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Development of a Performance Measurement System for Forwarders

K. Schmidt, Z. Miodrag, and C. Geiger

***Abstract*—**Performance Measurement is still a difficult task for forwarding companies. This is caused on the one hand by missing resources and on the other hand by missing tools. The research project "Management Information System for Logistics Service Providers" aims for closing the gap between needed and disposable solutions. Core of the project is the development of a performance measurement system for Forwarders.

***Keywords*—**Forwarder, Logistics, Management Information, Performance Measurement.

I. Introduction

DUE to historical developments forwarder agencies have a lack of an adequate performance measurement system. Until 1993 the German transport market was regulated and a concession was required to gain access to the market. Transportation rates for road haulage were fixed and linked to the charges of rail transport. These were the reasons for artificially high prices, calculation of tariffs instead of cost-performance ratio, a fragmented market and a low competition between companies. Nowadays most of the forwarders are still small and medium sized companies. In 2006 about 15,400 forwarding agencies existed in Germany, the average turn over amounted to 3.5 Mio. EUR [1]. There was no necessity for the companies to implement controlling because innovative incentives or productivity increases were missing [2].

In addition most of the forwarding agencies are not equipped with enough manpower or knowledge to build up and implement an own controlling system [3]. As one result of an empirical inquiry about the implementation of Controlling in German Logistics Companies Fig. 1 shows that 60 % of the small logistics companies do not have implemented an enterprise global controlling. In medium and larger sized logistics companies the share is still in excess of 30 % [3].

K. Schmidt is with the Chair for Transport and Logistics, TU Dortmund, Leonhard-Euler-Straße 2, 44227 Dortmund (+49 231 755 7340 e-mail: schmidt@vsl.mb.tu-dortmund.de).

Z. Miodrag is with the Chair for Transport and Logistics, TU Dortmund, Leonhard-Euler-Straße 2, 44227 Dortmund (+49 231 755 7336 e-mail: miodrag@vsl.mb.tu-dortmund.de).

C. Geiger is with the Chair for Transport and Logistics, TU Dortmund, Leonhard-Euler-Straße 2, 44227 Dortmund (+49 231 755 7341 e-mail: geiger@vsl.mb.tu-dortmund.de).

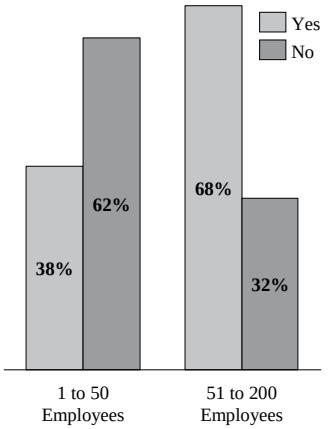

Fig. 1 Implementation of Controlling in German Logistics Companies

Another reason is the lacking understanding of the necessity to implement a global controlling. For the most small and medium sized companies performance measurement is an abstract and strategic topic. Their daily business is driven by operational tasks and questions. This leads to the fact that controlling or performance measurement has no priority.

The causes for the controlling application for small and medium sized forwarders are faced by the reasons necessitating controlling which will be explicated in the following.

One important reason is that controlling allows forwarders to monitor their costs. The supervision of their costs enables forwarders to adequately calculate their prices. This is necessary since the expansion of the European Union brought East European logistics service providers in the position to offer lower prices compared to German providers. Average profit margins are between 1 and 3% of the turnover for break bulk transports [3].

Apart from costs logistics service providers should control their performance. The implementation of a performance measurement system offers the possibility to improve process speed. This supports the companies in this high competitive market.

A further reason supporting controlling is that it permits the measurement of the provider's quality as well. Following the idea of Buzzell/Gale, that high quality leads to high market shares and company success, process quality has to be measured [4].

Finally, the creation of an applicable measurement system

in the context of a changing lending directive to Basel II for the companies plays an important role. [5]

The precedent explanations proof the necessity for logistics providers to apply a global controlling system in order to persist in the high competitive market.

The controlling of logistics services and existing systems in the research will be described and examined by their use for the previous mentioned enterprises in the next paragraphs.

II. Existing Performance Measurement Systems

To develop an adequate performance measurement system in the first step suitable performance measures have to be chosen or deducted, if not available. This causes no problems for financial indicators, because they are independent from the business. E. g. profit makes the same statement in a production plant as in forwarding agencies. In contrast performance and quality indicators are influenced by the business itself.

Several researchers and institutions have defined indicators for logistics controlling before. The most important approaches will be introduced below.

In the area of internal logistics a series of VDI standards was developed, that defines appropriate ratios, for example to the performance of the shipping area [6], [7]. This collection of performance indictors covers the logistics department of a producing company. Thus activities as transport and trans-shipment are not covered in a sufficient way.

A collection of indicators for works transport was compiled by Weber [8]. In general these indicators can also be used for the commercial goods transport. However, both systems might differ in their objectives. The strategic target of works transport is often the best load utilization. In contrast logistics service providers usually have to serve customers of different branches who impose varying requests to transport needs. This might lead to the fact that systems for commercial goods transport also have to comprise performance indicators, which consider aims as time, flexibility and quality of transport. The indicators developed by Weber do not consider these aspects.

Piontek also created performance ratios for distribution of industry or trade companies [9]. As mentioned before both systems - commercial and works transport - overlap in some way, but they are not congruent.

Most performance measurement systems have similar problems. General systems consider only financial aspects, e. g. the ZVEI-, DuPont- or RL-system [10]. Performance or quality of transport can't be measured by them.

Distribution with a strong focus on warehousing activities is the task of a performance measurement system developed by Stölzle and Gaiser [11]. They deduct indicators from some common logistics targets, which might fit also for forwarders. However, they do not consider transport in the system.

Berg and Maus developed indicators that allow distribution management [12]. As well as Pfohl and Zöllner their system has industry and trading companies in its focus [13]. Although both consider transport activities, their objectives differ from those of forwarding agencies, as described above. For example indicators for goods turnover were not developed.

Several other logistics performance measurement systems, which were developed by e. g. Syska [14], Weber [15], Filz et al. [16] or Reichmann [10], consider only the logistics of industry or trade companies. This leads to the same criticism as mentioned above.

Systems which are available at the market and were developed by software companies have different basic problems:

- No specialisation for forwarders
- Coverage of company parts, not the whole company
- Consideration of financial or performance aspects

These explications show that adequate performance measurement systems for logistics service providers are not available at the moment. This gap shall be closed by the development of a specialized management information system for logistics service providers.

Fig. 2 shows all introduced approaches and their coverage in an overview.

	Filz et al. (1989)	Stölzle/Gaiser (1996)	VDI 4400	Weber (1993)	Syska (1990)	Berg/Maus (1980)	Pfohl/Zöllner (1991)
Indicator System	✓	✓		✓	✓	✓	✓
Transport	✓		✓		✓	✓	
Ware-housing	✓	✓	✓	✓	✓	✓	✓
Turnover							
Commercial Transport							
Financial Indicators	✓	✓	✓	✓	✓	✓	✓
Performanc e Indicators	✓	✓	✓	✓	✓		
Quality Indicators		✓	✓		✓		✓

Fig. 2 Overview of existing performance measures and measurement systems

III. Development of a Performance Measurement System

A. Work Packages

The development of the performance measurement system proceeds in six steps, which will be described below.

1) 1st Work package: Conceptual Design

First typical company targets of forwarding agencies are deducted. Additionally the organizational structure is analyzed. After that standard processes as dispatching, loading/unloading etc. are defined in cooperation with participating forwarders.

Because the performance measurement system will be implemented in an Excel-Tool the necessary functionalities with partner companies are discussed.

2) 2nd Work Package: Deduction of Performance Measures

Based upon the results of the previous work package in this part performance measures are deducted. Therefore the method described below in B.3) is used.

After the definition of all necessary performance indicators, these are described in a so-called data sheet.

Result of this work package is an overview and a description of all performance indicators used in the measurement system.

3) 3rd Work Package: Evaluation of Data Needs and Data Availability

This work package serves to adjust data needs and data availability. Experiences gathered in previous projects showed that an information overload can occur or that needed data to determine the performances indicators are not available.

In cooperation with the participating partners the concept of the system and the used indicators are revised. The necessary data sources are also checked.

The results of this work package are an overview of indicators and methods of gaining them.

4) 4th Work Package: Creation of the PMS

In this work package the final performance measurement system is created. Results of the previous work packages are taken into account. All used indicators are described in data sheets.

To support the search for potential for optimization so-called cause-and-effect-chains (cf. Fig. 7) are developed.

Additionally potential data sources are collected and described. This overview reliefs the implementation of the latter tool, because the check of all data sheets to gain information about the data sources is not required anymore.

5) 5th Work Package: Development of the Prototype

To allow the application of the performance measurement system an Excel-Tool will be developed. This is the purpose of the 5th work package. Excel was chosen, because previous surveys have shown, that nearly 25% of forwarding companies work with MS Office to run their business [17]

To relief the handling, standard interfaces to popular software are coded.

6) 6th Work Package: Test-Implementation and Evaluation

The last step is the test-implementation of the tool at the partner companies. After some test-runs the system will be evaluated. Mistakes will be corrected and handling will become more comfortable.

B. Deduction of Indicators

The deduction of performance measures takes place in three steps, which are described in detail below. It starts with the elaboration of company targets. Then a standard forwarding process is created. After that measures are deducted for each process step under consideration of the company targets.

To support this action and to categorize all measures a morphological box was developed, which will be introduced as well.

1) Company Targets

In the first step company targets are defined. Four target levels can be distinguished. These are the financial, the performance, the quality and the structure level [18]. Each has its own objectives, except the structure level since it serves as a system description.

The targets of the financial level are profit gaining and liquidity [18]-[20]. Further objectives can be taken as individual company targets [21].

Velocity, system utilization, flexibility and sustainability are objectives of the performance level [22].

The quality level aims for reliability and robustness of the system.

There is no hierarchy between the different levels. They only describe the company from different views. Table I contains all levels and their targets.

TABLE I
Levels and Targets

Financial Level	Profit Gaining Liquidity
Performance Level	Velocity System Utilization Flexibility Sustainability
Quality Level	Reliability Robustness
Structure Level	-

2) Standard Process

The standard process has been defined upon the results of several interviews with forwarding agencies. On its basis process performance indicators can be deducted. For each step measures can be defined. In this way the risk to forget important measures is minimized.

The process itself starts with the order entry and the dispatch of an order. These tasks as well as the invoicing which marks the end of the process, are administrative. Between these steps the transport and if applicable the turnover of the shipments is located. The whole process can

be taken from Fig. 3.

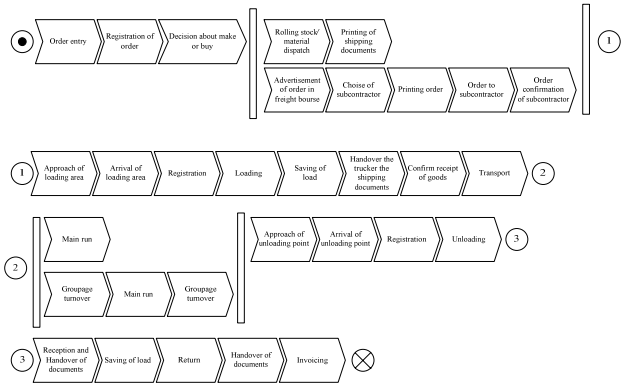

Fig. 3 Standard process in transport

3) Deduction of Indicators from Company Targets

According to the process and the above mentioned aims, performance measures can be defined. The process occurs as shown in Fig. 4. The enumeration of indicators in this example is incomplete and can be enlarged according to the needs of the company.

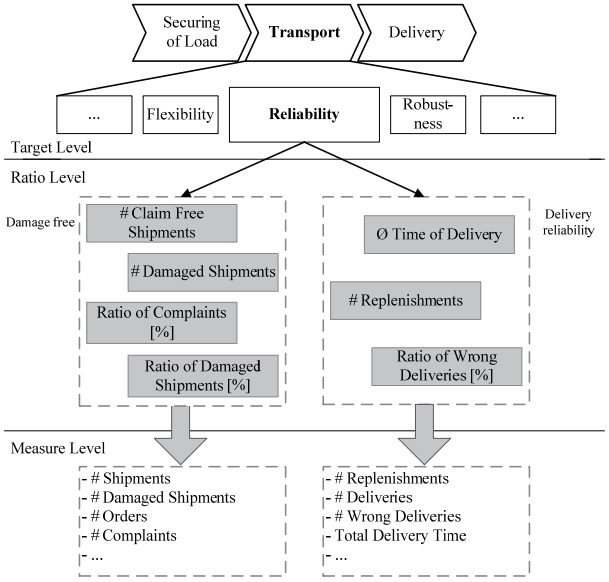

Fig. 4 Deduction of indicators from processes and targets

First the relevant element is taken from the process chain. For each element every target level with its objectives is analyzed. In this example the combination of transport as an element of the process and reliability as an objective was chosen. The question which measures represent this element and its objectives best has to be answered. Now ratios can be developed. Additionally for each ratio data source and counting measures have to be defined. This is the last step.

4) Morphological Box

A morphological box is an instrument to check all combinations of different criteria in a systematic way. As can be seen from the above described process of deducing indicators, there exist a lot of combinations of processes and targets. They have to be multiplied by evaluation objects and departments. The morphological box is shown in Fig. 5.

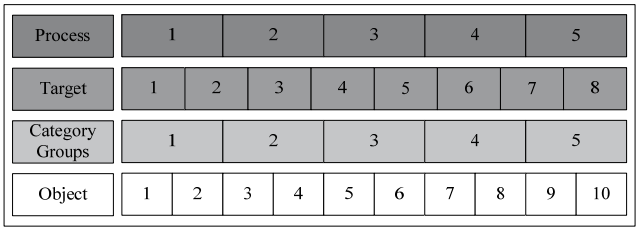

Fig. 5 Morphological box

Five processes have been elaborated in total. These are order acceptance/dispatch, billing, transport, loading/un-loading and handling.

They are followed by the already known targets.

Additionally five category groups can be separated. They are geared to the departments in ordinary forwarding agencies.

At least one finds different reporting objects. E.g. the turnover can be measured for the whole company or by product group or by customer etc. Ten different objects could be identified during the research.

The meaning of the figures in the morphological box can be taken from Table II.

TABLE II
FIGURES USED IN THE MORPHOLOGICAL BOX

	Process		**Category Group**
1	Order Acceptance	1	Pre/Subsequent Leg
2	Billing	2	Fleet
3	Transport	3	Handling
4	Loading/Unloading	4	Administration
5	Handling	5	Main Leg
	Object		**Target**
1	Customer	1	Profit Gaining
2	Relation	2	Liquidity
3	Vehicle	3	Sustainability
4	Driver	4	Velocity
5	Shipment	5	System Utilization
6	Employee	6	Flexibility
7	Order	7	Reliability
8	Company	8	Robustness
9	Subcontractor		
10	Product		

According to this scheme there exist about 2,000 possible combinations. This large number can be reduced in advance by some logical considerations. For example the combination of order acceptance as a process and the category group handling does not exist. With this approach in excess of 1,500 combinations have been eliminated. How to handle the rest is described in the next section: Development of a Performance Measurement System.

C. Development of a Performance Measurement System

Concerning the company requirements a new indicator system is developed at the chair of transportation and logistics. Its target is to involve financial, process performance and quality indicators. The indicators are assigned to a system of objectives. (Fig. 6)

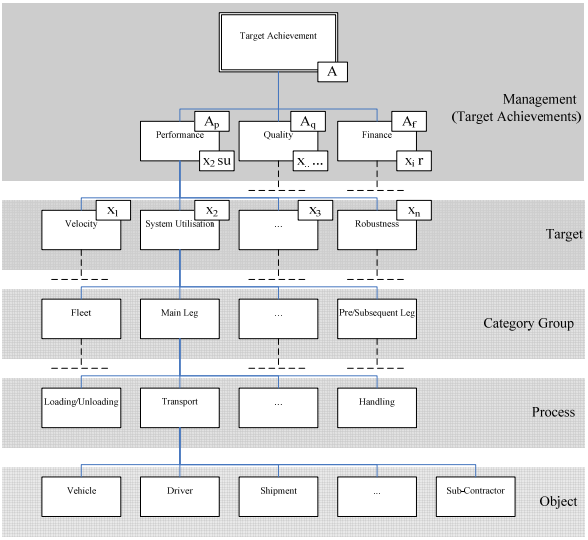

Fig. 6 Performance measurement system

This system of objectives consists of five levels, whereby the highest level represents the achievement of objectives. The achievement of objectives subsumes the achievement of the finance, quality and performance indicators.

In the second level these objectives are divided into further targets. For example the performance objective is divided into the targets velocity, system utilization and robustness. These targets are used for the operationalisation of the achievements of the first level and are assigned by weighting.

Furthermore, each target can be separated in category groups in the third level. By way of example, the system utilisation contains the category groups fleet, main and pre leg. In the fourth level each category is separated in processes such as transport or handling. For every process several objects can be defined in the fifth level. This is the operational level. It is possible to create an indicator for every required object such as vehicle, driver or batch.

In summary this indicator system can be matched for nearly every forwarder agency and their requirements by using weighted indicators.

D. Practicability

Concerning the results of the precedent analysis the data capture has to be as simple as possible for the development and implementation of a new performance indicator and performance measurement system. The verification shows that 27% of logistics service providers do not use specialised software to run their business. They work with standard office products e. g. MS Excel or MS ACCESS. This implies that the performance measurement system has to be developed in such a standard solution. In addition, the system has to be as simple as possible in use.

To support the companies in implementing and using the performance indicators a data sheet is designed for each indicator. It contains information about the calculation of the indicator, its interpretation, the data needed and possible actions in case of deviation.

Additionally, the service providers are supported during the analysis of deviations by so called cause-and-effect-chains. Depending on the process analysis in work stage one, it is possible to create those general chains as shown in Fig. 7.

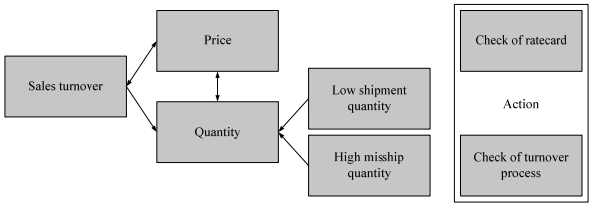

Fig. 7 Cause-and-effect chain

Referring to the management support, it is necessary to give a fast overview about the target deviation. Therefore, the key indicator system is build which allows the management to locate the relevant category groups such as performance, finance or quality to assign counteraction. An example for a fragmentation in weighted and conventional indicators is shown in Fig. 8.

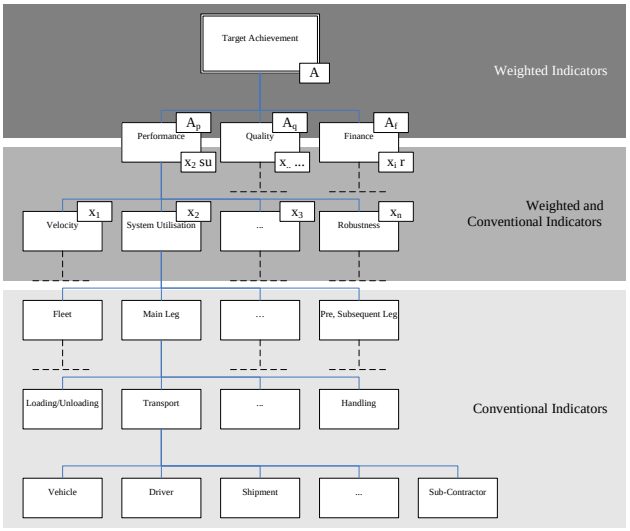

Fig. 8 Weighted targets

As mentioned in section IIIC the targets are weighted indicators with subsume the sub targets of the category groups. The management has the possibility to focus on one target by stronger weighting. If necessary the location of the deviation can take place by “drill down” based on the indicator system. The indicators in the lower levels are still conventional indicators.

In contrast to conventional indicator systems the achievement of objectives has to be updated by management

at regular intervals.

NEXT STEPS

The introduced performance measurement system resolves the lack of controlling tools for forwarders. It is aligned with the targets and processes in forwarding companies. For special needs it is even expandable.

To support forwarders in strategic questions, the performance measurement system will be enlarged by several functionalities. It is planned to add economic viability calculations to forecast the effect of decisions on the financial figures. The optimal date for replacement of e.g. trucks will be calculable as well.

Additionally a benchmarking tool will be implemented. Due to the fact that one-on-one comparisons between companies are very sensible, benchmarks will be surveyed from the branch and implemented in the tool. This allows a benchmarking with an average anonymous competitor.

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