ENABLING PERFORMANCE MANAGEMENT IN SMEs: A STUDY INTO WHAT SMEs NEED TO MEASURE AND HOW THEY SHOULD MANAGE PERFORMANCE

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ABSTRACT
This paper proposes and validates a set of requirements specifications for a performance measurement system that would support the adoption of performance management best practices within Small and Medium sized Enterprises. The literature review concludes that characteristics of performance measurement practices currently in use, limit their adoption within an SME environment. In addition, an in-depth multiple case studies create an understanding of the actual state and desired future state of performance measurement practices within SMEs. Based on the literature review and case studies a conceptual model for an ICT enabled performance measurement system was proposed.

Keywords; Performance management systems, Small and Medium sized enterprises; Performance Measurement

INTRODUCTION
A high number of research studies as well as industrial projects focus on performance management and measurement of logistic and supply chain related activities (Neely 1999; Franco and Bourne, 2003), however research on methods and tools is still lacking behind. As a matter of fact, Schmitz and Platts (2004) claim that, although the importance of this area is widely acknowledged, there are ‘‘significant gaps in theoretical and empirical knowledge’’ and there is no research on any real application of an integrated performance measurement system (PMS) for supply chain management. Rather this area is identified as a gap in the literature (Lambert *et al.*, 1998). Bititci *et al.* (2005) also add that “limited understanding of how to measure and manage performance in extended and virtual enterprises is one of the main barriers to wide scale acceptance and practical use of these concepts by industry”.

This becomes even more important when dealing with SMEs (Garvare and Wiklund, 1997; Wicklund and Wiklund, 1999). According to Gulbro *et al.* (2000), SMEs do not emphasise performance measurement (PM) as much as large enterprises (LEs) do. Let alone supply chain management. As a matter of fact, even though globalisation has changed the way small companies operate, SMEs have only recently started to be acquainted with the concepts of supply chain and supply chain management and have not progressed very far down the road of developing their supply chain (Morgan, 2004).

The objective of the paper is to identify a number of requirements that would make SMEs more willing and able to adopt performance measurement best practices. This was achieved through a literature review and a complementing case study to identify the current state of performance management practices in SMEs and the requirements for an optimal future state. Based on the definition of the future state requirements, an ICT based performance measurement system is proposed.

The research behind this paper studied performance measurement in SMEs networks. To do so, both deductive and inductive modes of knowledge generation were employed. The literature review identified a number of relevant gaps in current knowledge. In addition, a case study strategy was selected to understand the SME requirements in a real life context. Case studies are considered the most appropriate for this type of investigations (Eisenhardt, 1989; Yin, 2003). A multiple case study encompassing five SMEs was carried out (see also Eisenhardt (1989) and Meredith (1998)). In this deductive phase, the authors used current theories to formulate hypotheses, and then tested the construct through empirical observation (Himola, 2003; Gill and Johnson, 1991).

In the inductive phase, the authors used the observations from the case companies and consequently generated new knowledge and theories (Gill and Johnson, 1991; Burrell and Morgan, 1979) based on the lessons learned. Such knowledge was used to eventually design and develop what is called the Global performance management (GPM)-dashboard. More detail on the GPM-dashboard will be presented later in this paper. Evidence was mainly qualitative. Multiple data sources were investigated i.e. field work, verbal reports and in-depth interviews- to increase the validity of the research outcomes (see also Bonoma (1985)).

The paper is structured as follows. First the research methodology is presented followed by the literature review and case studies with findings. Thereafter the proposed ICT-supported performance measurement system is presented. Finally, conclusions and further work is discussed

LITTERATURE REVIEW: PERFORMANCE MEASUREMENT SYSTEMS IN SME`s

Traditional performance measurement systems

Performance measurement and management have been on the research agenda since the late-1980s (Johnson and Kaplan, 1987; Lynch and Cross, 1991; Eccles, 1991; Kaplan and Norton, 1992; EFQM, 1999; Thorpe and Beasley, 2004). Since then, there has been a proliferation of theories, models and tools (Franco and Bourne, 2003), to support practitioners better measure their performance and hence manage through measures. Market and production globalisation and the network- and knowledge-based economy are triggering continuous changes in the way companies are organized and the way they do business. With regards to performance measurement, the focus has shifted (Busi and Bititci, 2006):

- From performance measurement to performance management: To reap the benefits of performance measurement, organisations have to make use of the measures, i.e. they have to manage through measures (Amaratunga and Baldry, 2002).
- From individual to collaborative performance measurement (Konsynski, 1993).
- From lagging to leading performance management: The focus of operational control is shifting from past to present and performance measurement is a key agent of this change (Amaratunga and Baldry, 2002).

When studying performance measurement in the context of supply chains, it is possible to identify several limitations of existing PMS. Traditional performance measurement systems are inadequate in a collaboration-intensive enterprise context, since they are not designed with the networks performance in focus (see for example Busi (2005) and Holmberg (2000)). Most PMSs used in the manufacturing industry are limited in scope, and are not able to capture the whole network as one entity, but instead encourage sub-optimisation (Beamon, 1999; Gunasekaran *et al.*, 2001). These limitations hinder information sharing (i.e. forecasts, sales data and plans) that can improve supply chain performance.

Another aspect with today's PMSs is that they mainly use "lagging" measures (Bititci *et al.*, 2002; Hudson *et al.*, 1999), instead of "leading" measures. "Leading" measures enable feedforward control, i.e. the development and deployment of plans and objectives informed by measures of real-time performance. "Lagging" measures, on the other hand, enable feedback control, i.e. the measurement of performance against those objectives through historical lagging measures. Proactive performance management based on both feedforward and feedback control is based on the premise that a balanced set of leading and lagging performance measures should anticipate and not only correct bad performance (Busi and Bititci, 2006).

Table 1 summarises the conclusion of the thorough analysis of existing literature concerning existing performance measurement system. The first column on the left-hand side of the table simply categorises the limitations into more identifiable groups. This was done to support the authors in designing the interview questions for the case studies.

Table 1 Limitations of traditional performance measurement systems (Adapted from Busi (2005)).

Group	Limitations of traditional PMS	References
Performance Measurement/Management Practices (Focal firm perspective)	Encourage short-termism	Neely (1999)
	Lack strategic focus and fail to provide data on quality, responsiveness and flexibility	Neely (1999)
	Encourage local optimisation	Neely (1999); Busi (2004); Busi *et al.*, (2003); Busi and Strandhagen (2004); Chan (2003)
	Do not encourage continuous improvement	Neely (1999)
KPIs	Mainly making use of lagging measures (i.e. historical PMS with out-of-date and irrelevant information)	Ghalayini *et al.* (1997); Holmberg (2000); Love and Holt (2000); Bititci *et al.* (2002); Hudson *et al.* (1999); Busi *et al.* (2003); Busi and Strandhagen (2004)
	Lack of predictive ability to explain future performance (i.e., lack of leading indicators)	Ittner and Larcker (1998); Yeniyurt (2003); Busi *et al.* (2003) Busi and Strandhagen (2004)
	Strategy and measurement are not connected	Ghalayini *et al.* (1997); Adams *et al.* (1995); Eccles (1991); Holmberg (2000); Busi *et al.* (2003) Busi and Strandhagen (2004); Chan and Qi (2003)
	Inflexible: they have predetermined format	Ghalayini *et al.* (1997)
	Over-rely on financial aspects	Love and Holt (2000); Clarke and Clegg (1999); Holmberg (2000); Ghalayini *et al.* (1997)
	Do not accurately reflect the interest of stakeholders	Love and Holt (2000); Kaplan and Norton (1996)
	Missing link between non-financial metrics and financial numbers	Kaplan and Norton (1992); Yeniyurt (2003); Chan (2003)

	Too many isolated and incompatible measures	Holmberg (2000); Yeniyurt (2003); Kaplan and Norton (1992)
Supporting technology	Lack of appropriate integrated ICT infrastructure	Bititci *et al.* (2002); Busi (2004)
	Time consuming (require a large amount of data)	Bourne and Neely (2000); Bititci *et al.* (2002); Busi *et al.* (2003)
	Lack of a structured framework	Bititci *et al.* (2000); Busi (2004)
Performance Measurement/Management Practices (Supply chain perspective)	Inadequate in a collaborative enterprise context (be supply chain, virtual enterprise or any other type of enterprise network)	Holmberg (2000);Beamon (1999); Busi *et al.* (2003); Busi (2004), Chan (2003); Chan and Qi (2003); Bititci *et al.* (2005)
	Are not made directly towards the purpose of network performance analysis	
	Limited in scope (do not provide a complete picture of the network performance)	Beamon (1999); Busi *et al.* (2003)
	Report only functional process performance, but not cross-functional, cross-enterprise performance	Ittner and Larcker (1998); Yeniyurt (2003)
	They do not measure the value create	Yeniyurt (2003)
	Traditional metrics do not aggregate from an operational level to a strategic level	Kaplan and Norton (1992); Yeniyurt (2003); Busi (2004)

The identified limitations are experienced by both LEs and SMEs today to various degrees due to their different characteristics.

Performance measurement systems for SMEs

SMEs have several advantages compared to LEs, such as decreased bureaucracy, improved customer services, more efficient internal communication, and shorter time required to address problems (Sharma *et al.*, 2005). Nonetheless, the very nature of SMEs presents some inherent disadvantages compared to LEs and the implementation and use of PMSs. Resources are usually limited in terms of finance, people, infrastructure and access to knowledge (Sharma *et al.*, 2005). Management focus is on the short-term and long-term strategies are more often than not missing (Kueng *et al.*, 2000). The special characteristics of SMEs and their environment result in PM systems that are typically financially focused, informal and unstructured (Hudson *et al.*, 2001). In addition, the survey by Neely and Mills (1993), show that costs connected with measuring performance are an important concern of decision makers in SMEs. There is also often a misconception of PM, where the SME often do not understand the potential advantages of implementing a PMS (Garengo *et al.*, 2004).

Hudson *et al.* (2001) reviews a number of approaches for assessing and designing SME PM systems i.e. (Hynes, 1998; Barnes *et al.*, 1998), identifying its strengths and weaknesses. In addition Hudson *et al.* (2000) carried out a case study to evaluate the applicability of PM system design process developed for large enterprises (Neely *et al.* 57) to SMEs. Conclusions were that this process was fundamentally unsuitable in the SME context due to, among others, limited resources and emphasis on short-term performance. The results from Hudson *et al.* (2000) and Garengo *et al.*, (2004) point out that only a small number of PMS models have been developed specifically for SMEs.

Findings from the literature review clearly identify the limitations of existing PMS and the need for PMS developed specifically for SMEs (see also Wicklund and Wiklund (1999) and Garengo *et al.* (2005)). Design of these PMS for SMEs will address the same issues as shown in table 1; KPI development, performance measurement practices in the company and supply chain and supporting technology.

CASE STUDIES

The main objectives of the case studies were to:

1. Verify the limitations identified in the literature study with regards to performance measurement and management for SME and assess the current state with respect to performance measurement.
2. Assess the selected companies' desired future state with respect to performance measurement.

The data collection was designed to provide insight into these areas. This insight served as the basis, together with the literature review, for the development of the GPM dashboard.

The sample
The sample included:

- A manufacturer of electric wiring harnesses for the automotive sector
- An upholstery manufacturer for office chairs
- A wood furniture manufacturer
- A manufacturer of office furniture and
- A reverse logistics service provider

These companies act as first to second tier suppliers of products or services to typically larger OEMs (Original Equipment Manufacturer). The number of employees in the companies were lower than 250 with revenues ranging from 3 to 20 million euro. As these companies are partners in more than one network at the time, they present a somewhat differentiated product (normal to high complexity) and customer portfolio and face different challenges. In addition, they have all decided to explore new global markets, either in the supply or delivery side of the chain.

Data collection and analysis process
Several methods and instruments are available for collecting empirical data (Denzin and Lincoln, 2000). Observations, diary methods and informal and formal interviews were the methods adopted in the research behind this paper. Qualitative data are sources of well-grounded, rich descriptions and explanations of processes occurring in local contexts (Miles and Huberman, 1984). Even though analyzing data is the heart of building theories from empirical observations, the most serious challenge rests in that methods of analysis are neither well-formulated nor they are codified (Miles and Huberman, 1984). To analyse the data gathered, the authors used both within-case and cross-case data analysis. Within-case data analysis: to gain a good understanding of a particular case and to identify those unique patterns which emerge before generalising patterns across cases. Cross-case data analysis: to seek for patterns amongst more than one case (see for example Eisenhardt (1989)).

A total of 150 questions were prepared from the literature review. These questions covered the major areas in Table 1, 1) KPIs, 2) Performance Measurement/Management Practices Focal firm perspective, 3) Performance Measurement/Management Practices Supply chain perspective and 4) Supporting technology.

The data collection was conducted via semi structured interviews with key decision makers in the companies. For every meeting, minutes were approved by the interviewees and for each case the interview guide was completed by the researcher.

Findings from the case studies
Based on the interviews it was possible to analyse the current situation and desired future state regarding performance management in SMEs, as seen by the end-users, i.e. the SMEs.

The current state within the defined areas are summarised in the following table.

Table 2 Current state

Area	Current state
KPIs	• Performance measurement are in most cases based on experience and common good sense, and not from a well defined methodology • The performance indicators are not Key Performance Indicators, i.e. they are not linked to the overall business strategy • The performance indicators are mainly focusing on finance and operations, and do not provide a coherent overview of all important areas of the company
Performance Measurement/Management Practices Focal firm perspective	• The performance measurement efforts are limited to measuring operations and processes within the company • The measurement are mostly used for control and not actively used in management
Performance Measurement/Management Practices Supply chain perspective	• There is a general awareness of the importance and benefits of increasing visibility of the network performance; however models, guidelines or tools have not yet been defined for measuring and managing performance with partners. • The only performance data shared is that required by customers or suppliers and not collaboratively designed.
Supporting technology	• Technological upgrading is in general necessary, but limited resources both of time and economy, call for simple and ready to use technology. • The performance indicators are to a large extent manually gathered

Based on the current state the companies and researchers agreed on some obstacles in the use of PM in the SMEs regarding; KPIs, performance management (focal company and supply chain) and supporting technology.

Firstly the lack of knowledge to PM concepts, theories and tools were evident and thus resulted in an imperfect PMS (i.e. unbalanced, static, not aligned to strategy, suboptimal) or in worst case no system at all. In the cases where the company had a system the use of the system were often limited to control and not used in day to day management. Secondly, the aspect of collaboration was not in focus and the PMS was not designed to enable collaboration with other actors in several areas. And thirdly the companies agreed that the lack of a technological infrastructure to enable automatic data collection and visual presentation of the results was an important obstacle to effective use of PM in SMEs.

These findings confirm earlier studies i.e. Hvolby and Thorstenson (2000) and Barnes *et al.* (1998), and the limitations found in the existing PMS. Following the assessment of the current state the companies were questioned regarding the desired future state in the use of PM.

Desired future state

All companies agreed that the use of performance indicators to set goals, allocate and prioritise resources, view the current state, and to simulate future states, are an important enabler for competitiveness, both within the company and in the supply chain. Also, there was a general agreement concerning the needs to develop PMS that would enable:

- Translation of strategy into operational KPIs and objectives in the individual company.
- Monitoring, analysis and control of company of the performance in both the individual company and the network.
- Measuring and sharing KPIs in the whole network: collecting and processing information from i.e. ERP-systems, data collection systems, communication systems (EDI). The integration of systems gives the single company possibility to communicate and exchange data automatically.

- Integration and information sharing of relevant and up-to-date information in the supply chain, reflecting all important areas of the enterprise and the supply chain: cost, time, quality, flexibility, precision, innovation and environment.
- Effective performance management; using measures not only for control but to manage and improve the business performance and as a result acquire and retain customers.

The companies also commented on the infrastructure and the front end of the PMS as it should:

- Be based on a technology platform. An ICT system that is affordable, easy to implement, use and maintain should support the PMS.
- Ensure coherence and correct aggregation of the KPIs, within the different departments and levels in the organisation and network, is ensured through a set of rules for measurement calculations.
- Display KPIs values and trends in a user-friendly fashion: information built into the KPIs and useful for performance analysis must be shown using different display techniques, both graphical and text-based.

In addition end users pointed out that the system must protect each actor's confidential data to ensure the integrity of the system and the user's willingness to use it.

Based on the SME requirements, an ICT based performance management system was developed, specifically targeting SMEs' needs and characteristics. This system was termed the "GPM-dashboard" and illustrates how the requirements could be met.

THE GPM-DASHBOARD

The *Global Performance Management Dashboard* supports SMEs in measuring and sharing their operations' performance through graphical representation of the KPIs. Local and global KPIs are visualised to speed up the recognition process and allow quicker decision-making for the end users

To ensure an affordable system it was developed using open source tools and designed to be easy to implement, use and maintain, and therefore not require extensive technical knowledge.

Technical solution

The GPM-dashboard has been conceived as a modular and independent group of applications to provide companies with an affordable and easy-to-use IT solution. The technical solutions defined to implement the GPM-dashboard have four main layers (ordered from the bottom to the top in Figure 1):

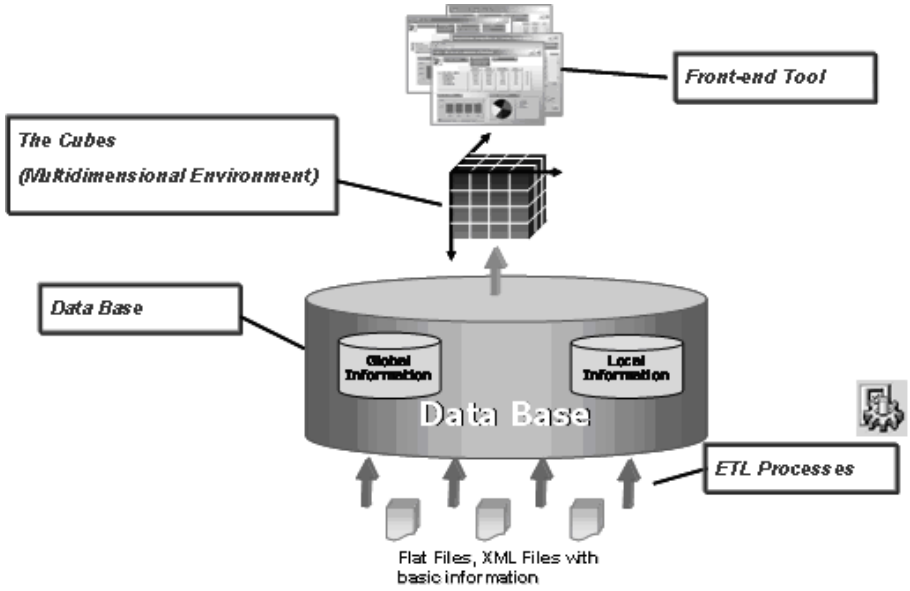

Figure 1 Technological solution.

- ETL Processes: Users feed the system by automatic uploading XML files into the system. When these files are uploaded, the system can automatically insert these data into the tables by combining these data received from partners.
- Database: The database store data received from end-users (partners) and the calculated KPIs as basic data. The global and local data are differentiated by the system.
- Cubes (Multidimensional Environments): KPI information is stored and can be analysed and accessed in several dimensions/perspectives, i.e. time, process, cost, product etc. The cubes include rules to ensure data security.
- Front-End: The end-user environment where the users to navigate and exploit the local and global data in a graphical environment. KPIs are monitored and alerts managed in a web environment. The security profiles are filtered by a log-in interface.

The GPM-dashboard is supported through a web application environment. With this environment, the users can view all KPI`s data with an Internet connection and an Internet Explorer (or similar) tool. In this client/server system the business logic is executed in the server and the client only has a client program (an internet explorer tool) to interact with the data. The GPM-dashboard is developed in JBoss AS, an Open Source Application Server that works as a system business logic container. This server is the responsible of the database connections interaction and to redirect the users to pages according to the user's navigation. The GPM-dashboard manages user's data by using a Lightweight Directory Access Protocol (LDAP) repository. This allows obtaining and storing this data with a standard protocol. It also allows using Secure Sockets Layer (SSL) connections to save the security access.
OpenLDAP is the used tool for this component in the GPM-dashboard. This is an Open Source tool that implements the LDAP and has a tree explorer to help manage the user's data in the repository. Using open source tools was one of the prerequisites in the project to ensure an affordable solution for the SME end-users.

Dashboard functionality
The three main areas of application in the dashboard are monitoring, analysis and management.

Analysis: Historical values of the KPIs can be accessed and analysed to investigate today's performance. Drilldown functionality allows investigation of the performance through different perspectives such as time, products or actors/locations, and different aggregation levels.

Monitor: Performance indicators are visualised and monitored. End-users can visualise performance indicator values, measured both at individual company level and at an aggregate level from the several participating partners. This can be used as an automatic system to evaluate the strategy of the company. Changes in the environment, market, etc. might lead to change of company goals, based on new opportunity and risks. These opportunities and risks are designed as new KPIs warning levels to allow managers to detect them and initiate actions to address the alert cause.

Management: Supported by the analysis and real-time monitoring of KPIs, decisions can be made instantly and enable SMEs becoming more agile and flexible partners in their supply chain.

A conceptual model of the GPM-dashboard is presented in Figure 2.

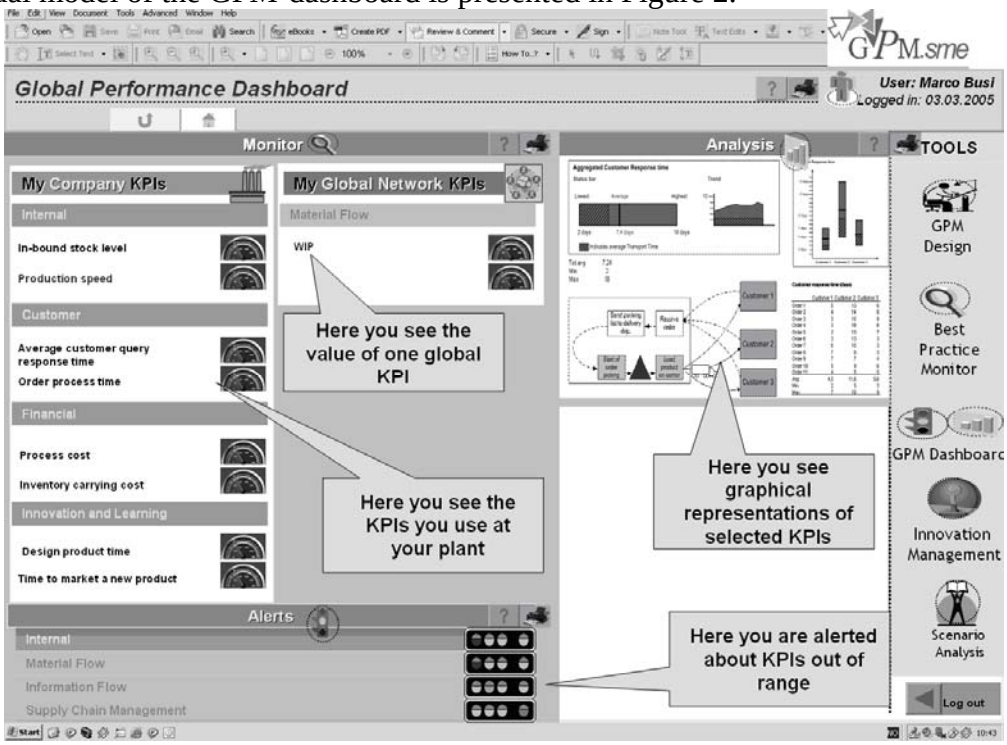

Figure 2 Conceptual model of GPM-dashboard

The dashboard enables i.e. electronic inter and intra- organisational communication, eliminating much of the "paper management" that can be a hindrance for effective collaboration.

In addition to the technical challenges in developing the system, the project also faced challenges common to efforts in developing supply chain performance measurement solutions as described by Hervani *et al.* (2005), i.e. lack of understanding of the measurement structure and different goals and objectives from the end users.

Testing the GPM-dashboard

The objectives of the tests were twofold; 1) to verify that the GPM-dashboard fulfils the SME needs and requirements, and 2) to evaluate system functionality. The input provided by end-users was used to further improve the tool in line with the objectives of the test.

A user-guide for the tests was distributed to the companies, which described the objectives, test procedures and expected results of the test. To report findings, a number of templates were included in the user-guide. Using the templates, users were able to document their findings throughout the testing period through a number of evaluation criteria (i.e. applicability for user, functionality, value added for user, interface etc.). Company-specific data was uploaded in the system to provide users with realistic data in the tests. Personnel involved in the testing were key people in the companies' performance management work. A certain level of IT skill was also a prerequisite for testing the technical part of the tool. The tests were carried out together with RTD partners.

All users saw the GPM-dashboard as an improvement of their internal performance management, and as an opportunity for supply chain collaboration through definition of "correct" KPIs and tools for information sharing. Even though the system is a prototype, one of the end users replaced their existing excel based system for performance measurement and information sharing with the GPM-dashboard.

Several improvement areas were also reported, particularly related to response time, graphics and visualisations and integration with other systems. Due to the fact that the tool was a prototype, this feedback was not unexpected. The test also revealed a lack of automated data collection in the companies for input in the different modules. The data collection was in most cases a manual exercise and clearly an area for improvement.

CONCLUSIONS

A number of requirements for performance measurement in SMEs were identified through a literature review and a complementing case study. The main findings from the case studies were the lack of knowledge and tools to effectively manage their performance. This includes KPIs that are primarily focussed on finance and internal operations, limited knowledge regarding performance management practices, and unstructured approaches to performance management. In addition, the technology to support an ICT based PMS is not present in the SME.

To meet the specific requirements for the SMEs and effectively support their performance management critical issues were identified. This includes the possibility to monitor, analyse and control performance in both the individual company and the network, effectively handle the integration and sharing of relevant and up-to-date information. The PMS should also be based on a technology platform, and be affordable, easy to implement, use and maintain.

The GPM-dashboard is an example of how the SME requirements can be met and is through testing in the case companies confirmed to be a first step to effective performance management in SMEs. Further development of the dashboard should address the existing and new requirements for SMEs to improve their ability to manage performance and become an attractive actor in the supply chain. Technical improvements should be done to improve graphics, integration with legacy systems and automated data collection to better suit SMEs needs and requirements. There is also a need to verify that the GPM-dashboard is applicable to SMEs in other industries than those represented by the case companies, as these might have requirements not addressed in the prototype of the GPM-dashboard. To be successful in these research tasks the authors believe close dialogue with industry partners is a prerequisite in the further development of PMSs for SMEs.

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