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IDENTIFY THE MOST SIGNIFICANT VARIABLES THAT INFLUENCE THE ECONOMIC EFFICIENCY IN A PRODUCTIVE COMPANY

Sorina MOICA[1], Elena HARPA[2]

[1-2]"Petru Maior" University of Tîrgu Mureş
Address: Str. Nicolae Iorga nr.1, Tîrgu Mureş, România

[1]sorina.moica@ing.upm.ro
[2]elena.harpa@ ing.upm.ro

Abstract

Measuring economic efficiency becomes one of the major problems for the persons involved in the production management. The purpose of this paper is to present the result concerning the Economic Efficiency indicator, which was done in a survey realize during then month's period in a SME. Because the Economic Efficiency indicator is calculated taking in consideration several variables, we chose to analyze the production variable without taking in consideration the price information. Our approach taken was to identify the variables that represent the technical efficiency and the main findings is that from thirteen variables we identify the most important six.

Key words: Economic efficiency indicator, Production, technical efficiency measure

1. Introduction

The recent literature of efficiency and productivity analysis present two important elements that are part of this indicator: one is the technical efficiency measure and the other is the price information for measuring [1] allocative efficiency.

The research problem has the base in Farrell study that demonstrates the connection between the technical efficiency measures and the utilization of price information [2]. Many researches are done with some incomplete price information. Kuosmanen demonstrated how incomplete price information can be utilized to obtain better approximations for economic efficiency [1].

Measure of technical and economic efficiency has been extensively analyzed in Production Company, where even the market price is not known, the Measure of technical and economic efficiency need to be done in order to be able to minimizing the cost [3].

The relationship between economic efficiency and technical efficiency measure relates to the absence of such price information: it is normal to assume that the technical efficiency (quantity based) measure offers a natural dual concept to the economic efficiency (price based) measure [4] .

This paper provides the analysis of the technical efficiency measures, realized in a productive sector during ten month period. We chose to analyze only the technical efficiency measure, because these are the variable we can directly influence with the production process we define. This research will provide a open view to all the variable we analyzed and will show which are the most important elements of the technical efficiency indicator.

2. Materials and Methods

The experiment was done in a medium enterprise during ten month period. The study area was chosen because we plan to put in practice some theoretical research done during the last period in this field.

The methods of collecting data were by participating to the management review meeting during ten month period.

The experimental design is made from two different steps that were put in practice with the help of statistical soft SPSS 20. The first step is evaluation of the validity of data measurement, and then we continued to make the correlation analysis.

We chose to test our data using graphic method: box plot. The box plot is a quick way of examining one or more sets of data. After we decide if our data are valid we pass to the correlation analysis in order to see which the most important variable is. In the table below (Table 1) we present the thirteen variables that were selected to be analyzed.

Table 1: The variable analyzed

No.	Variable	Variable acronym
1	Internal Fails	VAR_IF
2	Non Quality Costs	VAR_NQC
3	Production Fails	VAR_IFAILS
4	Fix Cost	VAR_FC
5	Quality Costs	VAR_QC
6	Raw Material Consumption	VAR_RMC
7	Cost Accomplishment	VAR_CA
8	Overdose	VAR_OVERD
9	Selling Expenses	VAR_SEL
10	Total Labor Cost	VAR_TLC
11	Productivity	VAR_PROD
12	Energy Consumption	VAR_ENG
13	Raw material Stock	VAR_RMS

3. Results

3.1 Descriptive statistics

As we can see in the corresponding table (Table 2) is shows the descriptive statistics for each of the variable that was selected for this current analysis.

These variables are part of the Economic Efficiency indicator, together with the price indicator. In this analysis we chose to present the Technical Efficiency variables that is part from that Economic Efficiency indicator and this variables are the most important in the production field (Technical and economic efficiency measures under short run profit maximizing behavior, 2008). We chose to compare thirteen variables that were monitories during then months in a SME's production company, in order to see which are the most important for the Economic Efficiency indicator without taking in account the price information. In the table above we also note the target value for each one of the variable.

Table 2: The descriptive statistics of the variable analyzed

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Target
Internal Fails	10	34766	139221	55208	31036	< 70.000 PPM[1]
Non Quality Costs	10	1%	2%	.0142	.00477	< 1,5%
Production Fails	10	1%	2%	.0097	.00350	< 1%
Fix Cost	10	2%	32%	.1581	.08437	< 12%
Quality Costs	10	2%	5%	.0311	.01097	< 1%
Raw Material Consumption	10	21%	38%	.2733	.04841	< 25%
Cost Accomplishment	10	88%	145%	1.2219	.21085	> 120%
Overdose	10	243	589	355.4000	113.23839	< 100k€
Selling Expenses	10	3%	7%	.0415	.01105	< 2%
Total Labor Cost	10	20%	31%	.2479	.03749	< 20%
Productivity	10	1.6	2.41	1.9910	.24094	> 4 k€
Energy Consumption	10	4%	10%	.0709	.01738	< 6%
Raw material Stock	10	17.61	43.8	26.9540	9.39035	< 20 days

3.2 Evaluation of the validity of data measurement

In this part we tasted the variable taken in consideration for Economic Efficiency indicator. If we analyze the variable `Internal Fails`, `Production Fails`, Row material Consumption` and `Row Material Sock` we identify outliers. We accept also these elements that are not included between the whiskers because all of them are within the target value. In fact all the outliers are coming from the inferior tolerance limit and this is acceptable for our study.

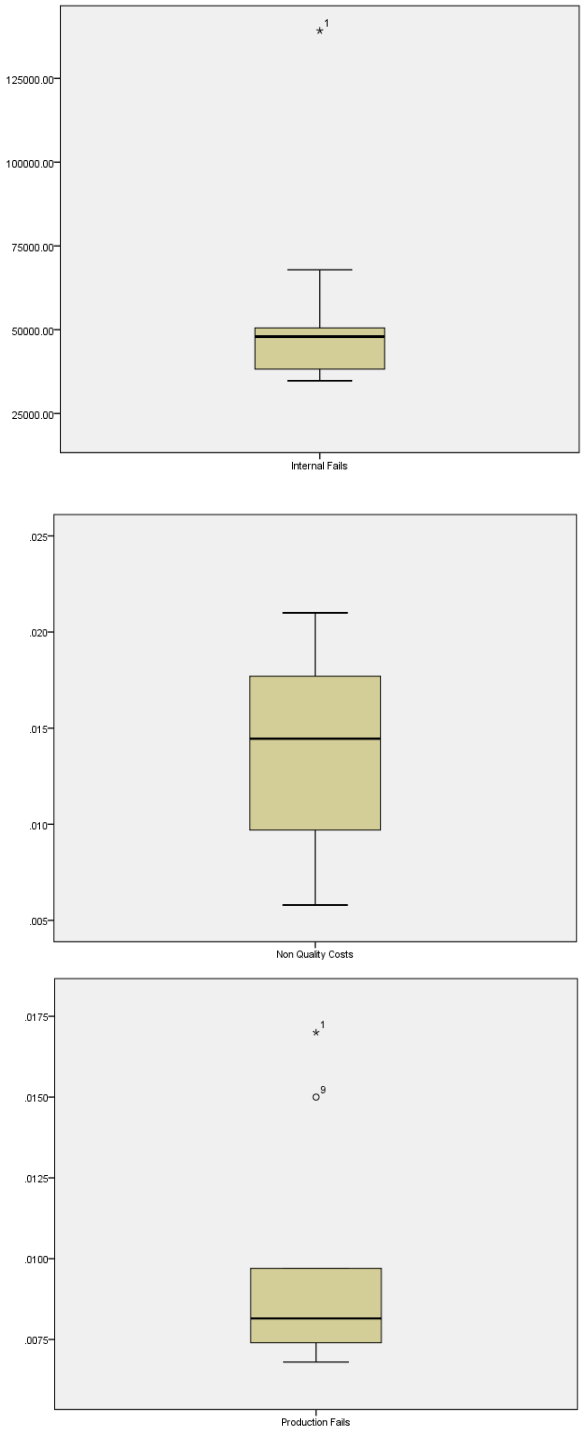

Fig. 1: Box plots for variables VAR_IF, VAR_NQC, VAR_IFAILS

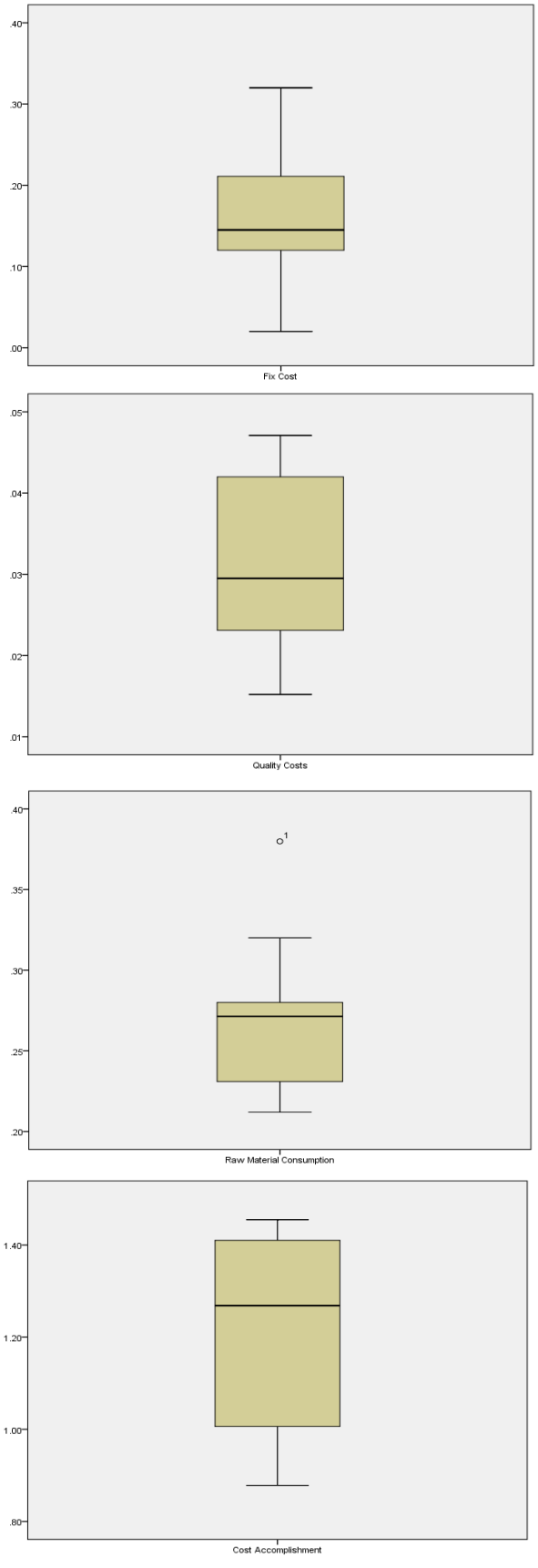

Fig. 2: Box plots for variables VAR_FC, VAR_QC, VAR_RMC, and VAR_CA

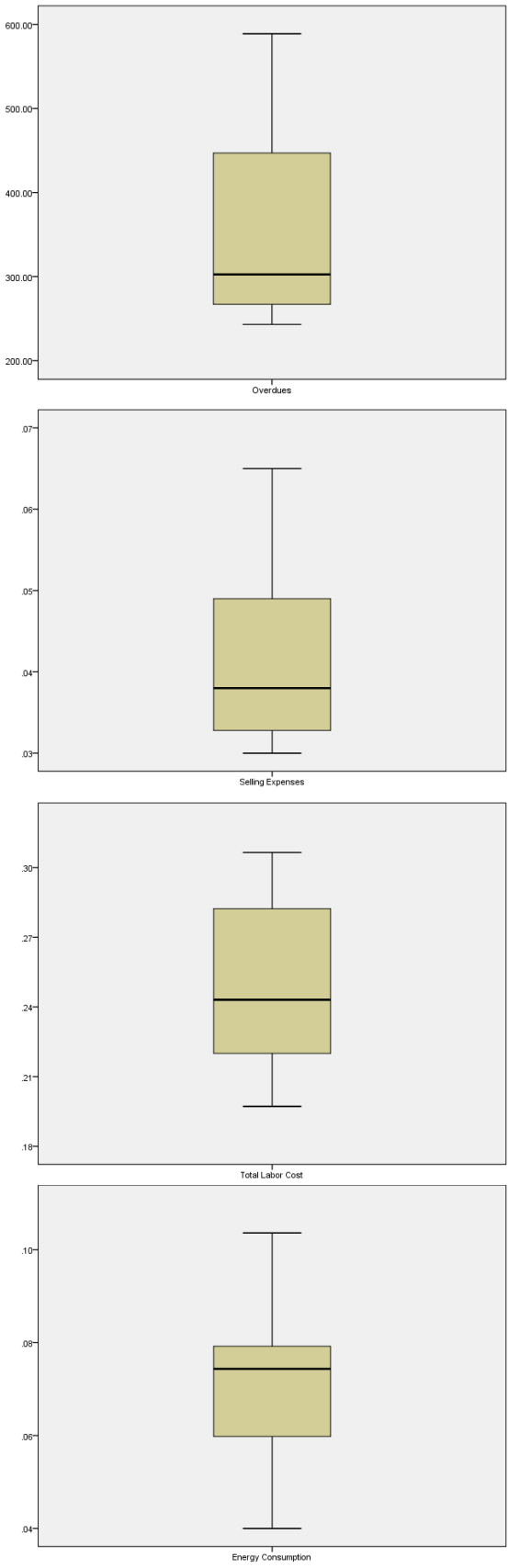

Fig. 3: Box plots for variables VAR_OVER, VAR_SEL, VAR_TLC, and VAR_ENG

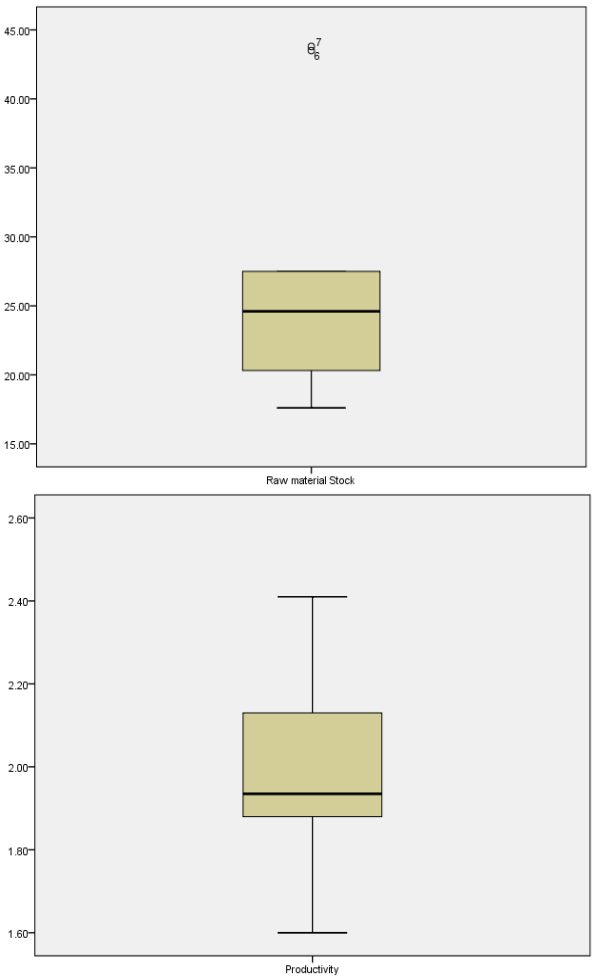

Fig. 4: Box plots for variables VAR_EMS, VAR_PROD

3.3 Correlation analysis

In this paper, we have use the correlation analysis method in order to see the existence of possible relationships between the variable that determinate the Economic Efficiency in a productive company. The bivariate correlations procedure calculates the Pearson correlation coefficient, which is a measure of linear association, with their significance levels. Two variables can be perfectly related, but if the relationship is not linear, the Pearson correlation coefficient cannot be an appropriate statistic method for measuring their association. According to the study conducted by Becheikh, [5] this statistical procedure is one of the most common in empirical studies to analyze the relationships between variables [6], [7].

Correlation analysis is used as a screening tool, and can detect behavior of the set of variables, like this we can establish the set of variables that are more significant in its effect on the result of Economic Efficiency in a productive company. What you get is an estimate of a priori variables that show significant direct effect on Economic Efficiency in production performance, those that have no impact on the result, and finally those (independent variables) that are interrelated and that is interesting to have them identified to address potential future cases of multicollinearity.

To begin the analysis, we study the possible relationships between the independent variables. Table 3 shows the correlation coefficients that are calculated for each pair of independent variables.

From this table (Table 3), we identify the pairs of variables that are correlated with each other, and therefore they may have the same concept. In this case, the correlation coefficients obtained are not very high (maximum value: 0.794 between `Total Labor Cost` and `Row material Stock`), so it is precipitated to affirm that the pairs of variables may be referring to the same concept. However, it is considered appropriate to identify these variables, and take them into consideration for future interpretations. Variables that show high correlation indices backed by high levels of significance (≤ 0.01) are summarized in the following table (Table 4).

No.	Variable 1	Variable 2
1	VAR_IF	VAR_IFAILS, VAR_RMC
2	VAR_IFAILS	VAR_QC
3	VAR_SEL	VAR_TLC, VAR_RMS
4	VAR_TLC	VAR_RMS
5	VAR_ENG	VAR_PROD

Table 3: Independent variables that presents high rates of correlation (sig. level 0.01).

The first thinks we can see is the existence of positive significant correlations, at 0.01 level for some variables. Specifically they are VAR_SEL and VAR_TLC, VAR_RMS, selling expenses positively correlate with total labor cost and also in relation with raw material stock; VAR_TLC and VAR_RMS, total labor cost in relation with raw material stock;

A slightly lower level, but considered significant (0.05 level) there are another group of variables. Here we are talking about VAR_IF with VAR_IFAILS and VAR_RMC, internal fails positively correlate with the production fails and row material consumption; VAR_IFAILS and VAR_QC, production fails in relation with quality costs; VAR_ENG and VAR_PROD, energy consumption correlate with productivity.

In order to respond to the first question of this study we proceeds with the statistical analysis, and we determinate the set of variables that are estimated to have a significant effect on the outcome of Technological Efficiency which is the production component of Economic Efficiency.

	Internal Fails	Non Quality Costs	Production Fails	Fix Cost	Quality Costs	Raw Material Consumption	Cost Accomplishment	Overdose	Selling Expenses	Total Labor Cost	Energy Consumption	Raw material Stock	Productivity
Internal Fails	1	.246	.751*	.047	.529	.770*	-.388	.284	-.408	.077	.202	-.271	-.224
Non Quality Costs		1	.467	-.161	.350	.095	.417	.082	-.651*	-.457	-.135	-.549	-.236
Production Fails			1	.244	.625	.501	-.272	.105	-.580	-.192	-.321	-.258	-.615
Fix Cost				1	-.016	-.095	-.138	-.167	.215	.211	-.142	.336	-.404
Quality Costs					1	.366	.160	-.484	-.148	.415	-.511	.280	-.726*
Raw Material Consumption						1	-.286	.359	-.335	-.021	.306	-.097	-.131
Cost Accomplishment							1	-.334	.112	.155	.016	.197	.084
Overdose								1	-.338	-.538	.540	-.705*	.511
Selling Expenses									1	.766**	-.020	.767**	.223
Total Labor Cost										1	-.078	.794**	-.122
Energy Consumption											1	-.296	.791*
Raw material Stock												1	-.279
Productivity													1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4: Pearson correlation analysis of the variable

4. Discussions

If we analyze the Table 4, we can see that some of the variable did not present correlation between each other. The purpose of this study was to respond to the question: which are the most important variable that define the economic efficiency indicator? Measuring economic efficiency with incomplete price information will take in account the production outcome. Our data was collected during then month's production period and we analyze them in order to see the normality trend. After evaluation of the validity of data measurement we can conclude that our data was valid and we proceed to the correlation analysis.

The correlation evidence the existence of positive relation between nine variables from a total number of thirteen. These seven variables are considered the most important for measuring economic efficiency and this are divided in two main categories: with a level of significance of 0.01(selling expenses, total labor cost and also, raw material stock; total labor cost in relation with raw material stock;) and with lowest level of significance of 0.05 (internal fails positively correlate with the production fails and row material consumption; production fails in relation with quality costs; energy consumption correlate with productivity.

The analysis allows us to consider the existence of a set of variables, a priori, due to the existence of univariate linear relationships, which have a big influence on the economic efficiency indicator.

5. Conclusions

Economic efficiency measure is a high priority activity in any production company. In many empirical studies the economic efficiency has two components one is related with the production activity and another is related to the price. We did our analysis taking in consideration the production elements that are called technical efficiency. From the entire variables that influence the technical efficiency we identify the most important nine.

We conclude by pointing the relevance of this study by using practical data collected in a real production plant.

The results we obtain in this study are the identification of the most important variables that has big influence when we measure the economic efficiency with incomplete price information.

These study will continue with the evaluation of the variables that are considered to have an important effect under the results of economic efficiency except for the five excluded.

6. Acknowledgement

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