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APPLICATION OF KEY PERFORMANCE INDICATORS AND SERVICE LEVEL AGREEMENTS IN SUPPLY CHAIN

Richard Antal [1], Daniela Marasová, jr.[2], Vladimir Mitrik [3]

[1]Institute of Logistics and Transport, Faculty of Mining, Ecology, Process Control and Geotechnology, Technical University of Košice, Park Komenského 14, 043 84 Košice, Slovakia, tel. +421556023113, e-mail: richard.antal@tuke.sk

[2]Institute of Earth Resources, Faculty of Mining, Ecology, Process Control and Geotechnology, Technical University of Košice, Park Komenského 14, 043 84 Košice, Slovakia, tel. +421 55 602 2932 , e-mail: daniela.marasova.2@tuke.sk

[3] Institute of Logistics and Transport, Faculty of Mining, Ecology, Process Control and Geotechnology, Technical University of Košice, Park Komenského 14, 043 84 Košice, Slovakia, tel. +421556023125, e-mail: vladimit.mitrik@tuke.sk

Abstract:
The main goal of this article is to analyse the findings of various authors on KPIs and SLAs with a focus on the application of the "perfect order" model in the field of supply chain in a manufacturing company. This model provides us with a more accurate interpretation of already used KPIs. In the practical part, we paid our attention to the application of SLAs and presented the advantages of their application. This practical adaptation was performed on KPIs from a company in refrigeration business with results that on first sight indicated smooth and very good performance in logistic and supply chain. In this paper we present results from a KPIs that are focused on customer orders.

Key words:
performance, measurement, service level agreements, order, supply chain

INTRODUCTION

The current business environment and high competition in the market are putting great pressure on companies to be efficient and effective. The quantification of these indicators creates a dynamic and promising picture of the current state of society in the researched area. The quantification of efficiency and effectiveness in processes is the first step by which it is possible to reveal process bottlenecks, but a very important element is the correct

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interpretation of measurements. The measurement of performance in the field of logistics of a manufacturing company will provide us a large amount of data which, using different interpretations, can skew the results and therefore in this article we focus on applying the most accurate model for evaluating key performance indicators. The distribution process in a manufacturing plant is usually composed of various threads whose level of performance is limited by an SLA (Service Level Agreement). To achieve the objectives, we used theoretical study that leaded us to creation of a model of a perfect order adapted to manufacturing plant in refrigeration industry.

The theoretical background is processed for the area distribution logistics, customer service, order processing and service level agreements. Distribution logistics is the sum of all logistics tasks and measures for the preparation and execution of distribution. It deals with all processes related to the flow of the product from the warehouse of finished products to the demand market. [1], [2]. The tasks of distribution logistics are to bridge the spatial and temporal differences between the areas where production takes place and the areas where products are consumed. Transfers concern both tangible and intangible assets. Distribution includes all the processes that are necessary to get the product from the point of production to the last point in the distribution channel. These processes consist of order processing, planning and deployment of warehouses, transport, and packaging [3], [4]. Before analysing the concept of SLAs, it is of the interest to examine the definition of SLAs. Literature provides wide and narrow definitions of SLAs. Barclay Rae provides a wide definition of SLAs: *"A SLA is a written agreement between a service provider and a customer, defining services to be provided in qualitative and quantitative terms."* They acknowledge an SLA as an agreement at a high level that defines services and service levels to be aimed for. Service level agreements are results of collaborative negotiation processes and are used to measure performance and to identify areas for improvement and resources required. The objectives of SLAs are managing services expectations to customers by setting target levels of service deliveries and providing valuable performance information to understand and provide suitable levels of services, resources and skills. [5]

According to Pantry and Griffiths [6], the success of the implementation of service level agreements depends on the expected level of performance. These levels should be as realistic as possible, because if they are too low, it will lead to a low level of services provided. On the other hand, if the level is too high, it will lead to frustration and adversarial relationships.

1   THEORETICAL BACKGROUND

Distribution logistics

The distribution logistics provides physical, organizational and information links between the source and consumers, the input store or point of acceptance. Distribution logistic, of its range of solution, is focused on the following tasks [5]:

- the proposal of distribution systems for enterprises and companies,
- allocation and placement of companies, warehouses and distribution centres,
- storing and technical equipment,
- optimization and development of distribution plans,
- the selection and optimization of modern information and expert systems in the area of distribution,
- defining the distribution circuits [5].

Customer service

The role of customer service in sales consists of logistics activities, such as providing information on the status of the order, uniformity of the order cycle and flexibility in dealing with special requirements and situations. [6]

One of the attributes of customer service is reliability. By combining logistics and other business factors, we gain the ability to provide all activities related to the order. We can evaluate whether the order was successfully processed by customer service by monitoring of several factors:

- the product arrived without damage,
- error-free documentation (invoice) has been attached,
- the consignment has arrived at the correct place,
- the shipment arrived on the agreed date.

Order processing

The order processing system is the source of control in the logistic system and the customer order is what initiates the whole logistic process and sets it into motion. The time is takes to fulfil the order and the quality of the information affects the effectiveness of the whole operation, slow communication will mean that the time to complete the order will increase and deadline will not be met and costs will increase and for warehousing services that means the carrying cost will increase and customers lose trust and the customer relationship is affected. In managing order process and information is made easy with the kind of Technology that the company uses which improves the flow of the information storage and handling of the information too using electronic commerce (e-commerce) which comprises of different kinds technologies that prevent the unnecessary paper flows within the work environment. It is important to make sure that the technology in use is used effectively and integrates well with the process because when it is complex it may make the information flow complicated too. [4] The customer order cycle includes the following steps listed below and displayed in Figure 1. [4]:

- Preparation and transmitting of order,
- Order receipt and entry,
- Processing of order,
- Picking and packing,
- Transportation,
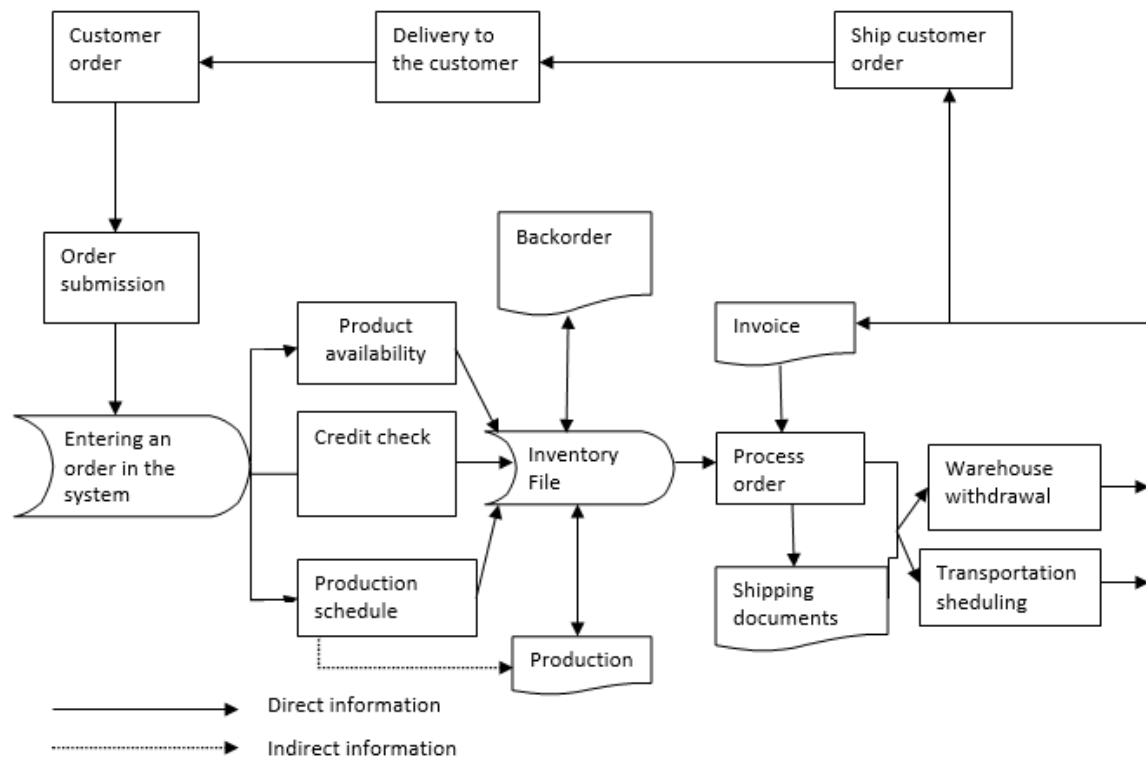- Customer delivery and unloading of goods.

***Fig. 1** Order Cycle [6]*

Service level agreements

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One of the main reasons why companies use service level agreements is that they can formalize agreements between the parties. They consider them to be a practical and appropriate tool for achieving quality-related outcomes. Examples of these quality-related results are ensuring appropriate quality and efficiency in the provision of services, better utilization of resources, and in particular help to improve the relationships between internal providers and users. [9]

The first characteristic of an SLA is the bilateral relationship between the service provider and customer. Both parties should approve the formulated agreement and therefore they are forced to keep the promises they made. This is in contrast to service guarantees which are promises of service providers to its customers, but the customer does not have any

participation in this relationship. In SLAs, both parties are responsible for the relationship and they announce to fulfil their obligations. [10]

The second characteristic of an SLA is the minimum acceptable service level which is determined by the consideration of the interests of the service provider and the customer. Cost and benefits of operational activities are taken into consideration and hereafter the minimum acceptable service level can be determined by the service provider and customer. So SLAs can be considered as an expectations-managing mechanism in order to achieve shared expectations about services and deliveries. [11]

Although, there are a many different forms of SLAs, some common characteristics in an inter-organizational relationship can be obtained from the literature. SLAs should contain the following elements [12]:

- A description of the nature of services
- The expected performance level of service, specifically its reliability and responsiveness and how these performance level will be measured
- The procedure for tracking and reporting problems with the service
- The time frame for response and problem resolution
- The process for monitoring and reporting the service level
- The consequence for the service provider not meeting its obligations,
- Escape closes and constraints.
- It should be noticed that this is not an exhaustive list, but it entails the most common elements of an SLA. According to Kandukuri the SLA should include a wide range of elements and they distinguish a number of elements of SLAs: introduction and purpose, services to be delivered, performance, tracking and reporting management, problem management, customer duties and responsibilities, warranties and remedies, security, legal compliance and resolution of disputes, and termination. These elements will be commented in detail. [13]

Process performance measurement

The measurement begins with the identification of the process that will become the basis for measuring performance at the strategic or operational level. The aim is to qualify the values of the defined process performance indicator. When we talk about measurement, it is necessary to define the following terms [14]:

- Effectiveness - (the extent to which the planned activities are implemented and the planned results are achieved),
- efficiency - the relationship between the result achieved and the resources used,
- productivity - the ratio of inputs and outputs per time unit,
- performance - a measure of the results achieved by individuals, groups, organizations and processes.

Key performance indicators

Key Performance Indicators, KPIs, are the most widely used performance measurement system. These are always rates, ratios, averages or percentages, never the numbers themselves. The numbers themselves do not provide the context of the measured data, their use is less efficient compared to KPIs. Key performance indicators should be designed to meaningfully summarize the data being compared.

Organizations need to control their performance to achieve their growth. With the help of performance indicators, we can control, manage and also improve processes. The main output of the measurement is information on the efficiency of the processes. The measurement of performance indicators should encourage partnerships, consultations or discussions of all

stakeholders in order to find a solution. KPIs are effective in coordinating and managing activities within an organization. They reflect the balance between cost, time, quantity and quality. KPIs are qualitative measurements that measure the outcome of critical factors and goals. It is inappropriate to change them often, as the long-term positions of the partners may be disrupted. KPIs are therefore factors used in companies to assess whether services and processes are performed at the required level. [15]

The purpose of KPIs is to measure the operational processes in order to increase the performance of companies. [15] Purposes of KPIs are to ensure the achievement of goals and objectives, to evaluate, control and improve procedures and processes and, to compare and assess the performance of different organizations, departments and individuals. [16]

Shepherd a Gunther investigated 42 journal articles and books and they found that KPIs can be categorized in several ways. They distinguish four main categories [17]:
- Whether KPIs are qualitative or quantitative variables [18],
- What they measure: cost and non-costs [19], quality, cost, delivery and flexibility [20], cost, quality, resources utilization, flexibility, visibility, trust and innovativeness [21], resources, outputs and flexibility [18]; supply chain collaboration efficiency, coordination efficiency and configuration [22] and input, output and composite measures [21],
- Whether their focus is strategies, tactical or operational [19],
- What the processes are in the supply chain they relate to. [23]

KPIs in the transport and logistics sector focus on time, quality, availability, costs, profit and reliability of provided activities. Internal metrics measure the performance of internal parts of a company, such as warehouses and transportation facilities. External metrics measure customer expectations. External metrics are the frequency of delivery and pickup or the percentage of delivery on time. Services and supplies are measured according to how they are provided in terms of time, cost and quality. [24]

KPIs in the logistics sector have either strategic or operational significance, depending on the type of activity. Operational KPIs are focused on the performance of individual parts of the process. Strategic metrics are more focused on the performance of the system as a whole.

2 PERFERT ORDER PROBABILITY AND APPLICATION OF SLA

This practical adaptation was performed on KPIs from a company in refrigeration business with results that on first sight indicated smooth and very good performance in logistic and supply chain. However, company was still facing many complaints from customers therefore we used the same data but applied the different interpretation of the results to point out that every delay even the small one have the potential to accumulate. In this paper we present results from a KPIs that are focused on customer orders. We can see six important entries in our KPIs with their performance expressed by percentage in Figure 2.
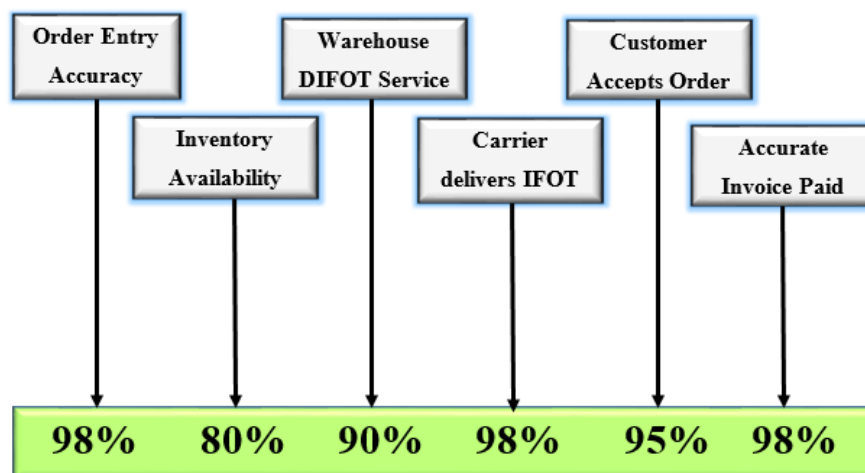
***Fig. 2** KPIs in order cycle*

These numbers present relatively high and good performance and showing that the biggest issue is in the inventory availability. To reveal a true impact of these errors we will use "perfect order model which is displayed in Figure 3.

***Fig. 3** Perfect (Error Free) order*

By multiplying each of the KPIs we will get to the final results of 64%. This model is used to highlight the consequences in earlier stages of an order which has the highest impact a final result.

In order to be able to identify bottlenecks in the process, it is necessary to determine the level of SLA fulfilment in individual plants. Subsequently, we can adapt good principles from plants with higher performance to plants where the performance is not meeting the required level. The company has several plants around the world where the actual production and subsequent distribution takes place. The processes of production and subsequent processing of orders are largely standardized in all plants. Therefore, we decided to measure the performance of individual plants and compare it between them. Agreements on the level of provided services define the time from the receipt of the order to its delivery for a period of 21 days. In table number 1 we can observe the level of fulfilment of these agreements in individual plants and the average time of compliance with the SLA and also in cases where the SLAs were not met. The performance comparison was evaluated for 2019.

Tab. 1 *SLAs fulfilment by individual plants*

Order by plant	Number of orders	SLA requirement met (%)	Average time (days)	SLA requirement not met (%)	Average time (days)
Plant 1	959	80.2%	15.84	18.2%	44.65
Plant 2	498	82.5%	8.28	17.5%	48.54
Plant 3	196	93.8%	11.89	6.2%	43.58
Plant 4	768	71.9%	18.02	28.1%	44.88
Overall	2421	82.1%	13.51	17.9%	45.41

3   CONCLUSIONS

From these KPIs, we can conclude that plants with a smaller number of orders, which is also due to lower capacity, ensure the fulfilment of SLAs to a greater extent. It is worrying to find that in the event of non-compliance with the SLA, the average time from receipt of the order to delivery of the goods to the customer there is a significant increase in time compared to the average time achieved in cases where SLAs target was met. Based on the overall average time which is 19.22 days we would say that SLA target 21 days is set up at a good level. However, when we take into account that in 82.1% of cases the SLAs were met and the average time reached 13.51 days, we can state that the SLA level is set too high. Therefore, it is necessary to measure the performance of individual threads to find places where SLA can be reduced. Increased attention needs to be paid to cases where there is a non-compliance with the SLA and the average time is more than tripled compared to cases where it delivers the fulfilment of the SLA, and doubled compared to the target set by the SLA. Here you can see the importance of the distribution of SLAs in cases where compliance has occurred and in cases where the targets set by the SLA have not been met.

By examining these KPIs, we can divide the overall process into threads, measure their performance as well as performance of SLA fulfilment for each of them. Then by applying the same principles to the individual threads as they use in the best performing plants we can achieve higher performance on overall level.

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