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Review of a Supply Chain Performance Measurement System: a Case Study

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Abstract: Since management's decisions are based on data generated by an SCPMS, it is crucial for the company's success that this system represents the essential business processes correctly. A literature review shows that there is only a small number of empirical researches on the review and update of existing SCPMS. In this study we carry out a case study on the review of an existing SCPMS. We show that a continuous review process of the SCPMS is important so that it can present the performance based on the best possible data. Also, the study identifies how important the automated creation of KPIs is for SCPMS. In addition, non-planned influences on the processes captured by the SCPMS show that the reality can only be mapped approximately by a PMS with several stakeholders in a supply chain. Finally, it can be identified that a joint visibility of the entered and used data is a key factor for the best and successful reflection of the reality.

1 Introduction and Research Gap

"What you measure is what you get" [1] is the famous sentence that the two scientists Kaplan and Norton mentioned almost 30 years ago in their study and which has even gained in importance today. It emphasizes the importance of performance measurement systems (PMS) for corporate decisions and thus the company's success. Through several Performance Indicators (PI) and Key Performance Indicators (KPI), PMS represent the performance of the company or individual business units [2]–[5]. As in particular the complexity of value chains has increased, PMS have been extended to Supply Chain Performance Measurement Systems (SCPMS), so that, in addition to the company's internal processes, they also represent processes with external stakeholders in the supply chain such as suppliers or service providers [6], [7].

Performance Measurement aims to quantify the efficiency and effectiveness of key business processes in order to achieve the company's goals. Processes are monitored and evaluated using PMS so that management can make data-based decisions [3].

In 1992, Kaplan and Norton were among the first scientists to include non-financial performance indicators in their Balanced Scorecard (BSC) model [1], [8]. Since then, there has been a variety of scientific research on PMS, which was expanded in 1999 to include SCPMS [7]. In 2000, a PMS lifecycle was developed, which includes the phases of PMS Design, Implementation, Use and Assessment (Review) [9]. In addition, Kennerley and Neely designed a lifecycle model in 2002 that starts in the Use phase and includes the continuous development of a PMS. It comprises the phases Reflect, Modify and Deploy [10]. Hald and Mouritsen (2018) have expanded this model to include external influences, the effects when it comes to an SCPMS that encompasses several parties in the SC context [11].

To the best of the author's knowledge, previous research has been particularly focused on the design and implementation of PMS [4], [12]–[16]. Only few empirical studies dealing with research on the further development of already introduced PMS like Braz, Scavarda and Martins (2011) and Gutierrez *et al*. (2015) could be found. The literature research also only identified one empirical study of existing and applied SCPMS that covers all stages of the PMS lifecycle (Maestrini, Luzzini, *et al.* (2018)).

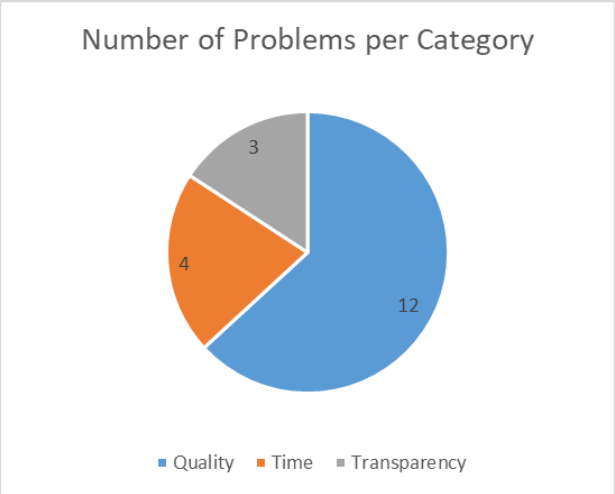
2 Research Design

In order to reduce this research gap and to complement previous studies, empirical research of an applied SCPMS is sought. The SCPMS of an OEM (Original Equipment Manufacturer) in the aviation industry for measuring the performance of its Logistic Service Provider (LSP) is investigated based on the model of Kennerley and Neely (2002). The following research questions have been formulated:
RQ1: What limitations can occur during the review of a SCPMS?
RQ2: How could a SCPMS be improved?
The data collection consists of qualitative and quantitative research. Qualitative data is collected through interviews with operational managers and experts of the OEM. In addition, quantitative internal data from KPI reports and the IT-system is analysed. This methodology is necessary for exploring the background and structures of the SCPMS.
The SCPMS to be investigated consists of five major KPIs to control the logistic contractor: the KPIs "Inbound (Dock to Stock)", "Stock Accuracy", "On time delivery regular outbound flow" (KPI 3), "On time delivery urgent outbound flow" and "Service Quality". All data for calculating the KPIs is gathered by the LSP and processed within its own IT-system called which is not accessible for the OEM. Thus, the contractor also creates and edits the KPI reports. This procedure is contractually determined. In a first step, the gross result of the KPIs is calculated. This value shows the joint performance. It is calculated by the percentage of all successful actions in relation to all actions accomplished. In a next step, the LSP indicates the responsible party for each Order Line that has not achieved the criteria of the specific KPI and thus contributed to lower performance results of the LSP only. The KPI results are baseline for bonus and malus payments.

3 Analysis of the SCPMS

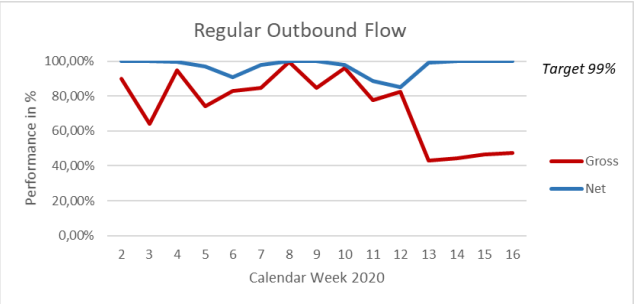
The objective of the performance measurement system is to display the real performance of the contractor. In order to gain an impression of the contractor's operational performance, unstructured interviews with operational logistic managers of the OEM were conducted. Main topic was the identification of recurring logistic problems that occur during the collaboration with the logistic contractor. Figure 1 includes the main categories of issues that have been mentioned.

Figure 1 Results of interviews with operational logistic managers



In the following step, the results of the SCPMS were evaluated in the form of KPI reports. With reference to the statements of the operational logistics managers, it turned out that the quality KPI was constantly achieving its target values. Moreover, the outbound KPIs showed significant differences between gross and net. KPI results were particularly striking during the crisis period of COVID-19: the performance of the LSP increased during the crisis, while the joint performance of LSP and OEM decreased significantly (see Figure 2).

Figure 2 KPI results of regular outbound flow



These findings from the KPI reports were then part of the interviews with logistics experts from the OEM. The results of the interviews were as follows:

1. The OEM has no transparency of data that is used to calculate gross results.
2. The analysis of some does not use the most modern infrastructure implemented as the contract does not yet include their use.
3. Outbound KPIs: the logistic experts assume that the outbound KPI's net results show a better performance compared to the real LSP performance. The LSP has the sole right to manually assign the Reason Codes for failed Order Lines to the parties and the OEM has no access to the IT-systems and thus to the data.

4. Service Quality KPI: results are not reliable as the tool which creates the data is not reliable, mainly due to manual data edits by both parties.

Additional analysis of comparing OEM with LSP data confirmed the interview results. Furthermore, a pareto analysis was carried out, which investigated the main causes of failed deliveries. It turned out that, on the one hand, the number of failed deliveries increased considerably during the COVID-19 crisis. However, the analysis also showed that the errors were largely attributed to only one cause. Without access to the data, it is impossible for the OEM to verify the correctness of the error allocation.

4 Conclusion of the results

There could be two categories of limitations identified:

1. Structural limitations of the SCPMS
2. Limitations of the function of the SCPMS due to interests of SC stakeholders

The first category refers to problems in the infrastructure or definition of KPIs that lead to limitations in the achievement of the SCPMS objectives. As an example, limitations in data collection, data evaluation or the case that certain KPIs do not contribute to the objective of the SCPMS. The second category refers to limitations in achieving the objectives of the SCPMS due to influences of SC stakeholder's interests.

Structural limitations of an SCPMS, such as the use of inadequate infrastructure, could also be improved by a continuous review process in which the conformity of infrastructure is reviewed continuously and, together with contracts, adapted if necessary. It could also be identified that own interests of stakeholders might be more important than the achievement of the goal of the SCPMS (category 2). The analysis shows that the LSP's advantage of having exclusive rights to the data and the evaluation of the KPIs could be exploited to better represent its own performance. This finding leads to the fact that the influence of interests of the different parties must be limited in order to ensure the achievement of the objectives of the SCPMS. Consequently, this leads to high demands on the structure and infrastructure of the SCPMS. The case study was able to confirm the findings of Maestrini, Luzzini *et al.* (2018) that a complete automation of the system (data generation, data collection and data evaluation), without manual involvement of individual stakeholders, is necessary [13]. However, unforeseen events such as crises or weather influences cannot be recorded automatically. Therefore, an SCPMS involving parties with different interests cannot fully meet the objective of quantifying the performance of certain processes. Due to the latter, equality in for instance data visibility or KPI creation and a cooperative partnership between the parties is highly recommended.

5 Further Considerations on the Findings

Consequently, it could be identified that the interests of SC stakeholders can have a considerable influence on the results and thus the achievement of the SCPMS objectives. The reason for the different interests are opposite positions between buyer and seller. As already described above, this problem occurs as soon as the SCPMS includes several companies. The study of this work has shown that when the complexity of the processes and the system increases (in this case during the COVID-19 crisis), the possibilities to influence results based on individual interests also increases, as monitoring is made more difficult.

The described problem will be present as long as partners in the SC have conflicting interests. The essential interest of the contractor of this work are monetary reasons since the results of the SCPMS are linked with financial bonus or malus payments. This raises the question of whether an SCPMS should be used for monetary purposes. A PMS was originally a controlling tool for mapping process efficiencies and, according to the author, did not have the function of a payment basis for service providers. On the other hand, Maestrini, Luzzini *et al.* (2018) criticise in their study the situation of missing incentives or disincentives for achieving KPI targets. Most probably it does not matter whether the incentive is created on a monetary or non-monetary basis, as it does not change the conflicting interests of the stakeholders. A situation should be created that leads all stakeholders to have an interest in the best possible real performance and the best possible measurement of this performance. One option would be to involve the contractor in the OEM's profits and to use the SCPMS as a controlling tool for identifying efficiencies, as it was the original task of PMS.

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