IS THE REDUCTION OF MAINTENANCE COSTS AN OBJECTIVE?

VERMES Pál - LIBOR József
TessedikSámuel College Agricultural Faculty (Mezőtúr) Hungary

Summary

Usually the costs of maintenance of machines have a significant rate in the total costs of firms. Many times a wish to reduce of the maintenance costs is among the rational consideration of the firm managers. The maintenance is an activity with a lot of resources, therefore the reduction of the utilization of resources may be desirable. The article shows a possible evaluation system and its application on the basis of the data of the agricultural units. It is verifiable, that the ambition for the sum of maintenance costs and the deficit of maintenance instead of minimalization for total costs of the maintenance system is practical.

INTRODUCTION

In 2000 the Research Institute for Rationalization of the Technical University Aachen made investigations with questionnaire for 27 German and 31 Austrian firms. From this investigation it appeared, that among the most determinant factors for maintenance the maintenance costs (26%) and obviously the running order of equipment (27%) are the leaders. (Figure 1.)

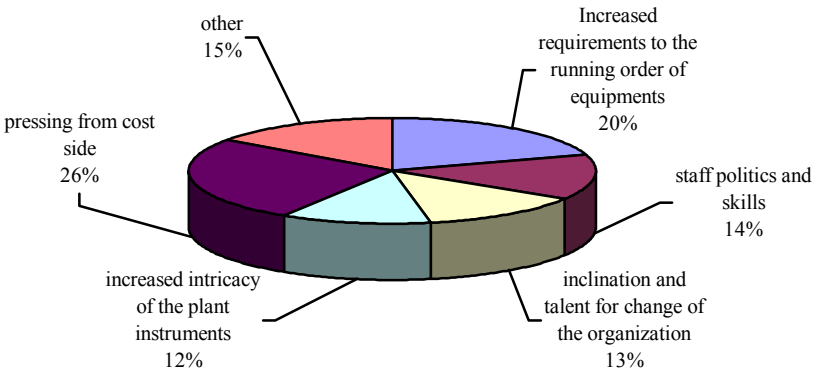

Figure 1. Determinant factors for maintenance [Brumby-Schick 2001]

This „cost pressure" made the maintainer to keep a record of his performance and costs as accurately as possible and to spare his resources.

MATERIAL AND METHODS

We determine the use index of resources for maintenance on the basis of knowledge of technical literature and practical experiences, after that we like to verify the utility of indexes by the example from practice.

The true economical evaluation of maintenance is not a simple task because of its complex character and speciality. Theoretically two ways present themselves:

– Determine the total cost of maintenance ($K_ö$) and strive for minimalization of this cost. This is a practicable way methodologically and it may be suitable for the firm management too, because it is good for cutting down costs – it is always desirable.

- If we accept, that we have to consider besides („direct") costs of maintenance the production falls, which depends from the applicated maintenance system, that is the

Dr. Pál Vermes – József Libor – Tessedik Sámuel College Agricultural Faculty (Mezőtúr) Hungary
5400 Mezőtúr, Petőfi tér 1. Tel.: 56/551-016; fax: 56/551-017; e-mail: vermes@mfk.hu, libor@mfk.hu

losslike results too, then we can try to determine the practical extent of maintenance costs theoretically.

To estimate the costs- and profit cover we may apply the determination of effective maintenance costs ($K_{ö}$): the maintenance costs according to reaction to change in the quantity and quality of the maintenance would be reduced to fixed- and proportional costs. The 100% good running order means Zero out of working deficit ($V_{ö}$), which may be reached with infinitely big maintenance costs theoretically. (**Fig.2**)

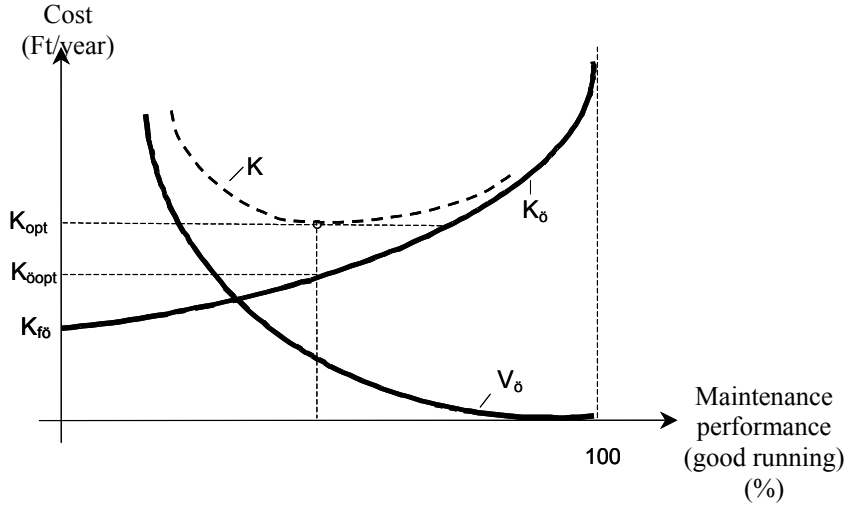

Figure 2. Optimum of maintenance costs [Vermes et al 1996]

The objective function for a system with n pieces of machine

$$K = \sum_{i=1}^{n} \left(T_{á} \cdot V_{ö} + K_{pö} \right) + K_{fö} \rightarrow \textbf{\textit{min .!}}$$

where:

$K_{fö}$	-	total fixed maintenance costs [Ft/year]
$K_{pö}$	-	total variable costs [Ft/year]
$K_{ö}$	= $K_{fö}$ + $K_{pö}$	- total maintenance costs
$T_{á}$	-	out of working time [hour/year]
$V_{ö}$	-	total deficit from out of working time [Ft/year]
K	=	$K_{ö}$ + $V_{ö}$ total costs [Ft/year]

RESULTS AND DISCUSSION

The maintenance system is an aggregate of resources for maintenance, of technical and organizing documentations and of plans about the character and time of the arrangement to maintenance of working faculty for the given machine park and of plans for realization of strategy conceptions (Fig.3)

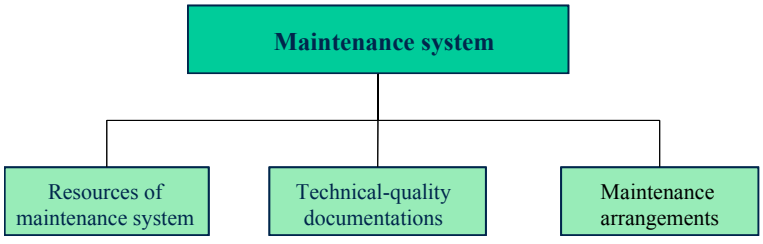

Figure 3. Components of maintenance System.

This time only the resources are stressed from the components of maintenance system, which according to their character are not different from any resources. If the goal is the examination with a view to cost of resources, the application of parameters from **table 1.** is advisable. [Vermes 2004]

System of index number for examination of maintenance resources **Table 1.**

Nr.	Name of group and parameter	Interpretation	Originating parameters
MAINTENANCE RESOURCES			
1.	**Labour** Rate of maintenance wages	$e_b = \frac{b_k}{b_{ö}} \cdot 100[\%]$ b_k - wage costs of maintenance [thousandFt/year] $b_{ö}$ - total wage costs [thousandFt/year]	– for machine group, organization unit, entirety of firm – for a definite period (e.g. one year) – with planned or factual data
2.	**Use of materials and components** Relative use of materials and components	$e_a = \frac{a_k}{k_{ö}} \cdot 100[\%]$ a_k - use of maintenance materials, components [thousandFt/year] $k_{ö}$ - total maintenance costs [thousandFt/year]	– use of materials and/or components – for machine, machine line, machine group, organization unit, entirety of firm – for a definite period (e.g. one year) – with planned or factual data
3.	**Energy consumption** Relative energy consumption	$e_e = \frac{e_k}{k_{ö}} \cdot 100[\%]$ e - energy consumption of maintenance [thousandFt/year] $k_{ö}$ - total maintenance costs [thousandFt/year]	– by types and/or total energy – for machine, machine line, machine group, organization unit, the entirety of firm – for a definite period (e.g. one year) – with planned or factual data
4.	**Instruments of maintenance** Standard of material instruments for maintenance	$e_t = \frac{N_k}{B_k} \cdot 100[\%]$ N_k - net value of material instruments for maintenance [thousandFt/year] B_k - gross value of material instruments for maintenance [thousandFt/year]	– for organization unit, the entirety of firm – in tested moment – with planned or factual data
5.	**Financial implements** Rate of maintenance amounts invested	$e_k = \frac{k_{ö}}{B_{ö}} \cdot 100[\%]$ $k_{ö}$ - total maintenance costs [thousandFt/year] $B_{ö}$ - gross value of material instruments [thousandFt/year]	– for machine, machine line, machine group, organization unit, the entirety of firm – for a definite period (e.g. one year) – with planned or factual data
6.	**Demanded maintenance services** Costs rate of demanded outside maintenance service	$e_{sz} = \frac{k_{szk}}{k_{ö}} \cdot 100[\%]$ k_{szk} - cost of demanded outside service [thousandFt/year] $k_{ö}$ - total maintenance costs [thousandFt/year]	– for machine, machine line, machine group, organization unit, the entirety of firm – for a definite period (e.g. one year) – with planned or factual data

Case example : evaluation of maintenance resources in agricultural companies

The parameters of table Nr.1 were formed by the help of seven chosen agricultural companies' data as part of an investigation on the situation of the maintenance in Hungary.

The companies have production or rather production and service activities, in view of their functional form four of them are Ltd., two of them are co-operatives and one of them is deposit company. They work mainly in cultivation, to a lesser degree in animal husbandry, their cultivated fields are 46-7800 ha.

In **table Nr.2** the index of maintenance resource consumption at companies are each and average value.

Index numbers of maintenance resource consumption **Table 2.**

[data in %]

Nr.	Name of group interpretation and parameter	Agricultural firms							Average rates
		1	4	6	7	8	10	12	
1.	labour rate of maintenance wages	2,56	6,57	4,27	8,3	56,9	20,0	13,44	15,72
2.	use of materials and components relative use of materials and components	18,62	66,97	42,8	39,4	10,31	77,8	49,9	43,68
4.	instruments of maintenance standard of material instruments for maintenance	62,5	19,31	75	-	80,0	20,0	50,7	51,25
5.	financial implements rate of maintenance amounts invested	29,18	4,67	163*	6,9	30,51	15,0	26,37	18,77
6.	demanded maintenance services costs rate of demanded outside maintenance service	5,82	27,66	0	4,14	9,86	11,1	0	8,36

* disregard

CONCLUSION

The altogether eight provide data create difficulties too: the dataset shows a large dispersion.
There are no correct data or they are not to be published.
There is no estimated data for energy consumption of maintenance.
It makes difficult to verify the effective wages of maintenance, that many times the bigger part of work is done by operators.
The shadowing of changes tendency by the addition of value index-system is possible (timeline research).
The optimum of maintenance costs can be worked out on the basis of minimum of total (maintenance and stop time) costs. The above mentioned show clearly, that in economic respect we can not strive for increased reliability of the production equipment at any price.

LETTERS

1. BRUMBY, L. – SCHICK, E.: Die Instandhaltung im Wandel. In: VDI-Berichte, 2001. 1598. sz. p. 479-491. MIÜF 2002/2. p. 11-15.
2. VERMES, P. et al.: Maintenance. Mezőtúr, 1996. lecture notes. p. 106
3. VERMES, P.: Managing resources of maintenance. 4th International Scientific Days of Land Management in the Great Hungarian Plain. Mezőtúr, 2004. CD