production, logistics, finance, procurement, and having a sales and operations planning process in place. Another big part is customer expectation management, which is reflected in 'customer orientation', with service levels that are clearly defined and in agreement with customers, measured on regular basis. If these elements were missing, results showed much greater volatility over the four years from 2007 to 2010.

Conclusions

Based on these elements, through a study of the literature on SCM models and case studies, the conceptual model was generated. The model covers the following elements: 'customer orientation', 'strategic view of supply chain management', 'operative view of SCM (supply chain practices and processes)', 'leadership & trust', 'operational performance', 'financial performance', 'customer satisfaction', and 'competitiveness'. Less than 30% of all models studied covered 'leadership' as an element, and those 30% did not touch it as behavior, following the elements of leadership (inspirational motivation, individualized consideration, intellectual stimulation, and idealized influence). Less than 50% of the models studied evaluated the impact on competitiveness.

The model was evaluated by interviews with 12 senior SCM-Managers

- It was possible to uncover important information beyond the semi-structured questionnaire with narrative parts, as there was also the possibility of explaining terms of questions if the interviewee asked for clarification.
 - Different industry specifics could be understood and discussed to ensure that the result reflected the right context.
 - Interviews were conducted by different people to ensure the results were not influenced by the author's own bias.
 - Benchmarking exercise with 12 Austrian-based companies, where the maturity results of the questionnaire were put in relation to the volatility of their respective financial results for the years 2007 to 2010.
 - These results showed a high correlation between their SCM maturity and the volatility of financial results during this volatile period of time (financial crisis in Europe).
 - The results were discussed with the supply chain managers of the respective companies to really understand the main differences of their maturity levels.
- In summary SCM as a multidisciplinary approach to management can reduce financial results volatility during volatile times, like 2007-2010. As economic volatility will continue as the new normal the use of SCM can help to take advantage of volatility.

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