BSC-APPROACH FOR SUPPLY CHAIN DEVIATIONS MANAGEMENT

Steffen REINECKE\textsuperscript{a}, Radim LENORT\textsuperscript{b}

\textsuperscript{a} ThyssenKrupp Presta Chemnitz, 09120 Chemnitz, Heinrich Lorenz Str. 57., Germany, Steffen.reinecke@thyssenkrupp.com

\textsuperscript{b} VSB – Technical University of Ostrava, 17. listopadu 15, 708 33 Ostrava-Poruba, Czech Republic, radim.lenort@vsb.cz

Abstract:

The objective of this research is to derive a basic systematized approach for the analysis of a supply chain element concerning performance, deviations and risks. Therefore, a literature research has been made analyzing the systematization approaches in the supply chain risk management, followed by a scheme for the analysis of deviations within a supply chain segment. In order to perform a precise evaluation, the Balanced Scorecard approach of Norton and Kaplan has been extended to those requirements and appropriate recommendations have been made regarding its application within the SCM.

Keywords:

Supply chain management, supply chain deviation management, risk management, SC-review, SC-balanced scorecard

1. INTRODUCTION

To the continuous changing conditions in the different areas of doing business, a company needs a systematic tool to control and react to deviations resulting out of the internal and external interfaces of the business environment. The tool should offer a view to the past, the actual status, as well as the future. Like in the military history it is the most important thing to get the right information at the right time, to come to the right conclusion and take the right decision first and change, install and apply the strategy to achieve your targets. In the literature a big advantage to competition will see in the management of the whole supply chain and collaboration with each partner to maximize the end customer’s benefit. This SCM approach covers strategic-, tactical- and operational performance of the supply chain as a whole.

2. SUPPLY CHAIN MANAGEMENT

2.1. The origin and definition of SCM

Several authors see the origin of the supply chain approach in the idea of Industrial Dynamics, which was developed by Forrester and his colleagues from the Massachusetts Institute of Technology (MIT) \cite{1}. In 1982, the term supply chain management was published for the first time when Keith Oliver, consultant at Booz Hamilton, used it in an interview for Financial Times \cite{2}. Nevertheless, the term has not further been used but, during the 1990s, it reappeared within publications and books concerned with the topic. Since the end of the 1990s, authors often use the term “Demand Chain Management” to put forward the customer’s benefit. The customer’s needs are the starting and reference points of business activities. They have to be discovered in the supply chain in order to be met efficiently \cite{3}.

Christopher \cite{4} defined SCM as “the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole.”
In the definition of Stadtler [5], SCM is “the task of integrating organizational units along a supply chain and coordinating material, information and financial flows in order to fulfill (ultimate) customer demands with the aim of improving the competitiveness of a supply chain as a whole.”

2.2. Supply chain system view
SC-networks are open systems, built of businesses and their interactions, so called value-added processes. Additionally, each business is seen as own system. That way, a supply chain network can be described as a "system and subsystem of processes and sub processes”. Indeed, in order to evaluate a supply chain, it has to be understood as a complete system, but it also has to be segmented into its single subsystems, which again have to be further analyzed and evaluated. From an evolutionary oriented point of view, it is less important to analyze a static condition in a certain point of time. It is more important to understand the mechanisms which led to this condition [6]. The aim is to discover disturbances within the internal and external interfaces of the system and process partners, which cause deviations and subsequent risks within the total supply chain system. For that, the term SCRM (supply chain risk management) became widely accepted in literature.

3. THE SUPPLY CHAIN DEVIATION- OR RISK- MANAGEMENT
The term risk is originated in the Greek language and means cliff or danger. The term is defined differently within single scientific disciplines and has also negative colloquial connotations as it refers to unfavorable prospects and undesirable states. Generally, a risk is defined as product of the occurrence probability of an event and its consequences in reference to the deviation of the desired results and is evaluated in the unit of the command variable [7]. From a scientific point of view, the concept of risk has to be considered in a more sophisticated way, because, on the one hand, risks have to be distinguished from uncertainties [8] and, on the other hand, they could also be linked with positive developments and prospects. Therefore, it is reasonable to use the term supply chain deviations management (SCDM) synonymously with supply chain risk management as the supply chain is a dynamic system of several interconnected and interacting subsystems and processes, where every modification of input or output is a trigger for risk potential. The following examples comment on several symptoms for internal and external deviations in the supply chain, which necessitate a detailed analysis:

Arranged delivery dates have to be adjusted to extra shifts (weekend, holidays), manpower surplus (temporary staff/overtime) and progress chaser; Shortages occur, although there are enough capacities; Adherence to delivery dates is not met despite of high stocks of semi-finished and finished material; Incoming orders highly change and have to be checked, although the outflow is stable in a long-term retrospective view; Deliveries via extra-tours are on a daily occurrence; Additional operations for sorting, checking and repacking are necessary; Daily short-term changes in the production plan; Excessive examination of incoming raw material and semi-finished material; Regular change of suppliers; Due to changes in demand or product, production time stretches; Despite of systematic stock management, the purchasing department places extra orders; Payment delays of customers or suppliers.

In order to analyze the whole network for a risk evaluation, it is necessary to systematize or classify the supply chain risks and to find another method to analyze the several supply chain segments.

3.1. Systematization approaches of supply chain risks
According to Baumgartner et al. [9] and Kajüter [10], risks are divided into internal and external risks. Also Hendricks and Singhal [11] differ between internal and external risks, at where external risks are further divided into customer and supplier risks. Norman and Lindroth [12] differ between strategic risks, which means plan variance, financial risks, which lead to a loss of financial control, operative risks due to human mistake ad error, commercial risks due to disturbances in the business relations, and technical risks resulting from total black out or damage to the capital assets.
Wagner and Bode [13] also distinguish between demand side risk and supply side risk, so in customer and supplier, but further differ between bureaucratic, infrastructure and catastrophic risks. In his arrangement of risks in logistic networks, in contrast, Tapiero [14] refers to operational risks, external risks, strategic risks and risk externalities. Cavinatho [15] separates the supply chain risks in financial, physical, informational, relational and innovational risks. In order to detect business risks, Christopher [16] suggests identifying his five main sources of risks via audit of the whole network, as they are responsible for the disruption of the supply chain. He describes supply risk, demand risk, process risk, control risk and environmental risk as main sources.

All these approaches are based on negative deviations, that means dangers which could lead to a supply chain disruption and harm the business. However, the criteria for risks should not be regarded in isolation, because they have an effect on each other. In an overall view, all the above mentioned risks can be integrated into the model of figure 1, respectively into the four main groups.

![Fig. 1 Panoramic view out of a supply chain segment](image)

### 3.2. SCM-review method to analyze and review a single supply chain segment

To determine the sources of deviations and disorders in the supply chain, a concept in reference to the systematization of Christopher is suggested. As shown in figure 1, the supply chain is broken into the smallest segment (system) and is analyzed from an internal business point of view, all around to the external interfaces. In order to determine deviations, dependencies and their risks, it is important to define objectives and indicators. When these objectives are not adequately defined, or not defined at all, the deviations cannot be identified or merely deficient [17]. The measurement and review of the performance and vulnerability of a management system is important to all levels of management from the top manager down to the operations manager. Aims in the application of performance measurements to review management system as presented from Gunasekaran & Kobu [18] are:

- Identify success;
- Proof whether the customer need is met;
- Better understanding of processes;
- Identification of bottlenecks, wastes, problems and improvement opportunities;
- Providing factual decisions;
- Enabling progress;
- Tracking progress;
- Facilitating a more open and transparent communication and cooperation.
3.3. Requirements on performance measurement systems

3.3.1. Involvement of each functional area
Wisner and Fawcett point to the significance to involve all functional areas in the measurement matrix and develop an understanding of each in achieving the various strategic objectives. They suggest developing global performance measures compatible for each functional area, which are capable to define a company’s overall competitive position to the top management [19]. Each business process whether core process, support process or management process is part of the company and is keeping the competitiveness by each performance at different levels so it should be measured.

3.3.2. Linkages between performance measures and company’s mission statement
In the beginning, there is a mission who describes which way the company will develop, so there is a need to clearly define the mission statement and use this as a guide to identify the company’s strategic objectives [19]. When the strategy is fixed and the performance measures are defined, the way is given how to achieve the business targets. Ghalayini connects the performance measurements with the company’s strategy by defining a set of improvement areas and associated performance measures that are related to company strategy and objectives [20]. Gunasekaran et al refer to measurement goals which represent organizational goals in relation to strategic, tactical and operational levels of decision making and control to achieve effective performance measurement and improvement. [21] Also Thakkar describes that it is necessary to reflect the clear linkages between performance measures and the various levels of decision making at strategic, tactical and operational level [22].

3.3.3. Involvement of each management level
The performance measurements should be visible to all levels of management. Therefore also the communication of strategic objectives and performance goals to lower levels in the organization is essential [19]. The performance criteria’s at each level must established specific, to break down the top management strategy objectives to the lowest operational levels and set targets. It is important to make sure that the management of the different levels will have the ability to impact there given performance measures. Otherwise they will not work on them.

3.3.4. Key measurable KPI’s
A requirement on performance measurement metrics is an adequate balance between financial and non-financial measures [21] / [22]. Additional to that Neely et al. further ask if the internal and external few have been covered, as well as which measures related to long and short term objectives have been introduced and whether any of these measures do conflict with each other [24]. In the meaning of Beamon, strategic goals involve key elements that include the measurement of resources, output and flexibility [23]. Ghalayini stresses the role of time as a strategic performance measure [20]. Neely et al. presents a few of the categories in the literature, including: quality, time, flexibility, and cost [24]. Wisner identifies the company’s strategic objectives guided by the mission statement in the few of profitability, market share, quality, cost, flexibility, dependability, and innovation [19].

Summing up extended with own ideas to pm-requirements:
Involvement of each functional area; Involvement of each management level; Linkage to the company mission statement; Linkage to finance performance; Cover strategic, tactical and operational level (Long and short term objectives); Balance between financial and non-financial measures; Internal and external view; Evaluation of the process output regarding cost, quality, time and service; Reflect the root cause relationship; Select performance drivers with deepest impact; Orientation on continuous improve- and deviations management; Risk & chance examination; No conflicting objectives.
3.4. Adjusted BSC to SCM and Risk requirements

In literature a lot of different approaches for performance measurements are available, for example the Performance Pyramid, the Performance Measurement Matrix, the SCORE-Model as well as the Balanced Scorecard BSC.

Additionally there are some company internal developed approaches like the Caterpillar-, Harman-, and the Skandia Navigator approach. [25] In the view of the requirements from chapter 3.3, the biggest amount of coverage could be seen within Norton and Kaplan's balanced scorecard approach.

The basic idea of the BSC is to measure the performance with a balance between long and short term objectives, non-financial and financial measures, internal and external performance as well as lagging and leading performance indicators. The focus lays on the measures with the highest impact to business to limit the number of measures. [26]

The standard Balanced Scorecard consists of 4 points of view to evaluate the corporate performance from different perspectives.

- The first is the financial perspective. It should answer the question: “How do we look to shareholders?”
- The second is the customer perspective. It should answer the question: “How do customers see us?”
- The third is the internal process perspective: This view is oriented at the internal value chain and gives answer to the question: “What must we excel at?”
- The forth is the learning and growth perspective. They will give answer to: “Can we continue to improve and create value?”

This standard balanced scorecard need to be updated to the requirements and dependencies of a supply chain. Regarding the risk approach two prospects are proposed to be added. One is the business environment which concerns all partners of the supply chain and has impact to a lot of functional areas and processes. For example the availability of infrastructure, high educated workers, stable political environment and sponsorship for R&D projects are outputs of the business environment. Another dependency in the view of a supply chain is the supplier performance. Especially during the launch of new projects the supplier involvement from the early beginning is essential for the project success. Both of them are external dependencies, where the influence and the scope of action are limited, but their impact on the company’s business success is heavy. So the authors recommend to use the Balanced Scorecard approach derived from Norton and Kaplan [26], shown in the figure 2.

In this classification the original balanced scorecard was extended with the prospects on the supplier as well as on the business environment. This is necessary to have all dependencies, risks, chances and deviations in the view of the supply chain management board. The scorecard is divided into 3 internal (black marked) and 3 external prospects (red marked).

This scorecard should measure and evaluate the indicators and performance drivers which lead a company in the overall view on its supply chain to advantages in competition and excellence in doing business. To achieve an overview of the whole supply chain, it is necessary to entirely apply this SC-system review from the whole, final customer to the supplier of raw material, with the help of supply chain managers, in order to detect risks and deviations and to arrange actions to correct, prevent, or improve and possibly redesign the SC.

All participants of the supply chain should also be involved in the definition of operating figures (KPI’s) and objectives, in order to assure an open information exchange and to improve a subsequent comparability to execute supply chain benchmarks. That way, the strongest and weakest chain segments are identified to establish penalties, rewards or a development in form of training and coaching. This approach deepens the SC internal customer-suppliers relationships and supports the knowledge transfer within the supply chain.
4. CONCLUSION

The idea of this article results from different points of view on the risks in the supply chain. The outcome was a simplified model, which includes all perspectives and protagonists and mirrors an overall picture, as long as it is applied to all businesses of the supply chain. In combination with the modified balanced scorecard it is possible to compare the contributory participants to each other and to evaluate them in order to derive appropriate procedures.

Further investigations should analyze how the participants collaborate together and how they perform the sharing of information’s, as well as the sources of limitations. So the following questions remain:

1. What KPI’s are commonly used by the supply chain partners?
2. What is the input and output of each prospect interface?
3. How could a standard BSC of a manufacturing SC looks like?
4. Which KPI’s are the supply chain partners willing to share up and down stream?
5. How will the SC-Partnership be evaluated?
6. How do they counter steer against deviations to prevent effects like bullwhip and others?

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LITERATURE


