HOW MATURE IS YOUR SUPPLY CHAIN?
– A SUPPLY CHAIN MATURITY ASSESSMENT TEST

Torbjørn H. Netland[1], Erlend Alfnes[2] and Håkon Fauske[1]

[1] SINTEF Technology and Society, Department of Operations Management, N-7465 Trondheim, Norway
[2] Norwegian University of Technology and Science, Dep. of Production and Quality Engineering, N-7491 Trondheim, Norway

ABSTRACT
This paper presents a tool to quickly assess the maturity of a firm's supply chain activities. A literature review on maturity models was carried out to in order to build the structure of the tool, whereas the content of the tool is based on a literature review on best practices in supply chain management and operations management. A total of 50 best practices, which most researchers will agree upon is really best practice, are defined. The Supply Chain Maturity Assessment Test (SCMAT) is a proven powerful tool to assess the current maturity and plan future development projects. Importantly SCMAT does not give any answers, it only poses questions. In order to develop in line with business strategy strategic discussions are needed to evaluate the test results. Answering the question "How mature is your supply chain?" is a first-step to focus supply chain development projects in the strategically right areas.

Keywords: Maturity model, Best practice, Supply chain management

INTRODUCTION
Using industry best practices to enhance business performance has been a topic for both practitioners and researchers for decades. A maturity model aims to aid companies in benchmarking the maturity of their operations relative to industry best practice. Maturity models have been developed within several areas, but only a few models are targeting supply chain management (Lockamy and McCormack, 2004a).

The purpose of this paper is to present a maturity test for supply chain operations. The test is based on a literature review on maturity models and on supply chain best practices, and aims to cover all aspects needed to supply products and services to the customer. Srai 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. In addition Foggin et al (2007) ask for a simpler diagnostic tool that inter alia should not require large amount of detailed data, should not take a long time to complete, and should be qualitative. Recent maturity models for supply chain management and operations management (e.g. Srai and Gregory, 2005; Lockamy and McCormack, 2004a) address these weaknesses. However, both of these tests are biased towards certain aspects of supply chain management (such as inter-company collaboration or supply chain processes). Best practices regarding for instance control, information and material flow are examined to a lesser degree. The Supply Chain Maturity Assessment Test (SCMAT) developed in this paper aims to take all factors of operation management into consideration. SCMAT has three main objectives: It is meant as a

tool to (1) map the degree of maturity of a firm's supply chain activities at the strategic and operational level, (2) communicate the degree of maturity in a logical and easy-to-understandable style and (3) identify improvement areas in a firm's development project.

Based on various researchers Voss et al (1994) adopted the researched-based best practice statements as signs of superior performance. SCMAT is developed in line with this methodology used by Voss et al (1994); the development of an assessment tool requires identification of best practices in each area. Moreover, SCMAT is inspired from multiple maturity models such as Voss et al (1994), McCormack (2001), Srai and Gregory (2005), Van Landeghem and Persoons (2001), IBM (2005) and Alfnes et al (2006).

This paper is structured as follows: First, maturity models are reviewed, and the design and structure of SCMAT is conceptualised. Second, best practices in supply chain management and operations management are reviewed, and the content of SCMAT is defined. Third, the practical use of SCMAT is briefly described. Finally, some conclusions are drawn.

MATURITY MODELS

According to McCormack (2001) the SCM journey is a difficult one, and "without a map and a compass, it is impossible". A maturity test paints a map and gives a hint in which direction to proceed.

Maturity models as research area

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 are; technology, innovation, R&D effectiveness, collaboration, reliability, quality management, and product design (all cited in Fraser et al, 2002), knowledge management (e.g. Klimko, 2003), service operations (e.g. McKlusky, 2004), and the use of ERP systems (Holland & Light, 2001), just to mention a few.

Even though there exists a great number of maturity tests within specific disciplines of operation management, there exist only a few targeting the management of the firm's supply chain (Lockamy & McCormack, 2004a). The studies by Srai and Gregory (2005) and Foggin et al (2007) both present lists of different maturity models within supply chain management issues, which span from simple two-hour self-assessment tests to large cause-and-effect analysis which require several weeks to fulfil. Different maturity tests developed for different causes have different design and content, are performed differently (some are qualitative web-based questionnaires, some are quantitative tests using financial data, some are meant for joint discussions in work shops) and as Fraser et al (2002) state have different purposes (some are used as an assessment tool, and some as a tool for improvement, or both). Table 1 lists examples of some relevant maturity models for this study.

Table 1 – Examples of maturity models for supply chain management and operations management

Maturity models	Authors	Short description / Field of study
SCM Process Maturity Model	Lockamy and McCormack (2004a; 2004b), (McCormack, 2001), (McCormack & Johnson, 2003)	The model describes a supply chain's "business process maturity", i.e. the degree of process integration in the supply chain. Probably the most described SCM maturity model. Uses the SCOR framework of the Supply Chain Council, and is, as most other maturity models, inspired by the Quality Maturity Grid and the Capability Maturity Model. The model is grounded in Business Process Orientation (BPO)

SC Capability map	Srai & Gregory (2005)	Maturity of supply chain capabilities based on the resource based view
Benchmarking of logistical operations	Van Landeghem & Persoons (2001)	Audit scheme for logistical operations based on 84 best practices in a causal model
Operations Excellence audit scheme	Alfnes, Dreyer & Strandhagen (2005)	Qualitative audit scheme for manufacturing operations and lean manufacturing. Combines the work of Godson (2002), Kobayashi (1990) and Schonberger (1986) into one Operations Excellence audit sheet, based on fifteen best practices from the lean production.
The Diagnostic Tool	Foggin, Mentzer and Monroe (2004)	A diagnostic tool for how to choose 3PL vendor, based on a decision tree questionnaire
Global Logistics Capabilities Diagnostic	SC Digest www.scdigest.com	A simple consulting questionnaire for diagnosing global logistical operations
Supply Chain Visibility Roadmap	Aberdeen Group (2006)	A methodology for assessing the degree of visibility in the supply chain
The Supply Chain Maturity Model	IBM(2005)	Level descriptions on the degree of integration in the supply chain. Aim is to achieve the "On demand supply chain".

Model conceptualisation and structure

According to Fraser et al (2002, pg. 244) "the principal idea of the maturity grid is that it describes in a few phrases, the typical behaviour exhibited by a firm at a number of levels of 'maturity', for each of several aspects of the area under study". This, simplicity characteristics, that maturity models are very easy to understand and communicate, is their strongest advantage (Klimko, 2003). Fraser et al (2002) list six typical attributes of a maturity model: It has a number of maturity levels (typical 3-6), a descriptive name for each level, a generic description of each level as a whole, a number of dimensions or process areas, a number of elements or activities for each process area, and a description of each activity as it might be performed at each maturity level

Most maturity models can be communicated in a two-dimensional way, where the "y-axis" describes the *processes* or *objects* to be measured for maturity and the "x-axis" outlines the *degree of maturity*. When building SCMAT two main questions arose; (1) which object classification to choose and (2) which maturity scale to use. To present the best practices in a logical and easy-to-follow way a superior object classification is of great help. Table 2 lists some examples of possible object classifications. SCMAT builds on Alfnes (2005), but add "supply chain strategy" as an additional category. Hence in the maturity model developed here, best practices are separated into the seven categories: (1) Strategy, (2) Control, (3) Processes, (4) Resources, (5) Materials (6) Information, and (7) Organisation.

Table 2 – Examples of object classifications in some maturity models and SCM frameworks

Alfnes (2005)	**EFQM**	**SCC (2001) - SCOR**
Control Processes Resources Materials Information Organisation	People Partnership Resources Processes	Plan Source Make Deliver Return
Foggin, Mentzer & Monroe (2004)	**Hanson & Voss (1994)**	**Srai & Gregory (2005)**
Inventory Customer service Organisation Systems Product flow	Organization and Culture Logistics Manufacturing systems Lean production Concurrent engineering Total quality	SC Network Strategic Design Product & Service Enhancement SC Processes Development/ Application Total Network Efficiency SC Network Connectivity
MPCOE Best practice collection	**Lambert & Cooper (2001)**	**Van Landeghem & Persoons (2001)**
Technical Areas	Product flow	Employees

Design Test Production Facilities Logistics Management	Customer Relationship Mngm Customer Service Management Demand Management Order Fulfilment Manufacturing flow Management Procurement Product Dvlpm & Commerz. Returns	Planning & Control Production & Assembly Research & development Distribution Order handling Purchase & suppliers Market & Clients

All maturity models have some kind of maturity scale (the x-scale) which describes the level of maturity for different operations. See Fraser et al (2002) for a discussion on maturity scales in 18 different maturity models. Here, based on Lockamy and McCormack (2004b) SCMAT state the following five maturity levels, according to a qualitative answer on the question: "To which extent does our supply chain use best practice stated?" From 1 = "Never or does not exist", 2 = "Sometimes or to some extent", 3 = "Frequently or partly exist", 4 = "Mostly or often exist", and up to 5 = "Always or definitely exist". This maturity scale is alike for all the best practices that shall be evaluated.

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.

BEST PRACTICES – THE CONTENT OF SCMAT

The core of SCMAT is 50 stated best practices that are evaluated regarding maturity. We adopt Van Landeghem and Persoons (2001, pg. 254) simple definition of best practice: "Best practices describe the state-of-the art of how to perform a business".

Finding best practices

There exist a variety of frameworks for companies to find and select best practices, but only a few attempts are made to collect the generic best practices (if there are any) and present them in a public available place. In 1994 Voss et al (1994) emphasised that there exist no general best practice database. Today, some initiatives for best practice collections exist: One major source for best practices, though not publicly available, is the Supply-Chain Operations Reference (SCOR) model developed by the Supply Chain Council. SCOR 7.0 includes a Best Practices Appendix that includes detailed background information on all of the best practices presented. Second, the Best Manufacturing Practices Center of Excellence (BMPCOE) in University of Maryland College Park is another pioneer in collecting and describing best practices from industry, government and academia. According to the BMPCOE webpage more than 150 companies and institutions are surveyed and over 2500 best practices are described and made public available. Third, the European Foundation for Quality Management's (EFQM) Excellence Model is a well known framework for achieving sustainable excellence based on best practices in quality issues.

Best practices take very different forms and exist on very different levels. Consider for example SMED versus CPFR, which both are descried as best practices in literature. Some best practice studies simply state that *techniques and technologies* are best practice. Examples are quick changeover (e.g. Kobayashi, 1990), flexible machines (e.g. Van Landeghem and Persoons, 2001), and voice recognition technology in warehouse management (e.g. Blanchard, 2007). The same goes for *concepts* such as e.g. Motorola's Six Sigma (e.g. Blanchard, 2007), Wal-Mart's Collaborative Planning, Forecasting and Replenishment (CPFR) (*ibid*), Dell's Extended Enterprise (*ibid*), and Toyota's Toyota Production System (e.g. Womack, Jones & Roos, 1990). More over, *performance measures* are often described as best practice; one example being "cycle-times are shorter than order lead times" (e.g. Blanchard, 2007).

Defining SCMAT best practices

In SCMAT, technologies, concepts or performance measures are not stated as best practices, but instead it is searched for short descriptive best practice sentences or statements that describe *how* companies operate their business on the strategic and operational level. It is not the intent of this paper to define 50 best practices that gives the definitive world-class performance. It is however the purpose to present 50 best practices that most researchers will agree upon is really best practice. Multiple sources are used to rephrase and define the best practices that have become part of the SCMAT. Based on a literature review the following 50 best practices are defined within the seven object classifications:

Table 3 – SCMAT best practices

Strategy	
1.	A clearly stated supply chain strategy exist (e.g. Fuchs et al, 1998)
2.	The strategy is customer focused (e.g. Godson, 2002; Schonberger, 1986; Lambert & Cooper, 2000, Blanchard, 2007)
3.	The supply chain strategy is aligned with each company's strategy, vision and mission (e.g. Fuchs et al, 1998; Godson, 2002)
4.	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.	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.	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.	All roles and responsibilities are clarified in the supply chain so that conflict is avoided (e.g. Lee, 2004)
8.	Roles and responsibilities and roles of each actor are distributed to optimise performance in the supply chain (IBM, 2005)
9.	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	
10.	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)
11.	Planning, forecasting and replenishment are coordinated in the supply chain (e.g. Blanchard, 2007; Skjoett-Larsen et al, 2004; IBM, 2005)
12.	Local control and management of production sites are integrated in the supply chain's global control and management (e.g. Kalsås & Alfnes, 2006)
13.	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)
14.	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)
15.	Key Performance Indicators are automatically measured and reported in same format through-out the supply chain; providing consistency and comparability (e.g. SCC, 2001)
16.	Risk awareness (risk indicators, contracts, alternative suppliers or transporters etc) is an integrated part of supply chain management (e.g. Peck, 2003)
17.	Contingency plans for supply chain events exist (e.g. Bovet, 2005; Blanchard, 2007)
18.	The supply chain has a holistic and visual representation (control model) of how production and logistic processes are conducted (Alfnes and Strandhagen, 2000)
Processes	
19.	There is a seamless ordering process from customer request to delivery of product (e.g. Lambert & Cooper, 2000; McCormack, 2001; SCC, 2001)
20.	There is a seamless procurement process through integrated manufacturing and supplier relationships (e.g. Lambert & Cooper, 2000; McCormack, 2001)
21.	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)
22.	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)
23. Processes are standardised (defined, updated and documented) to enable plug and play connectivity between supply chain actors (e.g. McCormack, 2001)
24. Continuous and incremental improvement is focused and gives tangible results (e.g. Hanson & Voss, 1995; Schonberger, 1986)

Resources

25. The supply chain is continuously seeking and implementing leading production technology (e.g. Kobayashi, 1990; IBM, 2005)
26. The supply chain has a strong focus on core competences (e.g. Prahalad & Hamel, 1990)
27. The supply chain has a high utilisation of machines and facilities (e.g. Laugen et al, 2005)
28. The supply chain has a high utilisation of transportation vehicles and inventories (e.g. Laugen et al, 2005)
29. The supply chain has a high utilisation of personnel and waste is minimised (e.g. Womack et al, 1996; Kobayashi, 1990; Hanson & Voss, 1995)
30. 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

31. The flow of materials in supply chain is directed and well defined (e.g. Womack et al, 1990; Godson, 2002)
32. Distribution is optimised through route planning, cross-docking etc. (e.g. Simchi-Levi et al, 2003; Blanchard, 2007)
33. 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)
34. Products are modularised to improve flexibility (e.g. Lee, 2004; IBM 2005a)
35. Inventories are minimised (e.g. Womack et al, 1996; Kobayashi, 1990; Godson, 2002)
36. A small inventory of key product components are kept to prevent manufacturing delays (e.g. Lee, 2004)
37. Different supply chains are created for different product lines to optimise capabilities for each product line (e.g Lee, 2004)

Information

38. A supply chain ICT strategy is clearly stated (e.g. Simchi-Levi et al, 2003)
39. 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)
40. Information is visualised in all processes, both value-adding and administrative (e.g. Kennedy et al, 1998; Godson, 2002)
41. 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)
42. Data capturing technologies and IT-systems facilitates decisions based on data and information that are in real-time (e.g. IBM 2005; Heinrich, 2005)
43. 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)
44. All supply chain actors' ICT systems are integrated (e.g. Simchi-Levi et al, 2003; Hanson & Voss, 1995)
45. 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

46. 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)
47. 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)
48. 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)
49. Best-in-class people possess the key positions for supply chain management (e.g. Blanchard, 2007)
50. 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 PROCEDURE

To assure content validity all best practices are based on an extensive literature review. However, practical usefulness and cross-industry validity can only be validated by testing the model in real-life companies. During autumn 2006 and spring 2007 the maturity test has been tested in several departments of four major Norwegian companies, within such different industries as food-, furniture-, sports equipment- and automobile industry. Practitioners all expressed positive

experience with the results, and the maturity profiles were added as major contributions to strategic discussions in the companies.

For example, a major Norwegian meat processor carried out the test in five major departments of the company. Completing the test took only approximately one hour for each department. Like most other maturity assessments, SCMAT can be performed by self-assessment as well as in team with an external auditor (c.f. Fraser et al, 2002). Experience shows that the best practices stated often need some further explanation for practitioners not familiar with all areas and research on operation management. For non-English natives the language becomes an additional barrier. Thus, for some departments the test was facilitated by SINTEF in a telephone conference, and for other departments, face-by-face in a meeting. A screen print of the SCMAT interface and a test result for the Norwegian meat processor is shown in Figure 1.

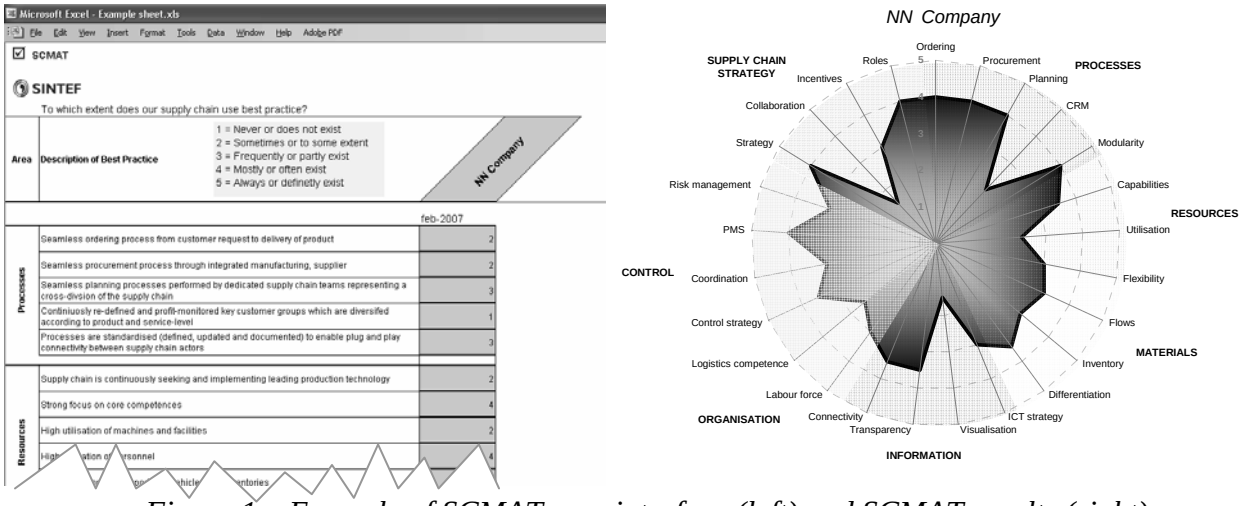

Figure 1 – Example of SCMAT user interface (left) and SCMAT results (right)

The 50 stated best practices are summed up in 25 areas of best practice within the seven object classifications. The maturity score of these 25 areas are presented in easy-to-read radar charts (c.f. Van Landeghem & Persoons, 2001; Alfnes et al, 2006; Srai & Gregory; 2005), which facilitates cross-comparisons between firms and departments performing the test. The results should be used to identify areas to improve in order to align strategy with capabilities. In the four Norwegian case-companies the results from the tests where analysed with the extremes as starting points. Areas that where considered to have especial improvement potential (maturity stage 1-2), and areas with a high level of maturity (stage 4-5) were initially focused. In this case, the results proved a lack of information integration in the supply chain and a need for better production planning routines. New development projects are initiated to increase the maturity of these activities in the company.

Importantly, SCMAT does not give any answers, it only poses questions. Because no enterprise can be world class in all dimensions, tradeoffs must be made. We agree with Srai and Gregory (2005) that it is important to assess the degree of fit with business strategy and thereby prioritize tradeoffs to be made. Therefore, strategic discussions must be held to agree on in which direction to proceed. However, in such strategic discussions SCMAT is a proven powerful input.

CONCLUSIONS

The developed maturity test 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 (based on Alfnes, 2005). It is designed to take no longer than one hour to complete and thus also applicable for the busiest managers. The results are communicated in a logical, visual and easy-understandable style. SCMAT helps managers formulate tomorrow's performance goals, while

acknowledging differences in strategic priority. The results from the maturity test are meant as input for strategic discussions enabling tradeoffs to be done in regard to different strategic priorities.
SCMAT is designed with simplicity as a key feature. Thus, a balance between detail and simplicity is stricken (c.f. Voss et al, 1994). We stress that SCMAT does not give any answers, it poses questions. It outlines what seems to be good, and what seems to have potential for improvement. Blanchard (2007, pg. 15) correctly states that "best practices don't just happen by throwing a lot of money at your supply chain problems. Improvements come through strategies that identify and track key supply chain processes early and often." Thus, considerations and actions must be done by action-oriented company managers.

Foggin et al (2007) and Laugen et al (2005) both point out that best practice studies never cover all the factors or practices that influence performance; "There may be companies that do not reach world-class status, due to the definition of best practices in these studies, which are really world class in terms of performance, but have implemented another set of practices to reach that level of performance" (*ibid*; pg. 134). In addition best practices are not eternal. With these words in mind, we conclude that further development and testing is needed, and other researchers and practitioners are invited to use, comment on and help contribute to the SCMAT.

REFERENCES

Aberdeen Group (2006) *The supply chain visibility roadmap – Moving from vision true business value*, Aberdeen Group Nov 2006

Alfnes, E. (2005) *Enterprise Reengineering – A strategic Framework and Methodology*, Doctoral Thesis NTNU 2005:135

Alfnes, E.; Dreyer, H.; Strandhagen, J.O. (2006) "The Operations Excellence audit sheet", IFIP WG 5.7 Conference, Wrocklav, Poland

Alfnes, E.; Strandhagen, J.O. (2000) "Enterprise Design for Mass Customization: The Control Model Methodology", *International Journal of Logistics Research and Applications*, Volume 3, Issue 2 July, pages 111 - 125

Blanchard, D. (2007) *Supply Chain Management Best Practices*, John Wiley & Sons, New Jersey

Bovet, D. (2005) "Balancing global risk and return", *Supply Chain Strategy*, Vol. 1, No. 3, August

Eckerson, W.W (2005) *Performance dashboards: measuring, monitoring, and managing your business*, John Wiley & Sons, Inc

Even, R.; Danks, A. (1998) "Strategic Supply Chain Management – Creating shareholder value by aligning supply chain strategy with business strategy", in Gattorna, J.L. (1998) *Strategic Supply Chain Alignment*, Gower Publishing, pg. 18

Foggin, J.H.; Signori, P.; Monroe, C.L. (2007) "Diagnosing the Supply Chain", in Mentzer, J.T; Myers, M.B.; Stank, Theodore P.(edt) *Handbook of Global Supply Chain Management*, SAGE Publications

Foggin, J.H; Mentzer, J.T; Monroe, C.L (2004) "A supply chain diagnostic tool", *International Journal of Physical Distribution & Logistics Management*, Volume 34, Number 10, pp. 827-855(29)

Fraser, P.; Moultrie; Gregory, M. (2002) "The use of maturity models / grids as a tool in assessing product development capability", *Paper presented at Engineering Management Conference, 2002. IEMC '02. 2002 IEEE International*

Fuchs, P.; Young, A.; Zwiedler-McKay, A. (1998) "New approaches to strategy – Dynamic alignment of strategy and execution", in Gattorna, J.L. (1998) *Strategic Supply Chain Alignment*, Gower Publishing Lmtd, pg. 8

Godson, R.E. (2002) "Read a plant fast", *Harvard Business Review*, May, pp. 105-113

Hanson, P.; Voss, C. (1995) "Benchmarking best practice in Euopean manufacturing sites", *Business Process Re-Engineering & Mangament*, Vol 1, Iss. 1, pg. 60

Hayes, R.H; Wheelwright, S.C. (1984) *Restoring our competitive edge: Competing through manufacturing*, John Wiley, New York

Heinrich, C. (2005) *RFID and beyond: growing your business through real world awareness*, Indianapolis, Wiley

Holland, C.P.; Light, Ben (2001) “A stage maturity model for the Enterprise Resource Planning Systems use”, *The DATA BASE for Advances in Information Systems*, Spring, Vol.32, No. 2, pg. 34

IBM (2005) “Follow the leaders – Scoring high on the supply chain maturity model”, *IBM Business Consulting Services*

Jagdev, H.S & Browne, J. (1998) “The extended enterprise – a context for manufacturing”, P*roduction Planning and Control*, Vol. 9, No 3, pp. 216-229

Kalsås, B.T; Alfnes, E. (2006) “Supply chain control –a case of three production units”, *Proceedings of SCMIS 5.7.7.2006*, National Chung Hsing University; Taiwan

Kaplan, R.S.; Norton, D.P. (1996) *The balanced scorecard –translating business strategy into action*, Harvard Business School Press

Kennedy D; Elliot, B; Carbone, F. (1998) “Lean synchronous manufacturing – Hard-writing production to demand” , in Gattorna, J.L. (1998) *Strategic Supply Chain Alignment*, Gower Publishing Lmtd, pg.338

Klimko, G. (2003) “Knowledge Management and Maturity Models: Building common understanding”, *Working paper*, Budapest University of Economic Sciences and Public Administration

Kobayashi, I. (1990) *Twenty keys to workplace improvement*, Productivity Press, Cambridge

Lambert, D.M.; Cooper, M.C (2000) “Issues in supply chain management”, *Industrial Marketing Management,* 29, pp. 65-83

Laugen, B.T.; Acur, N.; Boer, H.; Frick, J. (2005) “Best manufacturing practices – What do the best-performing companies do?” *International Journal of Operations & Production Management*, 25; 2; pg. 131

Lee, H.L. (2004) “The tripple-A supply chain”, *Harvard Business Review*, October

Lee, H.L.; Whang, S. (2001) “E-Business and Supply Chain Integration”, *Standford Global Supply Chain Management Forum*, November 2001

Lockamy, A. III; McCormack, K. (2004a) “The development of a supply chain management process maturity model using the concepts of business process orientation”, *Supply Chain Management*; 9, 3/4; ABI/INFORM Global pg. 272

Lockamy, A. III; McCormack, K. (2004b) “Linking SCOR planning practices to supply chain performance: An exploratory study”, *International Journal of Operations & Production Management*; 24, 11/12; ABI/INFORM Global pg. 1192

McCluskey, M. (2004) “How mature is your service operation?”, *Supply Chain Managemnet Review*, 8, 5, pg.17

McCormack, K. (2001) “Supply chain maturity assessement: A roadmap for building the extended supply chain”, *Supply Chain Practice*, Vol. 3, No. 4

McCormack, K.; Johnson, W. (2003) *Supply Chain Networks and Business Process Orientation*, CRC Press, 240pg.

Neely, A; Mills, J; Gregory, M; Richards, H; Platts, K.; Bourne M. (1996) *Getting the Measure of Your Business*, Cambridge: Works Management

Peck, H. (2003) *Creating Resilient Supply Chains: A practical guide, Centre for Logistics and Supply Chain Management*, Cranfield School of Management

Prahalad, C.K.; Hamel, G. (1990) “The core competence of the corporation”, *Harvard Business Review*, May-June, pp. 79-91

Schonberger, R.J. (1986) *World Class Manufacturing: The lessons of simplicity applied*, The Free Press, New York

Simchi-Levi, D.; Kaminsky, P.; Simchi-Levi, E. (2003) *Designing and managing the supply chain: concepts, strategies, and case studies*, McGraw-Hill/Irwin

Skjoett-Larsen, T.; Thernøe, C.; Andresen, C. (2004), “Supply chain collaboration – Theoretical perspectives and empirical evidence”, *International Journal of Physical distribution & logistics Management*, Vol 33, No.6, pp 531-549

Srai, J.; Gregory, M. (2005) “Supply Chain Capability Assessment of Global operations using Maturity Models”, in Demeter, K. (edt) *Operations and Global Competitiveness*, Proceedings of EurOMA 2005; 19-22. June 2005, Budapest

Supply Chain Council (2001) *Supply-Chain Operations reference-model – Version 5.0*, Supply Chain Council

Torres, L; Miller, J. (1998) “Aligned logistics operations – tailoring logistics to the needs of customers”, in Gattorna, J.L. (1998) *Strategic Supply Chain Alignment*, Gower Publishing Lmtd

Van Landeghem, R.; Persoons, K. (2001) “Benchmarking of logistical operations based on a causal model”, *International Journal of Operations & Productions*, Vol.21, iss.1/2, pg.254

Voss, C A; Chiesa, V; Coughlan, P. (1994) “Developing and testing benchmarking and self-assessment frameworks in manufacturing”, *International Journal of Operations & Production Management*, Vol. 14, Iss. 3; pg. 83

Womack, J.P; Jones, D.T.; Roos, D. (1990) *The machine that changed the world*, New York: Rawson Associates