

A PRACTICAL TOOL FOR SUPPLY CHAIN IMPROVEMENT - EXPERIENCES WITH THE SUPPLY CHAIN MATURITY ASSESSMENT TEST (SCMAT)

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ABSTRACT

This paper outlines the need for a quick assessment tool for mapping the maturity of a company's supply chain operations, and presents the Supply Chain Maturity Assessment Test (SCMAT) as a potential answer to this need. Experiences the researchers have gained in the development of SCMAT are summed up as strengths and weaknesses with the test. Guidelines for test and analysis procedure are presented, and a research agenda for further development is proposed.

Keywords: Supply chain management, Maturity model, Best practice

INTRODUCTION

The purpose of this paper is to report on experiences with a simple mapping tool for use in supply chain improvement projects. Mapping tools exist in many different forms, spanning from ten-minutes tests such as the operations excellence audit sheet (Alfnes et al, 2006), via Quick Scan (Naim et al, 2002) which requires ca a week to perform, to broad business modelling frameworks such as ARIS (IDS Scheer, 2002) and SCOR (SCC, 2006).

A maturity model aims to aid companies to benchmark the maturity of their operations relative to industry best practice, and assumes that companies pass through a number of maturity levels before reaching best practice. Maturity models have been developed within a wide range of disciplines. However, only a few models are targeting supply chain management (e.g. Lockamy and McCormack, 2004a, b; Netland et al, 2007; Srari and Gregory, 2005). Building on experiences with using the generic Supply Chain Maturity Assessment Test (SCMAT) (Netland et al, 2007), this paper aims to answer the following two research questions:

- Rq1) What are the strengths and weaknesses with the supply chain maturity assessment test?
- Rq2) How can such maturity tests be fruitfully carried out in real world projects? (Guidelines)

The paper is structured as follows: First, the need and requirements for assessment tools is outlined. Second, the Supply Chain Maturity Assessment Test (SCMAT) is briefly presented as a potential answer to this need. Third, the methodology used is described. Fourth, the authors' experiences with SCMAT are presented, resulting in a summary of strengths and weaknesses with the test as it is at present. Fifth, guidelines for use and analysis are discussed. Finally, conclusions are drawn and implications for practitioners and researchers are given.

NEED AND REQUIREMENTS FOR A QUICK ASSESSMENT TOOL

Today competition takes place more between supply chains than between single companies, and most companies are part of several supply chains. Thus, in order to stay competitive companies desire to improve their supply chain operations. Using industry best practices to enhance business performance has been a topic for both practitioners and researchers for decades. In order to reach best practice, companies have a need to map their current state of practice and point out directions towards best practice. The assessment of current state can be done by different methods, requiring different input of time and resources. One relatively quick method is to use diagnostic tools based on maturity models.

Maturity models are rooted in the field of quality management, where Crosby's Quality Management Maturity Grid was a pioneering work (Fraser et al, 2002). Numerous different types of maturity models have been developed within different disciplines since then. The maturity model concept is probably best known within information technology and software development in particular, where the Capability Maturity Model (CMM) describes stages in the use of information technology. Other examples of disciplines where maturity models have been developed are technology, innovation, R&D effectiveness, collaboration, reliability, quality management, product design, knowledge management, service operations etc. (Netland et al, 2007).

Even though there exist numerous maturity tests within specific disciplines of operation management, there only exist a few targeting the management of the firm's supply chain (e.g. Lockamy and McCormack, 2004a; Srari and Gregory, 2005; Netland et al, 2007). Srari and Gregory (2005) reviewed twenty existing maturity models and found that the models often lacked a supply chain perspective, were more or less single function oriented, dominated by financial measures, not linked to the overall business strategy, and mainly directed towards specific industries making cross industry comparison difficult.

Similar to maturity tests is self-assessment. Self-assessment is "a comprehensive, systematic and regular review of an organisation's activities and results referenced against a model of business excellence" (EFQM, 1998). Thus, self-assessment involves comparing activities of the firm against a model for business excellence (Fagerhaug, 1999). In his PhD-dissertation Fagerhaug (1999, pg. 92) lists some requirements for a self-assessment model that are valid to maturity models as well (Table 1).

Table 1 Requirements for self-assessment model and method (Fagerhaug, 1999; pg. 92)

-
- Enhance employee participation
 - Consider existing methods and models
 - Model and method must fit together
 - Be generic
 - Use a holistic approach
 - Focus on business processes
 - Be visual
 - Use different dimensions of performance (i.e. be balanced)
-

Foggin et al (2007) ask for a simple diagnostic tool that should not require large amount of detailed data, should not take a long time to complete, and should be qualitative in nature. Maturity tests made for the purpose of quick maturity assessment should be qualitative,

because quantitative tests built on performance indicators are too complex and time-consuming when attempted to be generic. Naim et al (2002) stress the importance and power of triangulation between sources in their quick scan methodology. The flexibility of such simple tests should be exploited for triangulation in order to secure the validity of the answers.

Summing up, there is a need for quick assessment tools for supply chain improvement that meets the fifteen requirements listed in Table 2 below.

Table 2 15 requirements for a quick assessment tool for supply chain improvement

<ol style="list-style-type: none"> 1) Addresses a company's supply chain operations (Lockamy and McCormack, 2004a; Srαι and Gregory, 2005; Netland et al. 2007) 2) Is industry generic and enables cross-industry comparison (Srαι and Gregory, 2005; Fagerhaug, 1999) 3) Spans several business functions (Srαι and Gregory, 2005; Fagerhaug, 1999) 4) Uses different dimensions of performance (i.e. is balanced) (Srαι and Gregory, 2005; Fagerhaug, 1999) 5) Does not require large amount of detailed data (Foggin et al, 2007) 6) Does not take long time to complete (Foggin et al, 2007) 7) Is based on qualitative parameters (Foggin et al, 2007) 8) Is linked to overall business strategy (Srαι and Gregory, 2005) 9) Allows triangulation of results (Naim et al, 2002) 10) Enhances employee participation (Fagerhaug, 1999) 11) Considers existing methods and models (Fagerhaug, 1999) 12) Ensures that the model and method fit together (Fagerhaug, 1999) 13) Uses a holistic approach (Fagerhaug, 1999) 14) Focuses on business processes (Lockamy and McCormack, 2004a; Fagerhaug, 1999) 15) Is visual (Fagerhaug, 1999)

INTRODUCTION TO SCMAT

The Supply Chain Maturity Assessment Test (SCMAT) was first described in Netland et al (2007). It aims to address the need and requirements for a supply chain assessment tool as outlined in the previous section. SCMAT's main objective is to quickly identify improvement areas in the beginning of companies' supply chain improvement projects. SCMAT v8.0 is attached to the paper in Appendix A. Here, three main model-aspects of SCMAT are briefly outlined:

- 1) Test structure: A maturity model audit scheme
- 2) Test content: Best practices in supply chain operations
- 3) Conformity with requirements

Test structure: A maturity model audit scheme

A literature review on maturity models has been carried out in order to build the structure of the tool. SCMAT is inspired from multiple maturity models, maturity tests and self-assessment frameworks such as Voss et al (1994), Fagerhaug (1999), Lockamy and McCormack, (2004a, b), Srαι and Gregory (2005), Van Landeghem and Persoons (2001), IBM (2005) and Alfnes et al (2006).

As illustrated in Figure 1, maturity models can normally be communicated in a two-dimensional way, where one axis describes the practices to be measured for maturity and the other axis outlines the degree or level of maturity for each practice (c.f. Fraser et al (2002) for a discussion on maturity scales in 18 different maturity models). To present the practices in a logical and easy-to-follow way a superior categorisation of the practices is of great help.

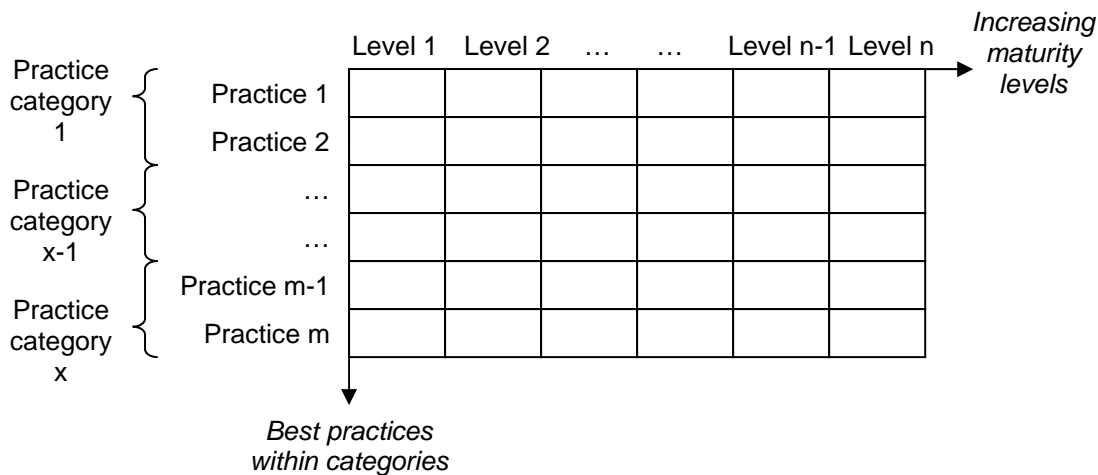


Figure 1 Typical structure of maturity models

SCMAT states five maturity levels, according to a qualitative answer to the question “To which extent does our supply chain use best practice stated?” (based on Lockamy and McCormack, 2004b) (cf. Figure 2). The maturity scale is alike for all the best practices that shall be evaluated in the test.

“To which extent does our supply chain use best practice stated?”

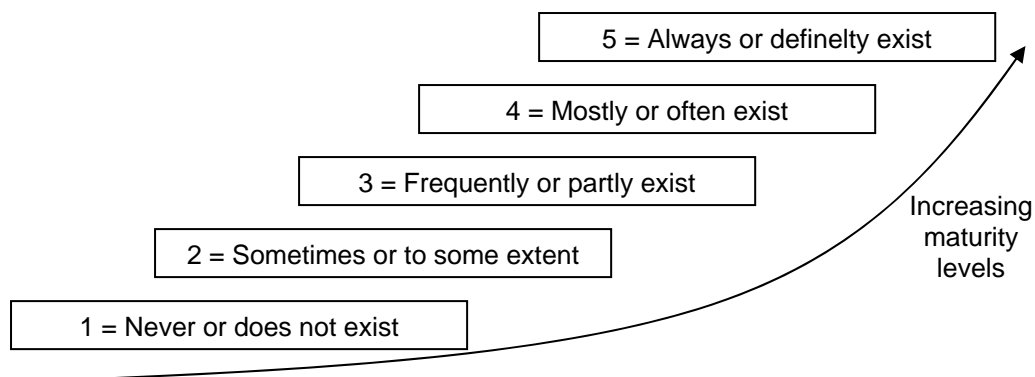


Figure 2 SCMAT maturity level scale (Based on Lockamy and McCormack, 2004b)

Test content: Best practices in supply chain operations

SCMAT is developed in line with Voss et al (1994) who adopt research-based best practice statements as signs of superior performance. Thus, a literature review on best practices in supply chain operations has been carried out in order to build the content of the tool.

Van Landeghem and Persoons (2001, pg. 254) simple definition of best practices is adopted: “Best practices describe the state-of-the art of how to perform a business”. In line with this definition, technologies (e.g. using AGV, RFID etc.), concepts (e.g. using SCOR, APICS etc.) or performance measures (e.g. 99 % service level etc) are not defined as best practices in the test, but instead it is searched for short descriptive best practice sentences or statements that describe *how* companies operate their supply chain activities on the strategic and operational level.

It is not the intent to define a certain number of best practices that gives the definitive world-class performance. It is however the purpose to present best practices that most researchers will agree upon is really best practice. Therefore multiple sources are used to rephrase and define the best practices that have become part of the SCMAT. 48 best practices

are stated and shall be evaluated regarding maturity in the current version of the test. SCMAT categorises the defined practices in seven categories based on a function perspective as outlined by Alfnes (2005). The seven function categories are: Strategy, Control, Processes, Resources, Materials, Information, and Organisation.

Conformity with requirements

As listed in Table 3, the proposed maturity assessment test meets all the requirements outlined in the previous chapter. There is however certain reservations to several of them as commented.

Table 3 SCMAT's conformity with the 15 requirements outlined

Requirements	SCMATs' conformity with requirements
1) Addresses a company's supply chain operations	Yes
2) Is industry generic and enables cross-industry comparison	Yes, but cross-industry comparison must be made with caution due to the qualitative nature of the test
3) Spans several business functions	Yes, but is limited to supply chain management and operations management
4) Uses different dimensions of performance (i.e. is balanced)	Yes
5) Does not require large amount of detailed data	Yes, no preparations necessary, but demands qualified test participants
6) Does not take long time to complete	Yes, only ca 1 hour for testing, but discussion of results comes in addition
7) Is based on qualitative parameters	Yes
8) Is linked to overall business strategy	Yes, but is only indirectly enabled when discussions are held on the results
9) Allows triangulation of results	Yes, but must be made with caution due to the qualitative nature of the test
10) Enhances employee participation	Yes, no block against wide participation, but the best practices requires high-level knowledge about the business processes
11) Considers existing methods and models	Yes
12) Ensures that the model and method fit together	Yes
13) Uses a holistic approach	Yes
14) Focuses on business processes	Yes
15) Is visual	Yes

METHODOLOGY

The maturity test presented in this paper is a result of a thorough development process starting early 2006 at SINTEF Operations Management. Several iterations have been made between literature reviews on maturity models and best practices in supply chain operations, and practical testing in real-world companies. The test has been continuously improved and is still not complete.

An action research methodology (e.g. Arbnor and Bjerke, 1997; Greenwood & Levin, 1998) has been applied, where the researchers have been involved in and facilitated projects with the maturity test and adjacent improvement processes. In action research projects, the researchers are both participants as well as observers in the development project, which give detailed insight into processes, procedures and data in the case companies. This paper reports on the experiences from a wide variety of companies from different industries where the test has been applied (cf. Table 4).

Table 4 Companies that have been involved in the development of SCMAT

Participating company	Industry	HQ location
Nortura BA	Processor of red and white meat	Oslo
Mustad AS	Manufacturer of fishhooks	Gjøvik
Hydro Automotive	Manufacturer of automotive crash management	Raufoss
Stokke AS	Manufacturer of furniture	Skodje
Bindalsbruket	Manufacturer of furniture	Terråk
Bama Gruppen AS	Wholesaler of fruit and vegetables	Oslo
Norplasta AS	Manufacturer of plastic bins	Stjørdal
NorgesGruppen	Retail chain and wholesaler of groceries	Oslo
Tollpost Globe AS	Provider of logistics services	Oslo
Peterson Emballasje AS	Manufacturer of cardboard packaging material	Trondheim
ICA Norge AS	Retail chain	Oslo
Tine BA	Processor of dairy products	Oslo

The included companies are chosen because they span a range of different industries, spanning from furniture manufacture to wholesale of fruits and vegetables, and because complete supply chains, from manufacturing via wholesale and logistics to retail, are represented.

EXPERIENCES WITH SCMAT - STRENGTHS AND WEAKNESSES

In the course of the development of SCMAT some strengths and weaknesses have become apparent for both researchers and test users. Both the main strength and main weakness of SCMAT is tied to the qualitative nature of the test, where persons answers on gut-feeling and experience to a limited number of best practices in a very short time. Due to this, the test is extremely quick to carry out and give a pretty good picture of the current maturity level fast. However, the results must be treated thereafter – they are the result of subjective impressions given under time pressure.

Based on feedback from users and researchers in projects where the test has been applied strengths and weaknesses have been collected and discussed. The most evident strengths and weaknesses with SCMAT are summed up in Table 5.

Table 5 SCMAT strengths and weaknesses (feedback and experiences from use in case projects)

STRENGTHS	WEAKNESSES
<p>Simplicity</p> <ul style="list-style-type: none"> - Simple and easy-understandable audit scheme for everyone to use - Results are communicated in a logical and visual style <p>Quickness</p> <ul style="list-style-type: none"> - Takes no longer than one hour to complete - Results are given immediately - Requires no preparatory work <p>Including</p> <ul style="list-style-type: none"> - Includes participants in an early phase of an improvement project - The discussions during the test procedure are highly valuable themselves <p>Applicability</p> <ul style="list-style-type: none"> - Allows a range of applications from self-assessment to benchmark studies <p>Qualitative input</p> <ul style="list-style-type: none"> - Allows qualitative consideration of 	<p>Qualitative and subjective answers</p> <ul style="list-style-type: none"> - Answers not based on facts and figures - Large variations of interpretation on maturity level inside a firm <p>Validity of best practices</p> <ul style="list-style-type: none"> - Best practice studies never cover all the practices that influence performance - Impossible to secure the validity of the best practices <p>Complexity of best practices</p> <ul style="list-style-type: none"> - The best practices stated often need some further explanation for practitioners not familiar with all areas of supply chain management <p>Non-normative</p> <ul style="list-style-type: none"> - Does not give any answers on how to improve <p>Lack of quantitative input</p> <ul style="list-style-type: none"> - The qualitative nature does not allow

maturity	quantitative analysis across companies and industries
Balanced	Compliance with other mapping techniques
- Allows triangulations of answers from different sources	- So far no triangulation with other tools
- Allows tradeoffs to be made through strategic discussions	- So far not part of broader mapping techniques
Generic	Language and translation
- Designed to be generic for any industry	- For non-English natives the language becomes an additional barrier

DISCUSSION ON GUIDELINES FOR TEST AND ANALYSIS

To structure the discussion on guidelines the following headlines are chosen:

- 1) Guidelines for test procedure
- 2) Guidelines for test result analysis

Guidelines for test procedure

SCMAT can be carried out in different ways. During the first two years with SCMAT the team of researchers have identified five different test procedures that fruitfully can be used interchangeably:

- a) Standard maturity self-assessment
- b) Gap-analysis (as-is and to-be)
- c) Counterpart triangulation
- d) Third-party triangulation
- e) Maturity benchmark study

In a Standard maturity self-assessment the test is carried out by a team of company representatives either alone or with the facilitation of researchers or consultants. The test-team gives qualitative experienced-based answers to each stated best practice according to what they believe is the company's current maturity. The facilitation from researchers can be made online on web, in a telephone conference or face-to-face in a meeting. This is the basic SCMAT procedure and all other procedure variants are based on this one.

In a Gap-analysis the company representatives answers two questions: In addition to the standard "To which extent does our supply chain use best practice stated? (as-is)", the test-team also answers the question "To which extent does our supply chain aim to use the best practice stated five years from now? (to-be)". Both questions are answered with the same five alternatives ranging from 1 = "never or does not exist" to 5 = "always or definitely exist". This way the gap between today's maturity level and the desired maturity level is mapped at once, and the analysis phase can more easily focus on the practices with the largest improvement gaps.

By Counterpart triangulation is meant that the company's supply chain partners are challenged to evaluate the company's maturity. When comparing the evaluation of the company with the evaluation of for instance the company's customer, triangulation of results can be made. This procedure has the potential to give very rare and valuable input to a company. This kind of information on how a supplier or customer sees your business can be a major eye-opener and be the trigger needed to enhance supply chain cooperation.

By Third-party triangulation is meant that a third-party, typically researchers or consultants, are challenged to evaluate the company's maturity. Researchers and consultants often have a broad experience from equal and different companies and industries, which normally would give a different maturity evaluation than the company's own answers. Comparing these two sets of answers allows triangulation and thereby enhances the validity of the test results.

A Maturity benchmark study can be made when the same maturity test is carried out in two or more companies. However, due to the strong qualitative nature of the test presented here, caution is called for when the results from different companies and industries are compared. It is the opinion of the researchers that if the test shall be carried out as a Maturity benchmark study, it is a prerequisite that the test is carried out in a plenary session where every practice is explained by a facilitator. This way self-interpretation of the practices is reduced and the results are more comparable from one company or industry to the other.

Guidelines for test result analysis

Before discussing methods of result analysis, an important observation deserves attention: Importantly, the test procedure itself can have just a powerful contribution to the company as the actual test results. When SCMAT is carried out on a team of representatives from a company, the team will be forced to discuss their understanding of key areas in supply chain management and not-to-mention agree on a maturity score for every practice that shall be evaluated. In several companies these discussions have revealed shades in interpretations among the participants, and more over large heterogeneity in the appreciation of maturity scores. Thus, SCMAT gives attention to areas that have been neglected or considered difficult in strategic discussions.

In any case, SCMAT does not give answers – it only poses questions. In order to develop in line with business strategy strategic discussions are needed to evaluate the test results. The highest maturity level in the model corresponds to world best practice. However the maturity of specific processes differs throughout the firm and between firms. As Blanchard (2007) points out, a best performing company does not have to have best practice implemented in all its business areas, but it is consistently good enough in the areas of importance for being best-in-class. If, for example, a company scores low on a certain best practice it might be because this practice is irrelevant for the company or contrasts the business strategy. An intuitive example will be the Spanish clothing manufacturer Zara, that would score low on the best practice “Utilisation of tangibles” due to their strategic decision on being more flexible and agile than cost efficient in their European clothing factories. A strategic discussion on the test results would quickly reveal this. Because no enterprise can be world class in all dimensions, tradeoffs must be made.

The analysis of the test results can be done in many different ways. However, in line with the core idea of SCMAT, the analysis phase should be as quick as the test itself. In the carried out projects, the researchers have chosen the following receipt for analysis: Practices that were considered having especial improvement potential (maturity stage 1-2) and practices with a high level of maturity (stage 4-5) were focused. These extremes were indicated in the radar diagrams, and presented for discussion in 2-4 hours’ work shops. During the workshops strategic trade-offs on which practices that must be addressed for the different companies were made. Typically, only one to three practices were initially chosen in order to focus the improvement project.

CONCLUSIONS

There is a clear need for a quick maturity test for supply chain operations. The test presented here aims to address this need. The Supply Chain Maturity Assessment Test (SCMAT) is an excel-based audit scheme built on best practice statements within key decision areas such as strategy, control, processes, materials, resources, information and organisation. In SCMAT a balance between detail and simplicity is stricken to the advantage of simplicity. It is underlined that SCMAT does not give answers – it poses questions. It outlines in a systematic way what seems to be good, and what seems to have potential for improvement. SCMAT has been tested in a two-digit number of Norwegian companies, and has received positive

feedback. However, there is a clear need for more conceptual and empirical research into SCMAT and supply chain maturity tests in general.

Implications for practitioners

Supply chain managers ask for a simple and quick tool which could be used as an eye-opener and a compass early in supply chain improvement projects. The test presented (SCMAT) has a proven potential to quickly point out directions for supply chain improvement projects. It has successfully been applied in several companies' development projects. By presenting guidelines for how a supply chain maturity assessment test can fruitfully be used in a company's supply chain improvement project, this paper fills a gap in the literature.

Implications for further research

It is underlined that the test presented here is not finally developed and need further adjustments both in model (structure and content) and method. In SCMAT a number of defined best practices in supply chain management are used which should continuously be considered and redefined; thus more conceptual research into the content of maturity tests is needed. In addition, more empirical case studies should be carried out to further develop and shape the technical functionality, structure and procedures of such maturity tests. The following research questions can be part of a prospective research agenda on supply chain maturity assessment tests:

- How can the validity of the best practices in the test be ensured?
- How can more triangulation of results be enabled?
- How can cross-company comparability be enabled?
- How can SCMAT be part of broader supply chain mapping techniques?
- What are pros and cons of SCMAT compared to similar maturity tests?
- How can the results be interpreted in a wider context?

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APPENDIX A SCMAT V.8.0

Table 6 SCMAT v.8.0 test sheet

Area of Best Practice	BP nr	Tag	To which extent does our firm use best practice? 1 - Never or does not exist 2 - Sometimes or to some extent 3 - Frequently or partly exist 4 - Mostly or often exist 5 - Always or definitely exist	1-5
Strategy	1	Supply chain strategy	A clearly stated supply chain strategy exists (e.g. Fuchs et al, 1998)	
	2	Customer focus	The strategy is customer focused (e.g. Godson, 2002; Schonberger, 1986; Lambert & Cooper, 2000; Blanchard, 2007)	
	3	Aligned strategy	The supply chain strategy is aligned with each company's strategy, vision and mission (e.g. Fuchs et al, 1998; Godson, 2002)	
	4	Aligned collaboration	The degree of collaboration in the supply chain is decided and based on analysis of factors such as strategic importance of product, availability of product and degree of customisation (e.g. Evens & Danks, 1998; IBM 2005a)	
	5	Aligned incentives	Supply chain partners share risk, costs and rewards when improving supply chain performance, i.e. incentives are aligned (e.g. Hanson & Voss, 1995; Lee, 2004)	
	6	Concurrent engineering	Processes, components and products are redesigned in collaboration with suppliers and customers (concurrent engineering) (e.g. Lee, 2004; IBM 2005a; Van Landeghem & Persoons, 2001)	
	7	Aligned roles	Roles and responsibilities of each actor are distributed to optimise performance and avoid conflict in the supply chain (e.g. Lee, 2004; IBM, 2005)	
	8	HSE&CSR	Corporate Social Responsibility and Health Security and Environment issues are focused, i.e. the company strive to understand and respond to the expectations of all stakeholders in society (e.g. Laugen et al, 2005; Godson, 2002)	
Control	9	Mass customization	The supply chain has a strategic use of customer decoupling-point where products are designed for postponement and mass-customization (e.g. Blanchard, 2007; Lee & Whang, 2001)	
	10	Supply Chain Coordination	Planning, forecasting and replenishment are coordinated in the supply chain (e.g. Blanchard, 2007; Skjoett-Larsen et al, 2004; IBM, 2005)	
	11	Shop-Floor Top-Floor	Local control and management of production sites are integrated in the supply chain's global control and management (e.g. Kalsås & Alfnes, 2006)	
	12	Aligned PMS	The performance management system translates supply chain strategy into objectives, metrics, initiatives, and tasks customised to each group and individual in the supply chain (e.g. Eckerson, 2005)	

	13	Balanced KPIs	Key Performance Indicators address financial and non-financial perspectives, internal and external perspectives, and short-time and long-time perspectives (i.e. they are balanced) (e.g. Kaplan and Norton, 1996; Neely et al., 1996)	
	14	Aligned KPIs	Key Performance Indicators are automatically measured and reported in same format through-out the supply chain; providing consistency and comparability (e.g. SCC, 2001)	
	15	Risk awareness	Risk awareness (risk indicators, contracts, alternative suppliers or transporters etc) is an integrated part of supply chain management (e.g. Peck, 2003)	
	16	Resiliency	Contingency plans for supply chain events exist (e.g. Bovet, 2005; Blanchard, 2007)	
	17	Control model	The supply chain has a holistic and visual representation (control model) of how production and logistic processes are conducted (Alfnes and Strandhagen, 2000)	
Processes	18	Ordering seamlessness	There is a seamless ordering process from customer request to delivery of product (e.g. Lambert & Cooper, 2000; McCormack, 2001; SCC, 2001)	
	19	Procurement seamlessness	There is a seamless procurement process through integrated manufacturing and supplier relationships (e.g. Lambert & Cooper, 2000; McCormack, 2001)	
	20	Planning seamlessness	There is a seamless planning processes performed by dedicated supply chain teams representing a cross-division of the supply chain (e.g. McCormack, 2001; Laugen et al, 2005; SCC, 2001)	
	21	Customer diversification	Key customer groups are continuously re-defined, profit-monitored and diversified according to product and service-level (e.g. Lambert & Cooper, 2000; IBM, 2005; Torres & Miller, 1998)	
	22	Standardised processes	Processes are standardised (defined, updated and documented) to enable plug and play connectivity between supply chain actors (e.g. McCormack, 2001)	
	23	Continuous improvement	Continuous and incremental improvement is focused and gives tangible results (e.g. Hanson & Voss, 1995; Schonberger, 1986)	
Resources	24	Technology leadership	The supply chain is continuously seeking and implementing leading production technology (e.g. Kobayashi, 1990; IBM, 2005)	
	25	Core competence focus	The supply chain has a strong focus on core competences (e.g. Prahalad & Hamel, 1990)	
	26	Utilisation of tangibles	The supply chain has a high utilisation of machines, transportation vehicles, inventories and facilities (e.g. Laugen et al, 2005)	
	27	Minimised waste	The supply chain has a high utilisation of personnel where waste is minimised (e.g. Womack et al, 1996; Kobayashi, 1990; Hanson & Voss, 1995)	
	28	Agility	The supply chain can manage an unexpected large increase in demand (> +20%) and deliver within agreed short-time delivery conditions (e.g. IBM, 2005)	

Materials	29	Material flow	The flow of materials in the supply chain is directed and well defined (e.g. Womack et al, 1990; Godson, 2002)	
	30	Optimised distribution	Distribution is optimised through route planning, cross-docking etc. (e.g. Simchi-Levi et al, 2003; Blanchard, 2007)	
	31	Synchronised deliveries	Delivery of products and/or complementary services from different actors in the supply chain is synchronized to fulfil customer needs (e.g. Jagdev and Browne, 1998)	
	32	Modularised products	Products are modularised to improve flexibility (e.g. Lee, 2004; IBM 2005a)	
	33	Minimised inventories	Inventories are minimised (e.g. Womack et al, 1996; Kobayashi, 1990; Godson, 2002)	
	34	Buffer stocks	An inventory of key product components are kept to prevent manufacturing delays (e.g. Lee, 2004)	
	35	Mass production lines	Different supply chains are created for different product lines to optimise capabilities for each product line (e.g. Lee, 2004)	
Information	36	ICT strategy	A supply chain ICT strategy is clearly stated (e.g. Simchi-Levi et al, 2003)	
	37	Information dashboards	Information is collected, processed, visualised and presented in a centralised decision point (dashboard), to enable efficient decision making (e.g. Eckerson, 2005; Hanson & Voss, 1995)	
	38	Information visualisation	Information is visualised in all processes, both value-adding and administrative (e.g. Kennedy et al, 1998; Godson, 2002)	
	39	Supply Chain transparency	A system is implemented that provides all actors equal access to forecasts, inventory status, point-of-sales data and plans (e.g. Lee, 2004; SCC, 2001; Lee & Whang, 2001; Blanchard, 2007)	
	40	Real time information	Data capturing technologies and IT-systems facilitates decisions based on data and information that are in real-time (e.g. IBM 2005; Heinrich, 2005)	
	41	Track & Trace technologies	Bar codes, sensors and/or RFID are used for track and trace functionality throughout all supply chain processes (supply, manufacturing, distribution) (e.g. Heinrich, 2005)	
	42	ICT integration	All supply chain actors' ICT systems are integrated (e.g. Simchi-Levi et al, 2003; Hanson & Voss, 1995)	
	43	Virtual networks	ICT systems have modular standardised interfaces to provide connectivity through a plug and play functionality between actors in the network (creating virtual networks) (e.g. Blanchard, 2007; IBM, 2005)	
Organisation	44	Supply chain teams	Cross functional and inter-organisational teams are established to improve supply chain performance and eliminate the hand-offs across functional boundaries (e.g. McCormack, 2001; Hanson & Voss, 1995)	
	45	Flexible labour	Supply chain actors have flexible and empowered labour force trained to carry out different processes (e.g. Kobayashi, 1990; Blanchard, 2007; Schonberger, 1986; Hayes & Wheelwright, 1984)	

46	Knowledge level	The supply chain actors have knowledge about advanced supply chain management tools and best practices and have good understanding of all supply chain processes and their interaction (e.g. Schonberger, 1986; Hayes & Wheelwright, 1984)	
47	Best-in-class people	Best-in-class people possess the key positions for supply chain management (e.g. Blanchard, 2007)	
48	Fellow feeling	There exist an healthy organisation culture supporting the overall supply chain strategy and stating “we’re all in this together” (e.g. Hayes & Wheelwright, 1984)	

SCMAT v.8.0 is developed by SINTEF Operations Management



For complete references to all best practices please see *Netland, T.H.; Alfnes, E; Fauske, H. (2007) “How mature is your supply chain? - A supply chain maturity assessment test”; In Proceedings of the 14th International EurOMA Conference Managing Operations in an Expanding Europe, 17-20 June 2007, Ankara, Turkey, available for download at http://www.sintef.no/content/page1_____17671.aspx*

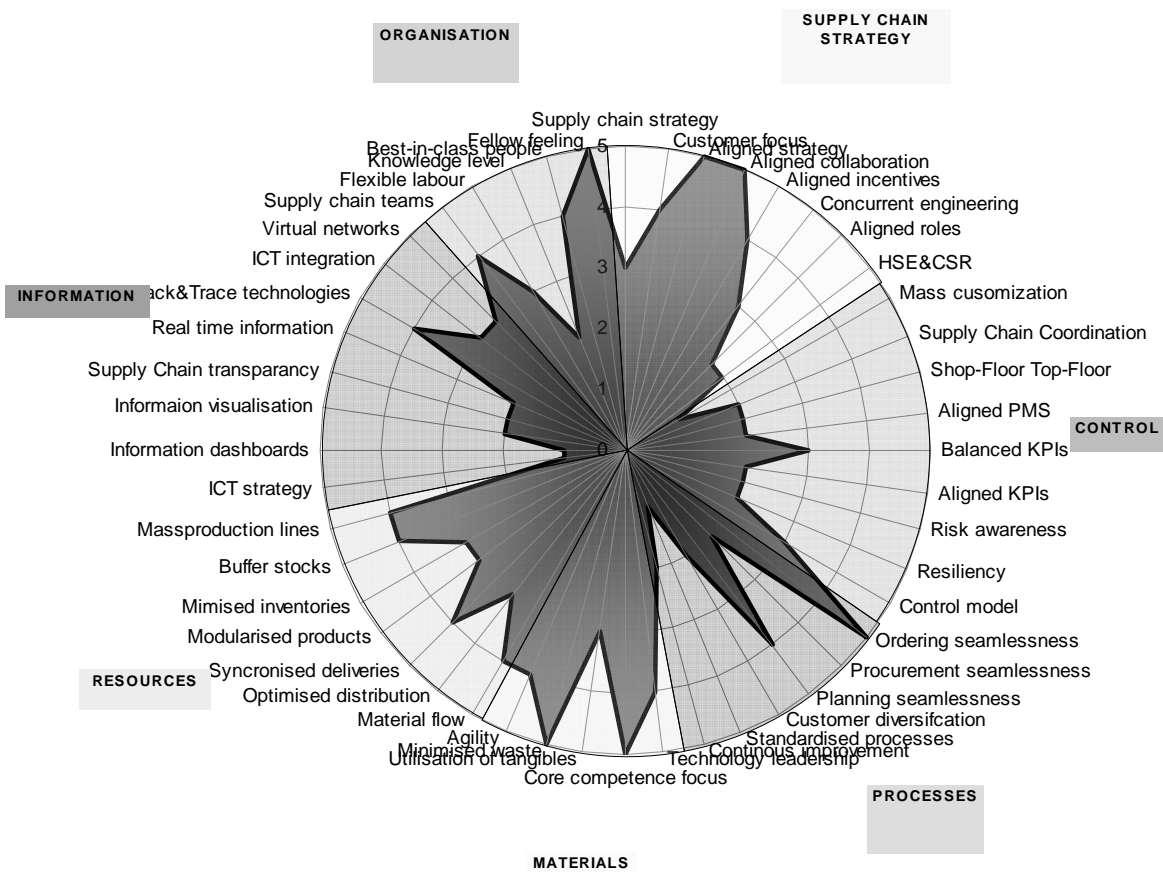


Figure 3 Example of a typical result of SCMAT visualised in radar diagram