Proposing a quick best practice maturity test for supply chain operations

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Summary

Purpose – *The purpose of this paper is to propose a quick maturity test to assist a company's development of a supply chain operations strategy. Maturity tests and models have been developed within several areas, but there is a lack of maturity tests targeting supply chain operations.*

Design/methodology/approach – *A literature review on maturity models is carried out in order to build the structure of the test, while a literature review on best practices in supply chain management is the basis for the test content.*

Findings – *The proposed maturity test is an audit scheme built on best practice statements within seven key strategic decision areas – strategy, control, processes, materials, resources, information and organisation. The test is designed with simplicity as a key feature and takes only one hour to complete. The test results are the input to strategic decisions regarding use of best practices in supply chain operations.*

Practical implications – *Supply chain managers ask for a simple and quick tool that can be used as an eye-opener and a compass early in the development process of the supply chain operations strategy. The proposed test has a proven potential to point out directions for supply chain improvement areas.*

Originality/value – *There is a need for a quick assessment tool for mapping the maturity of a company's supply chain operations. The proposed test is a potential answer to this need.*

Keywords *Supply chain management, Operations management*

Paper type *Research paper*

Introduction

Searching for and learning from ''best practices'' has been a topic for both industry and academia for decades. A lot of effort has been put into identifying best practices to support companies achieve superior performance. However, the piecemeal application of best practices that are common in many companies, limited to specific parts or functional areas and with conflicting objectives, often leads to inefficiencies and disappointing results (Rummler and Brache, 1995). In order to improve performance, companies need to map their overall current state of practices and point out which best practices they should pursue.

Assessing the maturity of supply chain operations is crucial for the development of a coherent operations strategy that encompasses customers and suppliers, and which is aligned to the overall business strategy of the enterprise. The assessment of the current state of practice can be done by different methods, requiring different inputs of time and resources. Mapping tools exist in many different forms, spanning from two-hours tests such as the Diagnostic Tool (Foggin *et al.*, 2004) via Quick Scan (Naim *et al.*, 2002) which requires a week to perform, to broad business modelling frameworks such as ARIS (IDS Scheer, 2002) and SCOR (Supply Chain Council, 2006). Best practice maturity models can be powerful tools to achieve this coherence between strategy and best practice programs. The purpose of this paper is to propose a quick maturity test to assist a company's supply chain operations strategy development.

Method

The test proposed in this paper is a result of a four-year development process, where literature reviews and pilot testing in industry are key parts of the method. First the authors reviewed literature on maturity models and maturity assessment tests. We searched titles and abstracts in the bibliographic databases EBSCO and Science Direct for the keyword combinations ''maturity test'', or ''maturity model'', or ''self assessment'', coexisting with ''operations management'', or ''operations strategy'' or ''supply chain management''. Second, reference lists in the selected articles were searched for additional articles. Third, based on expert advices we included other key contributions on the topic under study.

Based on the review findings, the structural design of the proposed maturity test was decided. One main finding was that research-based best practices are well suitable as test parameters (Voss *et al.*, 1994, Van Landeghem and Persoons, 2001). Therefore, a second literature review on best practices in operations management and supply chain management was performed. Again, titles and abstracts in the bibliographic databases EBSCO and Science Direct were searched for the keyword ''best practice'' coexisting with ''operations management'', or ''operations strategy'' or ''supply chain management''. We included a search for book titles at the university library at NTNU using the same keywords. In addition well known sources for best practice collections were added, such as the SCOR framework (Supply Chain Council, 2006), the Best Manufacturing Practices Center of Excellence (2008), and the European Foundation for Quality Management's Excellence Model (European Foundation for Quality Management, 1998).

Practical usefulness of maturity tests can only be evaluated by testing them in real-life companies. Therefore, the proposed maturity test was tested in ten companies during 2007-2008. A wide variety of companies and industries were targeted in order to test the applicability across industries. All companies were participants in one of two research projects funded by the Norwegian Research Council:

1. the Norwegian Manufacturing Future Centre (CRI Norman); and
2. Smart Flow of Goods.

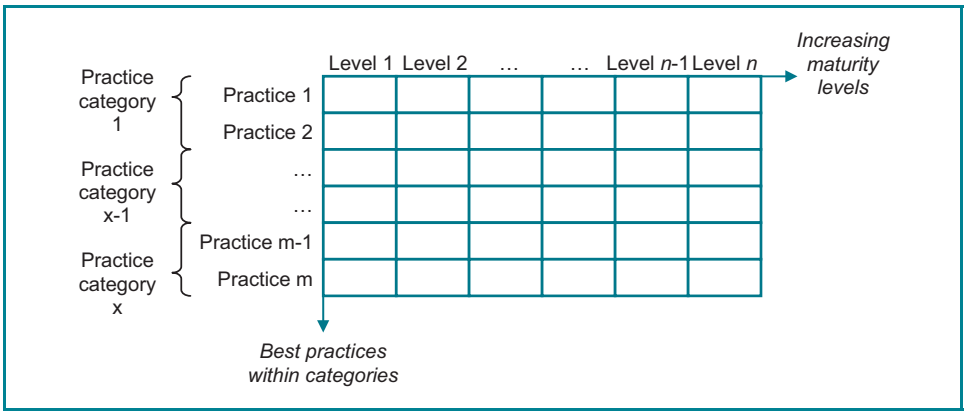
Criticisms and advice from the companies tested were collected in a formalised feedback scheme. Again, best practices were added, removed or redefined according to the advice received.

Theoretical background

A maturity model aims to aid companies in benchmarking the maturity of their operations relative to industry best practice. Numerous types of maturity models have been developed within different disciplines since Philip B. Crosby's (1979) pioneering work on the Quality Management Maturity Grid. Today, the maturity model concept is probably best known within information technology, and software development in particular, where the Capability Maturity Model (CMM) describes levels in the use of information technology (Humphrey, 1989; Paulk *et al.*, 1995). Other examples of disciplines where maturity models have been developed are R&D effectiveness (Szakonyi, 1994), product development collaboration (Fraser and Gregory, 2002; Fraser *et al.*, 2002), agility (Dove, 1996), knowledge management (Klimko, 2003), service operations (McCluskey, 2004), ERP usage (Holland and Light, 2001) and many more.

The principal idea of the maturity model 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'' (Fraser *et al.*, 2002, g. 244). This simplicity characteristic, that maturity models are very easy to understand and communicate, is their strongest advantage (Klimko, 2003). 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 level of maturity for each practice (cf. Fraser *et al.*, 2002, for a discussion on maturity scales and levels in 18 different maturity models).

Figure 1 Typical structure of maturity models



Different maturity models and their belonging audit tests have different purposes; some are used as an assessment tool and some as a tool for improvement, or both (Fraser *et al.*, 2002). -Moreover, different maturity tests are developed for different causes and therefore have different designs and content. The following section explores the need for a quick maturity test on a company's supply chain operations.

A need for maturity tests on supply chain operations

Even though maturity models have been developed within several areas, only a few models have targeted supply chain management (Lockamy and McCormack, 2004a). Srai and Gregory (2005) reviewed 20 existing maturity models and found that the models often lacked a supply chain perspective, were more or less single function oriented, were dominated by financial measures, were not linked to the overall business strategy, and were mainly directed towards specific industries making cross-industry comparison difficult. One maturity model for supply chain management is the Supply Chain Management Process Maturity Model (Lockamy and McCormack, 2004a, b; McCormack, 2001; McCormack and Johnson, 2003) that describes a supply chain's ''business process maturity'', i.e. the degree of process integration in the supply chain, by using the Supply Chain Council's SCOR framework. Another model is the Supply Chain Capability map (Srai and Gregory, 2005, 2008), that describes the maturity of a multinational company's supply chain capabilities based on the resource based view of strategy. A third model, proposed by Van Landeghem and Persoons (2001), is an audit scheme for logistical operations based on 84 best practices.

All these models however fail to be simple enough for mass adoption in industry and still comprehensive enough to cover all decision areas of operations strategy. There is a need for a maturity model and belonging test that meets the literature-based requirements listed in Table I. The proposed test is developed with 11 eleven requirements as design parameters.

Domains for maturity assessment

The strategic decisions that directly concern operations can be grouped together in decision areas that represent different domains of the enterprise. Often authors limit themselves to decision areas that traditionally have been the responsibility of the manufacturing function. The decision areas differ somewhat from author to author, but there seems to be an essential agreement that capacity, facilities, technology, vertical integration, workforce, quality, production control and organisation are areas that really matter for operations strategy (Skinner, 1969; Hayes *et al.*, 1988; Miltenburg, 1995; Fine and Hax, 1985; Hill, 2000). More recent authors in operations strategy (Lowson, 2002; Waller, 2003), suggest that the operations management responsibility also encompass the supply chain, and not only internal transformation processes.

Table I Requirements for a new maturity test

No.	*Requirement*	*References*
1	Addresses a company's supply chain operations	Lockamy and McCormack (2004a)
2	Focuses on business processes	Lockamy and McCormack (2004a)
3	Is linked to overall business strategy	Srai and Gregory (2005)
4	Is industry-generic and enables cross-industry comparison	Srai and Gregory (2005)
5	Spans several business functions	Srai and Gregory (2005)
6	Uses different and balanced dimensions of performance	Srai and Gregory (2005)
7	Does not require large amount of detailed data	Foggin *et al.* (2004)
8	Does not take long time to complete	Foggin *et al.* (2004)
9	Is based on qualitative parameters	Foggin *et al.* (2004)
10	Considers existing methods and models	Fagerhaug (1999)
11	Ensures that the model and method fit together	Fagerhaug (1999)

To reflect this view, the definition of decisions areas should be familiar to the operations managers in a wider variety of operations. Therefore a more broad and generic list of decisions areas are adopted inspired by modelling frameworks within enterprise modelling. Within enterprise modelling, several generic frameworks or architectures have been developed to provide a way of viewing the enterprise from different perspectives and showing how they are related. A well-known reference architecture of perspectives is the meta-model of GERAM suggesting that at least four fundamental aspects of an enterprise must be described:

1. function;
2. information;
3. resource; and
4. organisation (Bernus, 2001).

Other recognised aspects to describe are the material, information, and control flow (Berio and Vernadat, 2001). These views reflect distinct, yet complementary, perspectives of the enterprise that also can be used to categorise strategic decisions.

Alfnes (2005) therefore proposed the following list of more generic decisions areas for operations strategy:

1. resources;
2. materials;
3. information;
4. processes;
5. organisation; and
6. control (for detailed descriptions, see Alfnes, 2005).

We adopt the six decision categories proposed by Alfnes (2005). They include the strategic decisions at the supply chain level as suggested by Lowson (2002), and the level of excellence within these areas will determine the competitiveness of the enterprise. In addition, the strategy development process and especially the manufacturing's contribution to strategy is crucial for competitiveness (Hayes and Wheelwright, 1984). ''Strategy'' is therefore included as a seventh maturity area in the proposed test.

Best practices

Practice refers to the established processes which an organisation has put in place to improve the way it runs its business, ranging from organisational aspects such as teamwork and employee involvement to the use of techniques such as *kanban*. The term ''best

practice'' stems from the Western effort of identifying and describing the practices which made the Japanese companies so successful (Laugen *et al.*, 2005). Enterprises with best practices usually perform better than those without (Womack *et al.*, 1990). This is leading many manufacturing enterprises to seek best practice as the basis of their operations strategy (Voss, 1995).

Hayes and Wheelwright's (1984) World Class Manufacturing was pioneering work in the numerous contributions on best practices. Best practice is a much-disputed theme in academia, because best practices take very different forms and exist on very different levels. In this paper, Van Landeghem and Persoons' (2001, p. 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. automation, RFID), concepts (e.g. using SCOR, APICS) or performance measures (e.g. 99 per cent service level) are not defined as best practices in the proposed maturity test. Instead short descriptive best practice sentences or statements that describe *how* companies operate their supply chain activities are chosen.

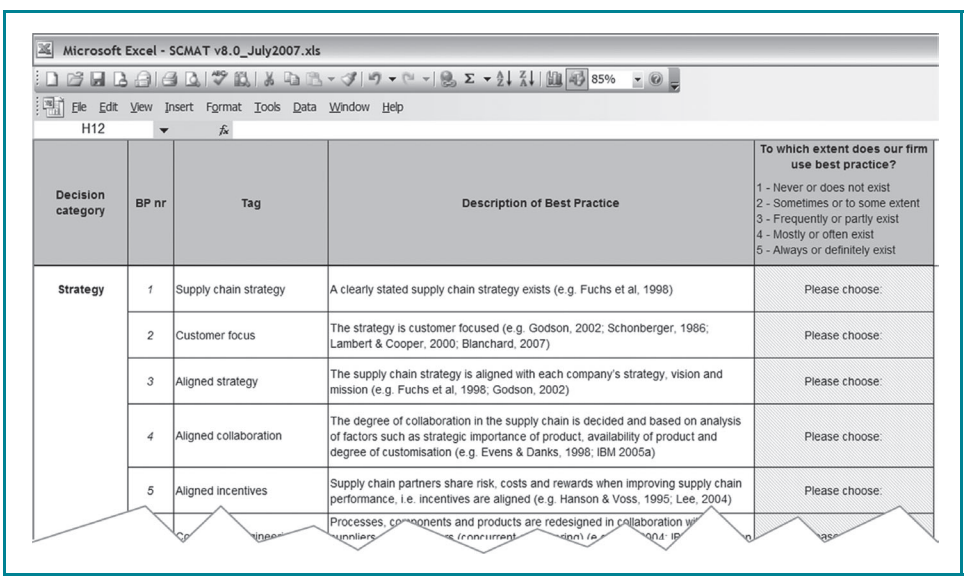
The proposed maturity test

In the following the test content, test process and strengths and weaknesses with the proposed test is presented and discussed.

Test content

The proposed maturity test is a quick audit scheme based on 48 best practices within seven decision categories for operations strategy development. For each best practice stated, the respondent gives a qualitative answer to the question ''To what extent does our company use the best practice stated?'' (based on Lockamy and McCormack, 2004b). The maturity scale is the same for all the best practices to be evaluated in the test, and ranges from 1 = "Never or does not exist'', 2 = "Sometimes or to some extent'', 3 = "Frequently or partly exists'', 4 = "Mostly or often exist'', and up to 5 = "Always or definitely exists''. Figure 2 shows a screenshot of the proposed test. The first five research-based best practices in the decision category ''Strategy'' are shown.

Figure 2 Snapshot of proposed best practice maturity test



Decision category	BP nr	Tag	Description of Best Practice	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
Strategy	1	Supply chain strategy	A clearly stated supply chain strategy exists (e.g. Fuchs et al, 1998)	Please choose:
	2	Customer focus	The strategy is customer focused (e.g. Godson, 2002; Schonberger, 1986; Lambert & Cooper, 2000; Blanchard, 2007)	Please choose:
	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)	Please choose:
	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)	Please choose:
	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)	Please choose:

Test process

Based on Pendlebury *et al.*'s (1998) description of successful change management and the experiences with the ten test companies a complete test process is suggested as given in Figure 3.

First, the preparation of the test is concerned with identifying which site or division to audit, who will be involved (typically logistics manager, supply chain manager, production manager and similar positions) and where and when the audit will take place.

Second, a test workshop of about 1-1.5 hour is arranged. The test team is supposed to give qualitative experienced-based answers to each of the 48 stated best practices according to what they believe is the company's current maturity. The output of the test is an easy-to-read radar diagram with maturity scores. Figure 4 shows an example of the test results from one of the ten companies.

Third, an analysis phase consists of two activities. In line with the core idea of the proposed maturity test, the analysis should be as quick as the testing itself. When analysing the results, practices that are considered having considerable improvement potential (maturity level 1-2) and practices with a high level of maturity (level 4-5) should be focused. These extremes are highlighted in the radar diagrams, and presented for discussion in a four-hour workshop with the team. During the workshop strategic trade-offs should be made on which practices to address in order to improve the supply chain performance. These practices are described in action lists.

Finally, change projects are carried out according to the action list. At this point the maturity test process ends, but it is recommended to start over again with assessments of the maturity during and at the end of the change projects in order to track improvements.

Figure 3 The proposed test process

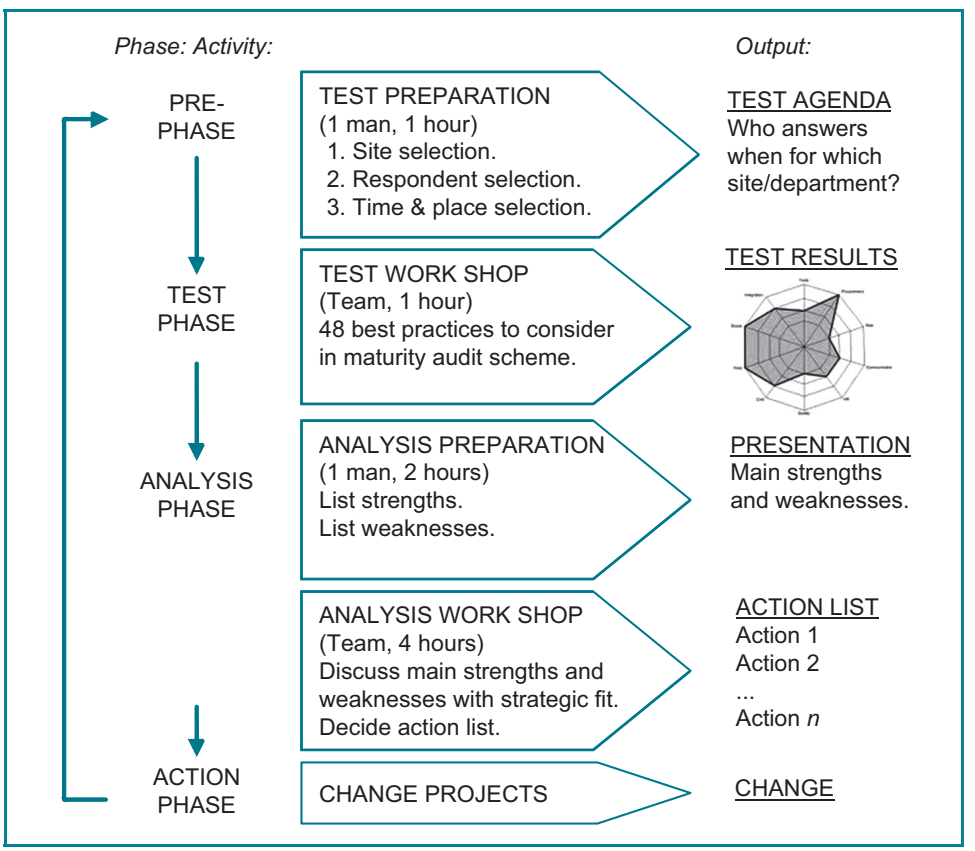
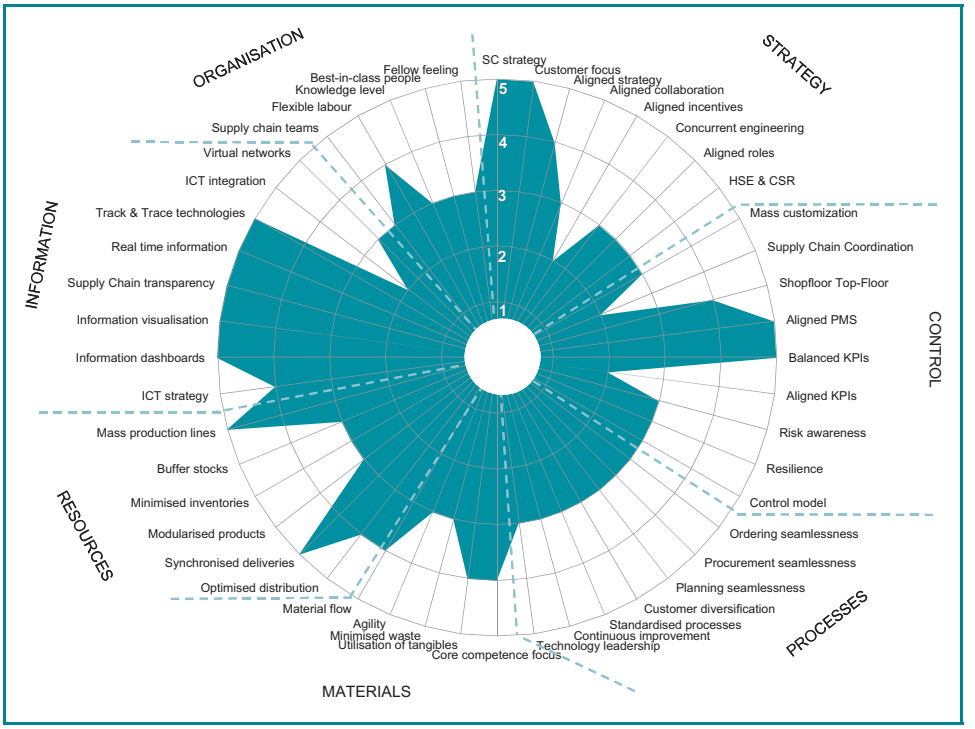


Figure 4 Example of a result of the proposed test visualised in radar diagram



Strengths and weaknesses

The proposed test is based on, and fulfils, all the 11 design requirements outlined in the theoretical background (cf. Table I). Both the main strength and main weakness of the proposed test is tied to the qualitative nature of the test, where a person answers on gut feeling and experience of a number of best practices in a short time. Due to this, the test is quick to carry out. However, the results must be treated thereafter – they are the result of subjective impressions. Based on feedback from users and researchers in the ten companies where the test was applied, strengths and weaknesses were collected and discussed. The most evident strengths and weaknesses as determined using the proposed test are summed up in Table II.

Conclusions and further research

This paper proposes a quick maturity test to assist supply chain operations strategy development. The proposed maturity test is developed through literature reviews on maturity models and best practices, and is tested and enhanced in close cooperation with ten industrial companies over a period of four years. The test is an audit scheme built on best practice statements within seven key strategic decision areas:

1. strategy;
2. control;
3. processes;
4. materials;
5. resources;
6. information; and
7. organisation.

Table II Strengths and weaknesses with the proposed test

Strengths	*Weaknesses*
Simplicity Simple and easily understandable audit scheme for everyone to use Results are communicated in a logical and visual style	*Qualitative and subjective answers* Answers not based on facts and figures Large variations of interpretation on maturity level inside a firm
Quickness Takes no longer than one hour to complete Results are given immediately Requires no preparatory work	*Validity of best practices* Does not cover all practices that influence performance Impossible to secure the validity of the best practices
Including Includes participants in an early phase of an improvement project Discussions during the test are highly valuable *per se*	*Complexity of best practices* The best practices stated often need some further explanation for practitioners not familiar with all areas of supply chain management
Applicability A range of applications from self-assessment to benchmark studies	*Non-normative* Does not give any answers on how to improve
Qualitative input Allows qualitative consideration of maturity	*Lack of quantitative input* Quantitative analysis across companies is difficult
Balanced Allows triangulations of answers from different sources Allows trade-offs to be made through strategic discussions	*Compliance with other mapping techniques* So far no triangulation with other tools So far not part of broader mapping techniques
Generic Designed to be generic for any industry	*Language and translation* For non-English natives the language becomes a barrier

It is designed with simplicity as a key feature and takes no longer than one hour to complete and is thus also applicable for the busiest managers. The test outlines what seems to be good, and what seems to have potential for improvement. The results are communicated in a logical, visual and easy understandable style. The maturity test results are input to strategic decisions regarding best practice in supply chain operation strategy. The complete test process, including preparation, testing, analysis and decisions on actions, typically takes no more than eight hours. The main model-aspects of the proposed maturity test are:

- *test scope* – manufacturing companies' supply chain operations strategy;
- *test structure* – a maturity model audit scheme;
- *test content* – best practices in supply chain operations; and
- *test process* – quick audit as part of strategic change process.

Best practice studies are not without critique. Foggin *et al.* (2004) and Laugen *et al.* (2005) both point out that best practice studies never cover all the factors or practices that influence performance. In addition best practices are not eternal, which means that all listings of best practices do not only have a room side, but also have a time side where the shelf life will influence their validity (Hanson and Voss, 1995). Zairi and Ahmed (1999) and Davies and Kochar (2000) warn that many best practice debates ignore the contextual background of best practices and focus solely on which best practices have apparently given companies a competitive edge. For example, it is well known that many Western companies have not achieved the expected success when implementing Japanese best practices. However, this

has not ended the widespread effort of identifying and implementing best practices in industry.

Further research

A number of defined best practices are used that should be considered and redefined continuously; thus, more 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 authors propose that the following research questions could be part of a prospective research agenda on maturity tests for operations strategy development:

1. How can the validity of the best practices in maturity tests be ensured?
2. How can the triangulation of results be enabled?
3. How can simple maturity tests be part of other and broader supply chain mapping techniques (e.g. QuickScan, SCOR)?
4. How can the results of maturity tests be interpreted in a wider context (e.g. is the company lean or agile)?
5. How can the proposed test be used in large quantitative surveys where results are compared across a large sample using statistical analysis?

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