Performance Measurement Systems for SME in Collaborative Settings

[004-0238]

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Abstract
Small and medium size enterprises (SMEs) do in many cases not have the financial strength, range of knowledge, or technical resources that are necessary in order to compete successfully with larger companies. One way for the individual company to solve this problem is through collaboration with other companies, large as well as small. There are different kinds and different levels of collaboration that may offer different possibilities and prerequisites to create competitive manufacturing. To evaluate the collaboration between companies, a performance measurement system which takes quantitative as well as qualitative factors into consideration is required. This paper presents a review over possible performance measurement systems and parameters that should be considered in the decision of performance measures.

Keywords: SME, Performance Measurement, Supply Chain, Supply Network

Introduction
There are different factors that could enhance SME’s competitiveness (Sandgren & Winroth, 2005). One of these factors is collaboration. Working with the supply chain is one way of collaboration with other companies. Collaboration between companies could also be in performed supply networks with different partners. In recent years, companies have realised that supply chain can be used to improve the supply chain, in order to be more competitive. There is, however, a lack of knowledge for the development of efficient performance measures and metrics to achieve a fully integrated supply chain. The aim of this article is to present a review over possible performance measurement systems and parameters that should be considered in the decision of performance measures.

Supply chain
Usually a company is a member of a supply chain and in general there are several companies involved in a products path from raw material to end customer. In a supply chain, the upstream flow and the downstream flow usually direct the material and information flow from the focal company’s point of view (Womack et al., 1990). The upstream chain is also called the production chain. The production chain consists of suppliers at different levels. The upstream flow consists mostly of information and assets, but even physical products could flow in the chain. The downstream chain, or the distribution channel, consists of the focal company’s customers and the customer’s customer. The main downstream flow is the flow of products or material, but also information and service is important. A more complex and advanced type of collaboration is through a supply network. As the name indicates, collaboration is carried out through a network of suppliers and buyers. Supply chain networks can be defined as a set of interconnected supply chains, describing the total flow of goods and services from original sources to end customers, from a focal company’s point of reference (Harland, 1996).

There are several aspects on supply networks. There is often a reduction of total costs, reduction of inventories, and increased levels of shared information (Maloni & Benton, 1997). Shi and Gregory (1998) show how strategies for supply networks affect manufacturing. They differentiate between two categories, multidomestic orientation and global orientation.
• Multidomestic Orientation: Coordination strategies that focus on a manufacturing system that is tailored for the local market and therefore the coordination between factories and in the network is autonomous.

• Global Orientation: Coordination strategies that are featured with integration and coordination in networks. The interdependence could come from the design system or dynamic operational mechanisms.

Another way to see cooperation between companies is through different collaborations relating to the product characteristics (Shaw & Lin, 1998). They describe three different kinds of networks depending on the product structure. The first network structure is convergent and appropriate when excess inventory should be avoided. The reason could be that final product or some detail carries a high stock keeping cost. Examples of industries are the automotive and the airplane industries. The second network structure is divergent and components are common to many product models and can be combined into a number of end-products. The network is composed of two parts. In the first part of the network, generic models are produced and assembled in complex manufacturing processes, in-house at the focal company. The second part contains less complex assembly processes where customized models are put together. Examples of industries are the electronic and computer industries. The third network structure is appropriate when ability to react to changes on the market is crucial. The manufacturing process uses the divergent differentiation approach and the differentiation into different product models is made at the manufacturing stage. A large variety of end products will create problems given that the product life cycle is short for this type of products. Example of companies in this type of network is within the fashion industry.

Complexity in networks has forced companies to go to real time communication systems (Srinivasan et al., 1994). There are several reasons why information is important, a high degree of information sharing could reduce uncertainty and improve the performance of the supply chain. An IT strategy during the development of a supply chain is important for the creation of a convenient supply chain and for marketing. Alignment between operations strategy and IT strategy is also important for creating a functional supply chain (Gunasekaran & Ngai, 2004). Information sharing could give financial benefits and conditions to compete globally. The design of the supply chain is not entirely dependent of IT, openness and trusts are just as critical as IT. The formation of a supply chain that is different from traditional e-commerce depends to a great extent on the infrastructure for information flow and that information is used for long-term relationship (van Hoek, 2001).

**SME in Supply Chain**

Supply Chain Management (SCM) could give many potential benefits through fast and feasible access to complementary partner assets (Arend & Wisner, 2005). There are, however, some challenges in technology management due to closer and technical intense and complex transaction set (Venkataraman & Van de Ven, 1998).

Boyle (1994) describes some main streams in SCM that could create benefits. The first stream is vertical integration and a small firm does not have the option to start a true vertical integration. On the other hand they generally do not have to consider antitrust issues (Arend & Wisner, 2005). The next stream is transaction cost economics (TCE) and small companies have more difficulties to create enough economical issues that are required because of the bargaining position.
The most positive issues for SMEs is that collaboration activity could help to overcome size and resource problems and reduce cost and increase innovation (Coviello & McAuley, 1999). A network also creates potential to differentiate and leverage through partners (Hartley, 2000). SMEs may be different from larger companies by a number of key characteristics. Generally positive characteristics could be described as (Hudson et al., 2001):

- Personalized management
- Flat, flexible structures
- High innovatory potential

Negative characteristics could be (Hudson et al., 2001):

- Severe resource limitations in terms of management and manpower, as well as finance
- Reliance on small number of customers, and operating in limited markets
- Reactive, fire-fighting mentality
- Informal, dynamic strategies

A good help for supporting customers through collaborative networks is to use web solution (Marshall & McKay, 2000). There are several solutions for web-based exchanges that connect customers and suppliers to the network. It could also make it easier to access foreign market and not only that, it makes easier to integrate foreign customers and suppliers into a closer relationships (Gunasekaran & Ngai, 2004). The level of information technology is still low between SME (Carbonara, 2005).

**Performance Measures**

Traditional accounting measures have been the most common performance measures used in annual incentive plans (McKenzie & Shilling, 1998). The intention with value-based performance measurement is to create a more direct link between management and shareholders. In the literature, different categories of performance measures are suggested, such as (Neely et al., 1995):

- **Cost** – The main purpose of cost measures is to show the profitability of the company. A problem with cost measures is that they often focus on short-term profit instead of long-term profit and performance (van Schalkwyk, 1998). Research and product development measurements are often calculated through investment project just to simplify visibility (House & Price, 1991). A way to avoid traditional problems could be to use activity-based costing (ABC) (Jeans & Morrow, 1989). Another problems with cost measures is the focus on visible costs e.g. direct material, while the majority of overheads is caused by “invisible” costs (Miller & Vollermann, 1985).

- **Flexibility** – Responsiveness to changes is a common approach to measuring flexibility (Beischel & Smith, 1991). It is however unclear exactly what to measure and White (1996) found that more research has to be done to find the right dimensions for measuring flexibility. Cox (1989) sees the concept of flexibility as a measure of efficiency with which the manufacturing process can be changed.

- **Quality** – Saraph et al. (1989) show the importance of measuring quality. Also quality has a range of measures across different dimensions (Saraph et
Traditionally, focus is on issues such as number of defects produced and the cost of quality (Neely et al., 1995). Quality measures often focus on process outcome, but the quality of the process input might be just as important as the output (White, 1996).

- **Time** – Time has been described as a source of competitive advantage but also as the fundamental measure of manufacturing performance (Neely et al., 1995). Another important delivery aspect is the lead time between customers’ orders and delivery of the finished product (Popplewell & Bing, 1995).

There is mostly no problem to decide what to measure in a company, both concerning financial measures and non-financial measures, the problem is to select which measures are important (Neely et al., 1995). Normally there are few key drivers that influence long-term success. When the number of performance measures becomes too many it is difficult to keep focus on the right subject. It could be difficult to choose the correct measures to track the true drivers and also to keep focus on the purpose of measuring. The manufacturing literature argues that performance measures should be derived from the strategy (Neely et al., 1994). They should be used to strengthen the strategy. This not always appear in reality (Neely et al., 1994). A strategy exists when one can identify a consistent pattern of decisions and action within a firm (Neely et al., 1995).

### Performance Measuring

There are several performance measuring system and one of the most well-known performance measuring frameworks of today is the balanced scorecard (Kaplan & Norton, 1992). The main benefit with the balanced scorecard is that the scorecard tries to integrate different classes of performance e.g., financial and non-financial, internal and external. Keegan et al. (1989) have also a framework with this strength. The problem with the framework by Keegan et al. (1989) is the missing link between dimension of business performance in the balanced scorecard. Other authors try to be even more prescriptive by describing a very detailed framework (Azzone et al., 1991). This framework seeks to identify the measures that are most appropriate for organizations with a strategy for time-based competition.

Brown (1996) introduced a framework that highlights the differences between input measures, output measures, process measures, and outcome measures. Also Lynch and Cross (1991) have a similar focus.

So far the discussion has focus on performance measurement systems for a single company. Other frameworks handle issues about inter-organizations. Beamon (1999) suggests a framework for performance measuring in supply chains using three types of measures:

- **Resources**
- **Output**
- **Flexibility**

They are all important for overall performance. Resource measures include: inventory levels, personnel requirements, equipment utilization, energy usage, and cost. Resources, in this framework, are generally measured in terms of the minimum requirements (quantity) or efficiency measure. Resource measurement is an important part for the measurement system (Beamon, 1999). Too few resources can negatively
affect the output and the flexibility of the system, while the deployment of too many resources artificially increases the system’s requirements. The next type is output and output measures include: customer responsiveness, quality, and the quantity of final product produced. Many output performance measures are easily represented numerically, such as: number of items produced; time required to produce a particular item or set of items; number of on-time deliveries (orders). However, there are also many output performance measures that are much more difficult to express numerically, such as: customer satisfaction; product quality. The last type in Beamon’s (1999) framework is flexibility which can measure a system’s ability to accommodate volume and schedule fluctuations from suppliers, manufacturers, and customers.

A more extended framework for inter-organizations is described by Brewer and Speh (2000). They have developed the balanced scorecard (Kaplan & Norton, 1992), for SCM, see Figure 1.

Figure 1 the Supply Chain Management framework (Brewer & Speh, 2000)

Brewer and Speh (2000) have selected other perspectives for the framework than Kaplan and Norton. The following perspectives are selected:

1. **SCM Goals** – The general goals of this perspective are waste reduction, time compression, flexible response, and unit cost reduction. These goals are important both for intra-organizations and for inter-organizations.

2. **End Customer Benefits** – To reach the goals for the organization and to create value to customers, there is a need to focus on the right issues for creating value and to find out what is important for the customers.

3. **SCM Improvement** – It is important to find out changes that are required for future needs. In order to do so benchmark is an opportunity to see world-class organisations. Benchmarking should be done quite often to find out items for improvements.
4. **Financial Benefits** – The aim to introduce a supply chain is to improve the financial result through better functions that could lead to better efficiency and higher productivity in actions connected with supply chain activities.

A performance measurement system for intra-organisations could be adjusted to be appropriate for supply chains, and then could performance measurement system be used for inter-organisations. The performance measurement system must be able to handle the best possible solution for all parts in the collaboration. For that reason should the focus be on the network instead for the single company, that in order to give best effects and result. Folan and Browne (2005) found that more research and further investigation is needed about performance measuring in inter-organisations.

**Selecting Performance Measures**

After that the performance measuring system is suggested the performance measures must be selected for the system. Several of authors have discussed how to select performance measures (Kaplan & Norton, 1993; Neely *et al.*, 1997). A suggestion how performance measures should be is describe below (House & Price, 1991):

- Simple to understand
- Have visual impact
- Focus on improvement rather than variance
- Visible to all

Kapland and Norton (1993) describe a process for selecting performance measures. The process for development of measures is connected with the design of the performance measurement system. First there is a need to identify different business units, to see if the performance measurement system could be useful. If the performance measurement system could be used, the first step in the process, to get a functional performance measures, is to start with interviews, focus on the purpose of the strategy and possible measures. During the process important questions should be asked: “If I succeed with my vision and strategy, how will my performance differ for shareholders; for customers; for internal business processes; for my ability to innovate, grow and improve?” (Kaplan & Norton, 1993). Next step in the process contains a loop with more interviews and workshops of different levels of the organisation to reach an understanding in the organisation, but also to adjust the performance measurement system over how functions for different measures will be coordinated to suit the strategy for the organisation. After some iteration with discussions and workshops of different levels of the organisation it is time to decide how different measures should be implemented for the scorecard in order to reach consensus with the vision, purpose, and measures. An overall agreement is important over how the implementation should be realized to reach the best result. The connection between the performance measurement system and the information system is important, and thereby the information system should support the performance measurement system. With the implementation there are some issues to consider: how the measures can be linked to information systems, how the scorecard can communicate throughout the organization, and how a second level set of metrics will be developed (Kaplan & Norton, 1993). After the implementation there is a need for regular updates of the system in order to coordinate the strategy plan with goals for the organisation and to be prepared for possible changes in the future.
Other authors have similar processes for selecting performance measures (Folan & Browne, 2005; Neely et al., 1997). After implementation there is a need for feedback and learning. Measurement is too often used to record the past and is not aimed at being a base for future growth. This is especially true for most financial measures (Schiemann & Lingle, 1997).

**Support for Selecting Parameters**
After the decision how to design and organise the collaboration a performance measuring system could be developed. There are a couple of issues to have in mind in the selection of measures for a performance measurement system.

**Synchronize with strategy**
The performance measurement system only reflects the translation of the strategy and not all long-term strategies are profitable. It is also important to select a performance measurement system for collaborating SMEs, different perspectives should be considered. In order to make the system to work, companies need to translate the goals into specific measures. Here it is necessary to focus on the goals for the network and thus not sub-optimizing for a specific company in the network. It is also important to integrate the performance measuring system with the long-term strategy to retain the initiative with performance measuring system and the awareness for measuring. There could be a problem if there is a belief that a sophisticated financial model will guarantee positive results or that the model will work well in all business situations. Because non-financial measures are included with financial ones, then the focus tends to be on strategy and vision and not on control (Vokurka & Fliedner, 1995). In the selection of performance measures there are several procedures that can be used to help performance measures to synchronize with the strategy. Kaplan and Norton have their own model for the balanced scorecard (Kaplan & Norton, 1993). Another possible process for design measures is a model from Neely et al. (1997).

**Company size**
The choice of performance measures could be different between a small company and a larger company. One explanation is that SMEs do not have sufficient resources to handle information for the performance measurement system (Carbonara, 2005). There is also a different between a small company and a larger company is that a small company does not implement the collaboration with the same focus on physical closeness to partners in the network (Arend & Wisner, 2005). It is also possible that SMEs do not implement as deeply as larger firms, which could lead to that SMEs do not use the network to compensate for weaknesses in strategic focus areas.

**Company culture**
Another difference between small and larger companies is the company culture. A different could be the organisation structure, there small companies often have a flat and flexible organisation compared larger companies (Hudson et al., 2001). Network strategy could help companies in the collaboration to overcome problems depending on organisation issues. The challenge is then to manage different cultures for different organisations. Otherwise it could lead to misunderstanding. Therefore the understanding of different cultures is important for collaboration to reach required results.
Focus on few measures
Other problems with performance measuring systems are that it could lead to many performance measures, which could lead to a lack of focus (Neely et al., 1995). Problems with performance measuring system is that it could be too much focus on financial terms, which is not suitable for strategic products that will need longer time to show profit and thus it is not possible to be measured in short term (Goold & Quinn, 1990). Cost, that is shared between different products with some common parts, is also problematic since it in some cases will be profitable first in the second generation (Bradley & Baron, 1993). There is also a risk that there will be too much focus on unimportant measures and therefore there is a lack on the important measures. However, too few measures can raise the possibilities to miss the idea for the performance measurement system. The effect with the performance measurement is then vanished.

Regular updates
Another problem with a performance measurement system is that there is a need to change the performance measures over time (Suwignjo et al., 2000), in order to have a functional performance measuring system over long time for evaluation. To update the performance measuring system there is a request for time and money to carry out the update.

Precision and simplicity
All measures could not be measured with precision, e.g. it could be difficult to measure the level of knowledge of employees with precision. In some cases could it be hard to get the right value for a specific measure and then could estimation be an alternative. Also for some measures it could be impossible to show an exact value, still these measures are important. Example of this type of measure is how well the plant adopts to volume changes (Cox, 1989). At the same time should possible measures be as correctly as possible. Measures improvements in one field that does not necessary generate total improvements. In that case different measures could be based on the wrong decisions in the process for selecting measures and not suitable for the performance measurement system (Kaplan & Norton, 1992).

Incitement for improvements
It is important to integrate the performance measurement system with long-term commitment, otherwise efforts invested in developing a performance measuring system could be lost. A prerequisite for integration of the performance measurement system is that all partners have the possibility to influence measure, to feel that they are involved. A way for commitment is to introduce incitement for all employees to reach the goals for performance measures. This is especially true for SMEs where the management often is personalised (Hudson et al., 2001). If there is no incitement to improve measures for performance measurement system it could lead to distrust if it is not possible to affect the own condition at work. Nevertheless, there is also a risk for reduced productivity and the advantage with a performance measuring system is lost.

Conclusions
From the discussion there are some parameters to consider in the design of measures for a performance measurement system for SME in collaboration. These parameters could be a support tool to congregate parameters.
• **Synchronize performance measures with the strategy** – The strategy should be synchronized with measures for the performance measurement system, thereby could the performance measurement system to be a help in improving competitiveness. If not the strategy is synchronized with measures for the performance measurement system there is a risk that development will not generate competitiveness.

• **Adjust performance measures after company size** – To adjust measures after prerequisite for the own network is important. Large companies and large networks need other types of measures than small companies and networks.

• **Have in mind the company culture** – Size is not the only that matters in the selection of performance measures. The company culture also has a great impact on the selection of performance measures.

• **Focus in few performance measures** – Too many measures could generate problems for the performance measurement system. The easy part is to choose measures, and the difficult part is to focus on the right measures. There is also a risk that unnecessary measures consume too much funds and efforts in demand, and thereby the effect from the performance measurement system could disappear.

• **Periodic development and changes** – There is always a need for development, which lead to periodic development for the performance measurement system to handle different changes. By updating the performance measurement system often the aim for the performance measurement system could retain, and also become prepared for future changes.

• **Use both precision and simplicity** – Sometimes it could be difficult to have a high precision for measures, and in some cases it could be impossible, however, a high precision is important. Simplicity is important for network measurement, because there are many other things that interrupt the performance measurement system for network manufacturing.

• **Incitement for all involved** – The use of incitement gives all people involved better conditions to reach goals for the manufacturing networks. The aim with performance measurement system could disappear if not all involved try to fulfil the goals of the network.

However, there is also a need for further investigation about possibilities to use measurement systems developed for intra-organisations and to use these systems for measuring inter-organisations, also how these systems could be adopted for SMEs.

**References**


