POTENTIAL PERFOMANCE MEASUREMENTS OF ROMANIAN AGRICULTURAL COMPANIES

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***Abstract**: Measuring the performance of agricultural companies is not only a difficult task in Romania but in the whole world, as there are complicated processes in almost every company's life. In order to get more accurate information about companies, it is recommended to set up a performance measurement system for the given companies. In my article, I present the potential performance measurements based on a survey of 25 Romanian agricultural companies. The survey was supported by the Tempus Public Foundation.*

***Keywords:** performance measurement; transport cost; agriculture; competitiveness.*

***JEL Classification:** Q4.*

1. The definition and importance of performance measurement

To have an extensive view on this topic, it is important to understand how performance measurement works.
Based on the 2004 work of Adams et.al. the performance measurement system renders it possible to make well-established decisions and actions that quantifies the effectiveness and efficiency of past actions by collecting, processing and analyzing the adequate data (Adams et.al., 2004).
The 2004 work of Chris et.al., also confirms that the performance of a company depends on its previous effectiveness and efficiency. According to Chris and Adams, performance measurements quantify previous actions, which basically determine the current performance of a company (Chris et. al, 2004; Adams et.al. 2004).
Considering the above-mentioned reasons, the goal of performance management is to follow the business performance and to utilize the relevant data to achieve its goals and to improve performance by taking the previous actions into account. The goals and developments are most concentrated in the fields of efficiency, effectiveness and cost-effectiveness (Wimmer, 2014).
Measuring the business performance is crucial in a company's life, as profit-making is one of the keys of appropriate performance. In order to increase profit in the future, it is recommended to make measurements in every sector of a company: production, corporate strategy, client satisfaction, performance of the company (Waters, 2010).
At the same time, performance measurement is also important because business performance measurement provides feedback, thus it helps the preparation of a decision and the decision-making itself. Market, financial and operational features also help performance measurement; however, it is also important to notice that economic, social and environmental factors are also significant. The correlations are illustrated in Figure 1. (Wimmer, 2014). As it is shown, business performance has four levels, where environmental and social performance is at the bottom and these are followed by operational performance. The second level is characterized by

flexibility, cost and time. This is the basis of the third level, which is market performance. Market performance can be calculated from market shares, sales and customer responses. On the fourth level, we can find yield, profit and cash flow; this level gives financial performance for a given company.

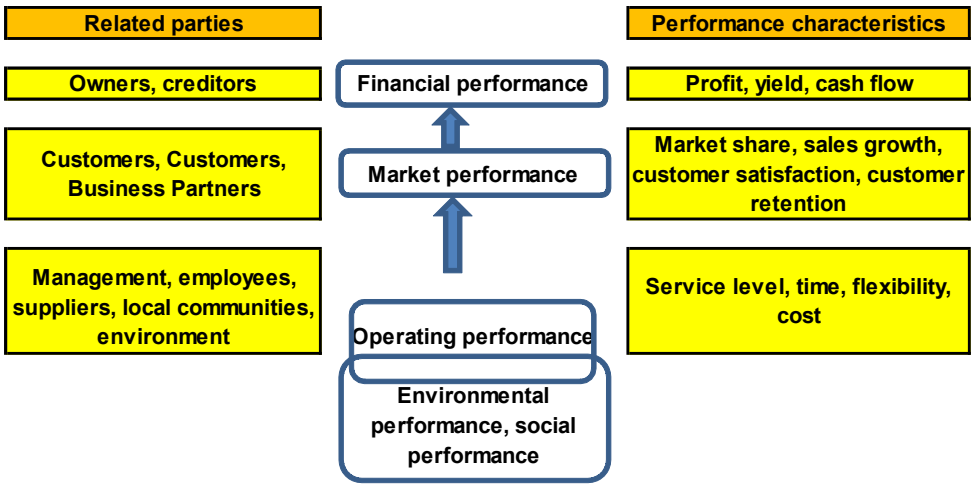

Figure 1. Levels of business performance
Source: Own edited, based on Wimmer (2014)

2. Indicators of business performance

As it was described in the first section, for performance measurement, performance indicators (performance criteria) are required. The performance measurement system collects all the data, from which it calculates a given performance index that makes it easier to characterize the company (Schönsleben, 2007).
Another approach is that the performance index provides such information about the company, which supports the management of the company and its goals, and it is in a close relation with certain specifications and standards (Duma, 2005).
Based on the related literature, these indicators can be divided into groups according to different criteria. One of the most frequent grouping distinguishes global and local measurements. Global indexes are a group of indicators that give a comprehensive view of the company's performance, such as cash flow, capacity, and utilization. Local indicators are related to a given resource or process that could influence global performance indicators, such as lead time, change in stock, location utilization (Schönsleben, 2007).
Another classification distinguishes external and internal performance indexes, and financial and non-financial indicators (the most significant are the input and output process meters) (Duma, 2005). Input performance meters, such as efficiency and utilization indicators, measure input of the given activities. Process meters can be characterized by transformation characteristics (inventory, speed of rotation, etc.), productivity and flexibility. Outputs can be characterized by output meters**,** such as performance and reliability (I01).
Within performance measurements**,** logistics performance measurements have a significant role; it will be described in the next section.

3. The definition and importance of logistics performance measurement

Logistics is one of the most significant factors of competitiveness; an appropriate (objective) measurement of logistics performance is extremely important. As a matter of course, for companies, the primary index of success is the achievement of the highest financial performance. However, in many cases it is not enough to run a company successfully. In order to accomplish their business and financial goals, companies have to measure their performance extensively (Némon, 2002).
Examining logistics performance means the measuring of the combination of the followings: service quality, customer satisfaction and economic efficiency. It is shown in Figure 2. It can be seen that in sales, the aim of logistics is to maximize customer satisfaction (by assuring quality). Examining economic efficiency, it is necessary to measure the performance of inputs that are required to the given service; it influences the quality of the given product (service), which determines the quality of the service and customer satisfaction (Némon 2002).

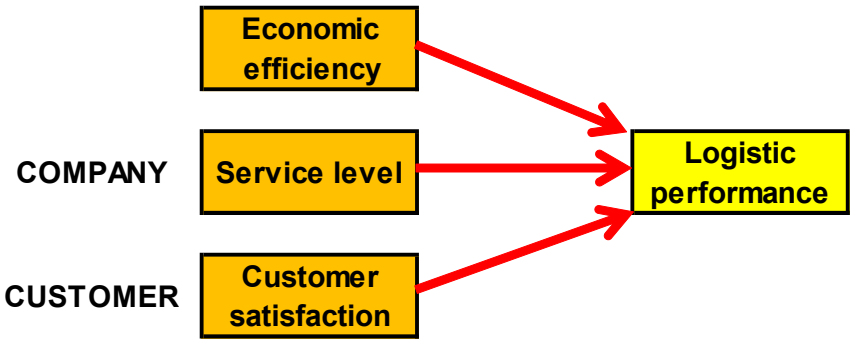

Figure 2: The most important influencing factors of logistics performance measurement
Source: Own edited, based on Duma (2005)

Based on these correlations, Schönsleben explained that logistics performance measurement analyses logistic activities, considering the whole company, by using various indicators. Its areas are quality, cost, flexibility and transport (Schönsleben, 2007).
Thus, logistics performance measurement is an area of high priority in companies' lives, as it supports the preparation of decisions. By measuring logistics performance, information can be gained on different activities; it also influences the company's future behavior and motivates it to make its performance better (Monczka, et al., 2009).
As the above-mentioned explanations show, performance measurement can be used to solve multiple problems, which is different in every company's case (their comparison is therefore difficult). For the sake of easier comparison, I present the different types in the next section.

4. Classification of main indicators of logistics performance measurement

The factors presented in the previous section are essential elements of performance measurement; however, there are more complex and extensive groups of performance measurement. The most significant classification is associated with name of Némon, where two main groups can be distinguished: internal and external performance measurements. Internal performance measurement focuses on comparing corporate activities and processes with earlier results or goals (for example logistics costs, logistics service quality, productivity, tools, quality). Comparing to these, the aim of external performance measurement is to acquaint the customers' requests, which is measured by customer satisfaction, and to get the best criteria of corporate performances. This is benchmarking, which is a comparative analysis of products (services) with the competitors or industry (Némon, et. al., 2006).

Besides these, the following point of views can be considered:

- **By activity**: it focuses specifically on logistics. (The same indicator cannot be used for different areas of logistics/warehousing, transport, stockpiling, shipping, sales/.) (Orbán, 2012).
- **By participants:** differentiation of market participants (e.g. logistics service, company, customer, supply chain).
- **By measured features**: either operational performance (a measurable point in an organization's output, e.g. speed of transport, reliability etc.) or financial/business performance should be measured. In every case, the main aspect is to keep efficiency in mind.
- **By its type**: it can be complex (it is characterized by a series of activities) or a partial performance index (each component of a given performance is measured individually).

In each of the companies I have examined, I have always found that the given companies always choose the potential performance measurements based on their objectives of logistics. It is therefore necessary that the first step is to define the objectives, and then to choose the proper indicators of the performance and to determine their requirements (Némon, 2002).

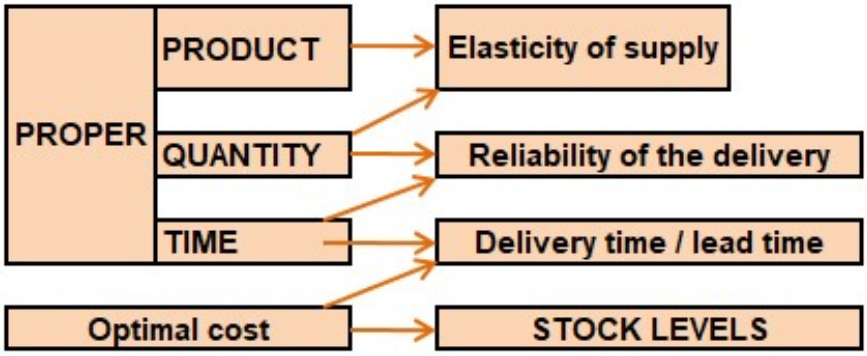

Figure 3: Requirement system of logistics
Source: Own edited, based on Némon (2002)

The structure of the logistics requirements system is shown in Figure 3. It can be seen that there are quite strong correlations among the elements. Company and customer goals are on the same level. It is important that the first step is to define the goals, to which the requirement system should be assigned, and then the indexes. Necessarily, the aim is to keep the right product in the right place at the right time at optimal cost and with reliable transport. If these conditions are fulfilled (requirement system is complete), then according to Némon (2002), norms and control ranges must be fixed**,** and based on these, the methods and tools of performance measurement should be chosen (Némon, 2002).
In the next section, I will present a classification based on activities, as the performance measurement of transport was crucial for each of the companies I examined.

5. The aim and development of performance measurement of transportation

The task of transporting activity is to establish a connection between the two phases of the supply chain. The supplying activity is in the interest of the customer, however it also has to be economic, so the performance indexes focus on these two requirements (Némon, 2002). The other goal of the performance measurement of transportation is to have feedback, which is needed for development. Both the transporters and the companies need these feedbacks to evaluate their current situation (by getting feedbacks, it is possible to fix errors and keep developing). It is also important for them to trust the other party and thus share essential business information that is necessary for progress. Therefore, they want to maintain a relationship that can be profitable and assists to their growth.
In order to properly develop the performance measurement indexes, it is important to ask the following questions: What are our expectations for our transporters? What are their expectations for us? What strategies should we use to fulfil these expectations? Which processes should be effective to implement the strategy? What capabilities should we built to operate the processes?
Based on the answers to these questions, we need to decide who our most important transporters are: which transporters are the best, what are their costs etc. In order to satisfy all the requirements, we have to rank. Only after these, performance indexes should be chosen.

6. The main indicators of transportation performance measurement

From the explanations above, it can be stated that indicators of performance measurement can be grouped according to many different aspects. The most significant classifications are listed in Table 1. (which are related to the questions mentioned earlier). Our demands towards our transporters can be connected to the complaints related to their performance, and the number of issues related to the products after sale (Adams, et. al., 2004). At the examined companies, the followings are amongst the transporters' demands: the average duration of cooperation**,** accuracy of demand forecasting, or even the ratio of expired transportation demands. The effective implementation of strategies can be characterized by the number of processed transport accounts, while the ability to operate can be characterized by the cost of managing transport invoices, the size of inventory shortages and the financial stability of transporters.

Table 1: Indicators of transportation performance measurement

Indicator group	Indicator
Lead time related	**1.** lead time of transport **2.** Speed of transport
Quality related	**1.** quality of transport **2.** Reliability of transport
Resource related	**1.** utilization of capacity of vehicles **2.** Efficiency of vehicles

Source: Own edited

Besides the main groups, we also have to calculate the smallest figures, which can be summed up by the following indicators (I03):

1. Regarding *productivity indicators*, the most important is the time of delivery per order; utilization of means of transport in percentage; transport performance, the total quantity of goods supplied in relation to all the time spent on transportation; the distance travelled by one vehicle; the distance driven by one driver; the average time spent on repair; average time of transport; average amount of quantity of goods per order; effectiveness of distribution; transportation performance correlated to annual working days
2. *Economic indicators* focus on costs: average transport cost per order; cost of transport per unit of mass**;** cost of transport per ton-kilometre; cost of transport in percentage of production; average running costs of each means of transport; ratio of transport costs to total costs; transport cost per unit of mass; number of executed orders; etc.
3. *Indicators of quality*, from which the most important are: degree of service in percentage; meeting the deadlines in percentage; percentage of accidents; frequency of damage; loyalty of the transporter

In the analysis of logistics performance, it is also important to use different forecasts, as changes in stock exchange rates, changes in consumer habits, changes of the economic cycle and the future requests of manufactured products are determined by forecasting.

There are several different kinds of methods. Within the methods, qualitative and quantitative forecasts are distinguished. The qualitative method means that there are no numerical data for the past, or if there is, it is not suitable for forecasting future requests. The quantitative method is used, when there is related numerical data. Quantitative methods can be divided into further groups, so it is inevitable to differentiate according to the trend or seasonality of the series of data (Koltai, 2006). As a first step for the companies I have examined, I have calculated the quarterly transport costs. Then I used a line diagram to examine if there was any tendency in different data sets. As a 75% decline tendency showed up, I found it useful to use the Holt-Winter exponential smoothing method. The point of the moving average is to approximate the corresponding elements with the average of the elements in its environment. This can be 2, 3, 4, and 5, depending on how many elements are averaged. The double moving average is different from the simple moving average in the sense that we are averaging the simple moving average and building our forecast on that (Hunyadi – Vita, 2008).

Steps of my calculation:

- 1. simple moving average calculation: $M_t = (Y_t+Y_{t-1}+\ldots.Y_{t-k+1})/k$, where Y_t is the data for the t period, Y_{t-1} is the data of the t-1 period, k is the number of elements

- 2. Double moving average calculation: $D_t = (M_t+M_{t-1}+\ldots M_{t-k+1})/k$, where M_t is the moving average of the t-th period, M_{t-1} is the moving average of the t-1 period, k is the number of elements
- 3. Defining the basic level**:** $E_t = 2M_t - D_{t,}$ where M_t is the moving average of the given period and D_t is the double moving period of the given period
- 4. Defining the trend: $T_t = (2M_t - D_{t,})/(k-1)$, where $2M_t$ is the 2 times moving period of the t-th period, $k-1$ is the number of elements – 1
- 5. Defining the forecast: $Y^{\wedge}_{t+n} = E_t + nT_{t,}$ where Et is the basic level of the t-th date, nTt is the t-th time trend (Winstone, 2003)

Since forecasts are uncertain, the possible errors should be measured. From the most commonly used indicators, I used MSE or residual variances first with the formula Σi(Yi-Y'i)2/n, where Yi is the actual value of the T-period and Y'I is the predicted value. Then I used the square root of MSE, RMSE. If the value of the indicators is low, then the forecast is quite accurate, but if it is high then it is uncertain. The above-mentioned indicators were calculated for all the three forecasts (Hunyadi – Vita, 2008).

As the received forecasts did not exactly follow my basic data line, I used the Holt method, the double exponential smoothing method. The point of the process is that we do not evenly consider the requests of the different periods. Since the rate of growth between periods is also fluctuating, we need alpha and beta parameters. Thus, the forecasts came from the sum of these two, separately smoothed data (I02). Steps of my calculation:

- 1. Defining the basic level: $Et = \alpha Y_t + (1-\alpha)(E_{t-1} + T_{t-1})$, where α is the smoothing parameter, Y_t is the data of the t-period, E_{t-1} is the basic level of the t-1 period, T_{t-1} is the trend of the t-1 period
- 2. Calculation of the expected trend value: $T_t = \beta(E_t – E_{t-1}) + (1 – \beta)T_{t-1}$, where β is the smoothing parameter, Et is the basic level of the t-th date
- 3. Making the forecast: $Y^{\wedge}_{t+n} = E_t + nT_t$, where E_t is the basic level of the t-date, nT_t is the t-th time trend (I13).

After the Holt method, I also made Holt-Winter forecast models. Holt-Winter forecast models can be done by addictive and multiplicative seasonal effects. As my data was mostly characterized by the multiplicative season, I chose that as the main guideline. This means that seasonal fluctuations are roughly identical to the trend (Hunyadi – Vita, 2008).

The Holt-Winter model is practically a version of exponential smoothing, where the constant element, seasonality and trend are present at the same time. All three must be evaluated separately, and then a forecast can be made based on the evaluations (Winston, 2003).

Steps of my calculation:

- 1. Defining the basic level: $E_t = \alpha(Y_t/S_{t-p}) + (1-\alpha)(E_{t-1} + T_{t-1})$, where α is the smoothing parameter, Y_t is the data for the t-th period, S_{t-p} is the seasonal factor for period 1, E_{t-1} is the basic trend of the t-1 period, T_{t-1} is the trend of the t-1 period
- 2. Calculating the trend: $T_t = \beta(E_t – E_{t-1}) + (1-\beta)T_{t-1,}$ where β is the smoothing parameter, E_t is the basic trend of t-th period, E_{t-1} is the basic trend of the t-th period, T_{t-1} is the trend of the t-1-th period
- 3. Defining the season factor: $S_t = \gamma(Y_t/E_t) + (1-\gamma)\ S_{t-p}$, where γ is the smoothing parameter, Y_t is the data of the t-th period, E_t is the basic trend for the t period, S_{t-p} is the season factor of the 1. period,

- 4. Making the forecast: $Y^{\wedge}_{t+n} = (E_t + nT_t) S_{t+n-p}$, where E_t is the basic level of the t-date, nT_t is the trend of the t-th time, S_{t+n-p} is the season factor of the 1.period (Winston, 2003).

7. Presentation of a forecast for the transport data series of a Romanian agricultural company

After analyzing and evaluating the transportation performance indicators, I prepared a forecast for the expected transport costs. I believe that agriculture can change so suddenly that it will have a significant impact on transporters, manufacturers and sellers at the same time. Considering these factors, I have prepared the forecast for transport costs of 2018; the first step is shown in Figure 4.

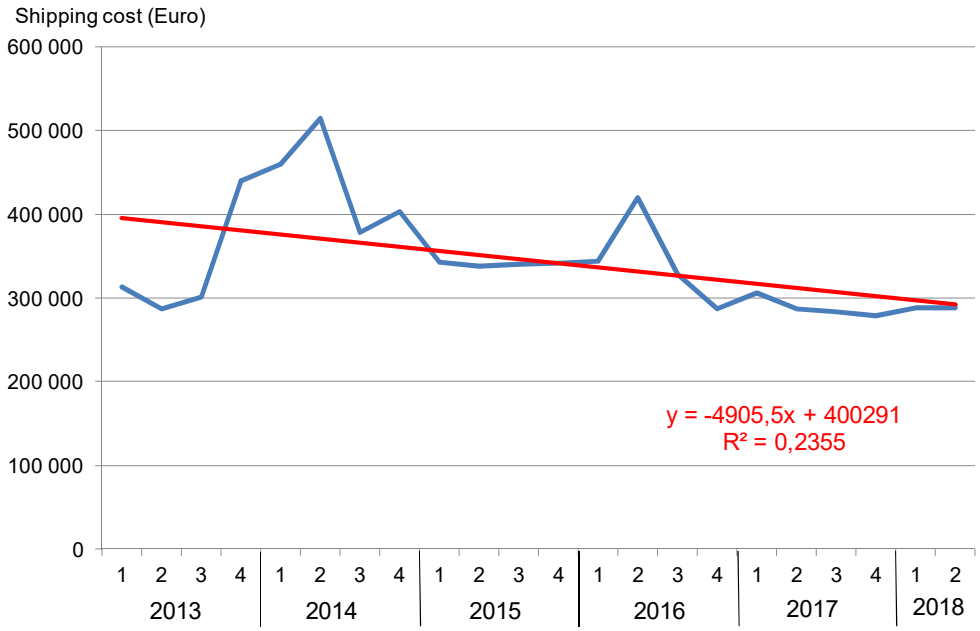

Figure 4: Transport costs in euro with the trend line
Source: Own calculations, based on the data of a Romanian agricultural company (the survey was supported by Tempus Public Foundation) (2018)

In Figure 4, I concluded with the help of a line diagram and a trend line that a trend effect is prevailing in transport costs during the observed period. This trend effect is decreasing, which means that the values of the basic level are not moving around a constant value, but they are showing a decreasing tendency. There are peak periods, when the swing is the largest in transport costs. This peak period is the second quarter of 2014, when more than 500.000 EUR was spent on transport by the given Romanian company, and at the same time, it also means that it was the highest cost between 2013 and 2017. In the fourth quarter of the same year another peak was observed, however, this was far behind the result achieved in the second quarter, while the peak of the second quarter of 2016 was much closer to it.

8. Double moving average forecast

After I observed that there was a decreasing trend in transport costs, I prepared my first forecast model by using double moving average method. This is illustrated in Figure 5.

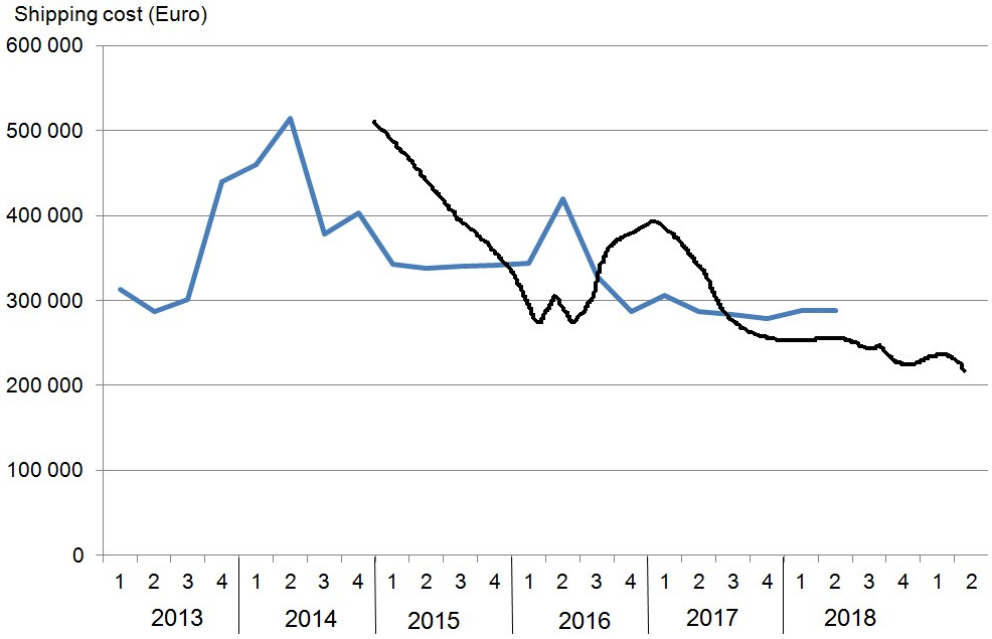

Figure 5: Double moving average forecast
Source: Own calculations, based on the data of a Romanian agricultural company (supported by the Tempus Public Foundation) (2018)

As it is shown in Figure 5, the forecast was made from the fourth quarter of 2014, as the double moving average is based on a four-member moving average. My forecast model smooths fluctuations in transport costs; according to this model, costs will decrease in 2018. The transport cost is at its peak in the first quarter of 2018, but afterwards, it describes a decreasing tendency in all the other quarters. This forecast model is quite fluctuant, so it does not follow the basic data perfectly, thus an accurate forecast cannot be provided. This fact is also supported by residual variance and residual deviation; their values were very high in the case of the double moving average model. As a result, I had to make further forecasts that would smooth these deflections further.

9. Double exponential smoothing (Holt method)

Based on the pervious data, I had to make further forecast models, since the double moving average model did not show accurate forecast. To eliminate errors and deviations, I used the exponential smoothing method (Holt method) that is shown in Figure 6.

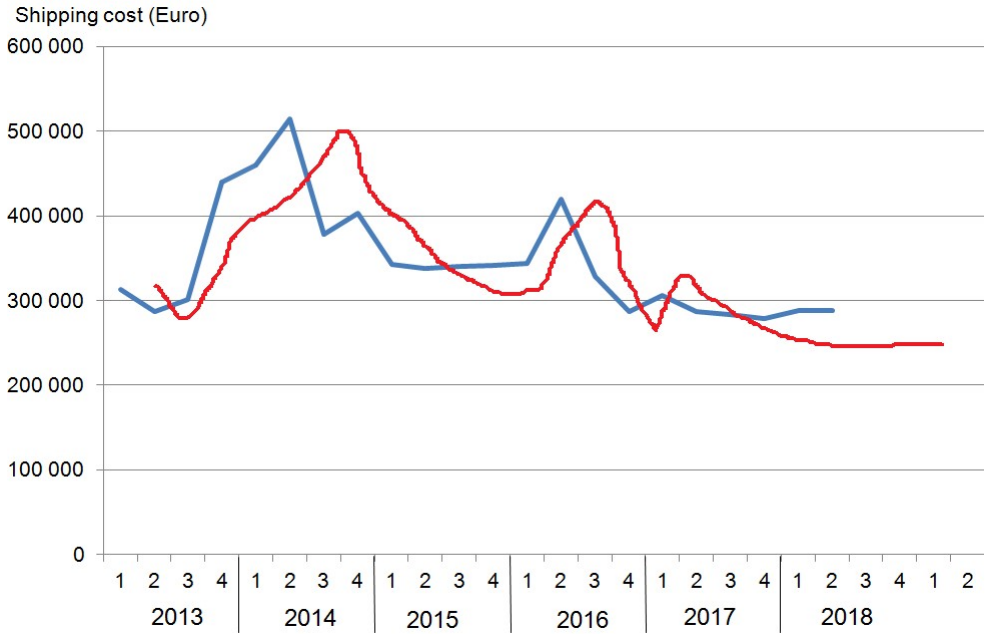

Figure 6: Forecast with double exponential smoothing
Source: Own calculations, based on the data of a Romanian agricultural company (supported by the Tempus Public Foundation) (2018)

It can be observed that the double exponential smoothing forecast model follows the original data line better. I used Solver extension to create the model, with which, I could determine whether the forecast will adjust to the basic tendency or to the trend. Since alpha is 0.66, while beta is 0, the forecast will follow the basic tendency. I also determined the values of MSE and RMSE, which were much lower than those of the double moving average forecast model. From these results, I assume that this forecast could give a more accurate picture of future transport costs. However, by using the Holt-Winter forecast model, I could further smooth the fluctuations in the line diagram, so I have also prepared this forecast.
The Holt-Winter model uses gamma parameter besides alpha and beta, with which it takes seasonality into account. Since my basic model has a multiplicative seasonal effect, I used the Holt-Winter method that is shown in Figure 7.
Figure 7 shows that the Holt-Winter model does not fit exactly to my basic model; the difference is shown by the high values of MSE and RMSE. In these calculations, I also used Solver to determine alpha, beta and gamma. Based on the results, it can be stated that my forecast takes seasonality into account, as the gamma has the highest value. In my opinion, this is the reason of the difference, since seasonality is not as significant in my basic model as Holt-Winter assumes.

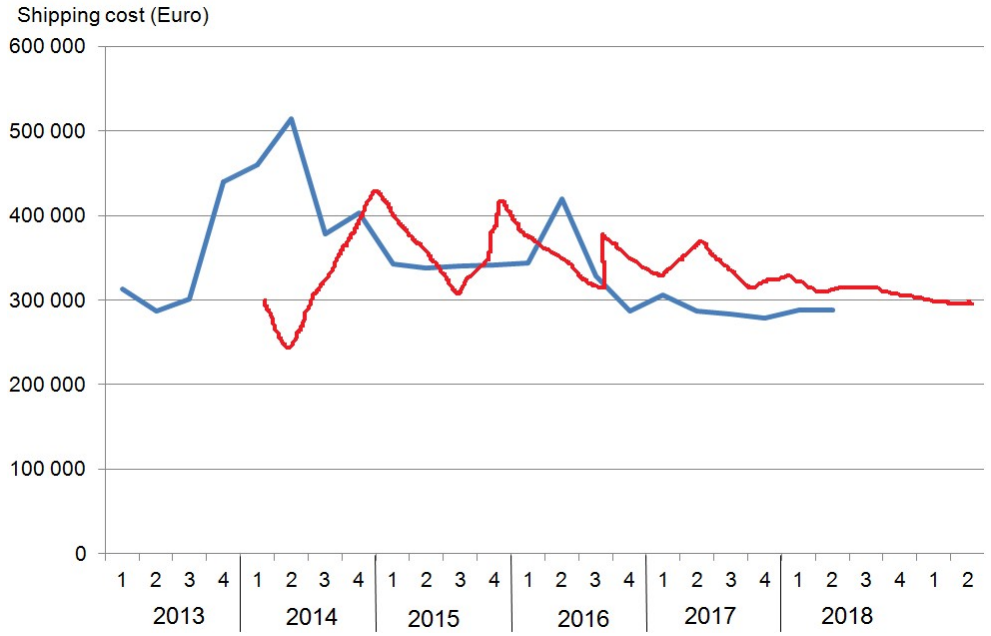

Figure 7: Holt-Winter forecast model
Source: Own calculations, based on the data of a Romanian agricultural company (supported by the Tempus Public Foundation) (2018)

10. Conclusion

In my article, I examined the possibility of logistics performance measurement for Romanian agricultural companies. The main guideline of my observation was the cost of transport, suppliers, as it has an important role in every agricultural companies. Based on my calculations (supported by Tempus Public Foundation), it can be stated that one of the most important issues for a company is to determine optimal transport costs.
Based on the present three models, it is shown that none of them gave an accurate picture of the costs expected in 2018. However, the Holt model, i.e. the double exponential smoothing forecast, was the closest to my basic curve. All the three forecasts assumed that the transport costs would decrease in 2018, although the Holt model showed a minimal decrease. However, it was the double exponential smoothing model that, after comparing the MSE and RMSE values, provided the least indeterminate forecast.

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