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CONTRIBUTIONS REGARDING THE WORK PRODUCTIVITY GROWTH IN THE TEXTILE INDUSTRY ENTERPRISES

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ABSTRACT

The work productivity reflects the efficiency of work in production and the work content analysis like an essential premise to develop a system of indicators to provide quantitative aspects of it and to allow more precise the determining factors that influence depends. Having this consideration like start point in this work was realized the study of the economic effects of work productivity growth achieved at the micro level and the factors that increase the productivity of individual work. The originality of this study is given by the theoretical realization of mathematical models to determine the correlation between labor productivity growth and output growth correlation between increasing productivity and reducing production costs and the correlation between productivity and technical equipment and electrical power level work. Labor productivity level is influenced by many factors, primary and secondary, direct and indirect that mingles and sometimes acts in different directions. Raising productivity is dependent on the general factors existence. These factors act in all social organizations. In this study has developed a multifactorial model of labor productivity.

Keywords: productivity, mathematical models, multifactorial model, textile industry.

INTRODUCTION

Labour productivity reflects the work efficiency in production and it is expressed either by the quantity of products produced with a consumption of labor, either by consumption of labor force involved in implementing enterprise product (Dencker, 2009). Analysis of labor productivity content is a precondition for developing a system of indicators to provide quantitative aspects and can be determined as accurately as possible factors that influence depends (Saifallah et al, 2010). Labor productivity (W) whatever level it is calculate is expressed in quantitative form by the report of the results (effects) obtained in the production (Q) and effort (labor consumption) made (T):

$$W = \frac{Q}{T} \quad (1)$$

Depending on the expression of production and work consumption it can be build a series of concrete indicators to measure the work productivity (Kumar & Suresh, 2009). The methodology for calculating of productivity indicators must satisfy two requirements: the establishment of such size numeric computing elements, to determine the quality level of work productivity, providing opportunities for studying the evolution of this level in time and space (Green, 2001). At the same time taking into account the productivity indicator must respond to different needs, depending on the organizational level that is determined (Timofte &Chirugu, 2011). Thus, at the enterprise level, work productivity is a criteria of work efficient of establishment of correlations. The choice of one or other calculation methods of work calculation depends on the purpose followed and the critical analysis of indicator's content obtained in order to secure a real level as it leads to the conclusion that each has advantages and also limitations and shortcomings.

General Informations

Labour productivity in such units is obtained by dividing the output value expressed to work consumption, the importance of value indicators of labor productivity. Labor productivity in the unit value calculation at the level of specific enterprises in textile industry may be made using the global

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production, finished goods and one for realization, labor consumption being represented by the average number of staff, the total number of man-days or man-hours, resulting that the annual productivity (total or per worker), daily and hourly. Studies on labor productivity presented in this paper were made in the Rosko Textil Company that has as main activity is the manufacture of under

Table 1: The dynamics of value and individual productivity

Indicators	2009	2010	2011
Calculated by global productivity			
annual productivity	114,7	155,1	191,9
monthly productivity	118	157,2	191,9
daily productivity	119,7	162,7	202,5
hourly productivity	121,4	163,7	203,5
Calculated by value of goods			
annual productivity	121,6	164,4	192,1
monthly productivity	125,1	166,8	192,1
daily productivity	126,7	172	202
hourly productivity	128,6	173,6	203,7
Calculated the value of freight carried			
annual productivity	126	170,6	202,7
monthly productivity	129,6	173,2	202,7
daily productivity	131,6	178,9	213,8
hourly productivity	133,3	180,3	215

Study the Economic Effects of Increasing Work Productivity at the Microeconomic Level

Work productivity growth in the textile industry has multiple influences, emerging as the main source of increase in industrial production, the systematic expenses of manpower decrease having favorable economic consequences of all financial indicators of the business. However, increasing the work productivity is a decisive factor in obtaining real corelations between basic indicators of economic activity.

Correlation Between Productivity Growth And Output Growth

In the textile industry as in other branches of industry work productivity growth is the determining factor of global output. Output (Q) is the phenomenon and effect, which may be expressed according to the phenomena cause productivity (W) and average number (N) as a linear regression equation multiple (2).

$$Q = a + bW + cN \quad (2)$$

Parameters a, b, c are obtained by relations 3-5:

$$na + b\sum W + c\sum N = \sum Q \quad (3)$$

$$a\sum W + b\sum W^2 + c\sum NW = \sum WQ \quad (4)$$

$$a\sum N + b\sum NW + c\sum N^2 = \sum NQ \quad (5)$$

Following correlation is established between production indicators and determinants factors determined at micro economic level, the resulted situation is presented in Table 2:

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Table 2: Dynamic growth factors influence global production in 2009-2011

Year	Indices			Global production Increase	
	Global production I_Q	Work Productivity I_W	Average number of workers I_N	Number of workers (DN)	Work Productivity (DW)
2009	131,9	118	111,7	37	63
2010	132	157	127,6	36	65
2011	132,1	192	134,1	35	68

It may be noted that the net production company experienced in the most effect the work productivity grow. The global variation of the considered textile industry company in relation to determinants factors occurred after multiple correlation relationship equation (6), the correlation coefficient R = 0.998 and of determination R^2= 99.6%.

$$Q = -156 + 1{,}59W + 0{,}89\,N \quad (6)$$

The work productivity grow at the microeconomic level is reflected in the realization of significant absolute and relative work force savings.

Correlation Between Work Productivity and Wages of Labor

One of the economic scale is critical to increase the welfare of workers subject to the correlation that must be formed between work productivity and wages of labor. Direct economic consequence of achieving a correlation is to reduce production costs are determined by the relation (7):

$$DC_r = S_1\left(\frac{I_R}{I_W} - 1\right) \quad (7)$$

S1 is the share of wages in total expenditure. Corresponding to this reduction, significant savings can be achieved. Studying the effect of this correlation to one of the textile industry enterprises, it was found that each year has reduced consumption by the thousand lei wages net production, which helped obtain significant savings in production use. Between labor productivity (X) and development expenditure with wages that bald to l000 lei net production (Y) there is a hyperbolic inverse, relationship 8, whose parameters a and b are obtained by equations 9-10

$$Y = a + \frac{b}{X} \quad (8)$$

$$a = \frac{\sum Y \sum \frac{1}{X^2} - \sum \frac{1}{X} \sum \frac{Y}{X}}{n \sum \frac{1}{x^2} - \left(\sum \frac{1}{X}\right)^2} \quad (9)$$

$$b = \frac{n \sum \frac{Y}{X} - \sum \frac{1}{X} \sum Y}{n \sum \frac{1}{x^2} - \left(\sum \frac{1}{X}\right)^2} \quad (10)$$

Correlation Between Labor Productivity and the Potential Benefit Increase

Labour productivity growth is a factor reducing the costs to 1000 lei finished goods production, have a positive influence and indicators that depend on them: rate of benefit and potential benefit. The relationship between indices of benefit (Y) and labour productivity indices (X) in situation of an enterprise in the textile industry characterized by the model 11, where the correlation coefficient is R = 0.88 and determinationR^2= 77.44%.

$$Y = 1{,}513X - 0{,}476 \quad (11)$$

Potential benefit is obtained by expense reducing on the total economy in 1000 lei spent for finished goods ware and can be expressed in terms of productivity by model 12, where R is the benefit rate.

$$B_p = \frac{R}{1000} NWa \quad (12)$$

To the potential benefit increase a decisive role had productivity, benefit contribution rate and number of workers being in constantly decreasing. Correlating the potential benefit (Y) with work productivity

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(X) resulted equation 13, where the correlation coefficient is R = 0.92 and of determination coefficient $R^2 = 84{,}64\%$.

$$Y = -129 + 101{,}4X (13)$$

To achieve more effective use of assets it is necessary to increase production value obtained at 1000 lei at base assets and to have at base the increase at higher rates of work productivity compared with the level of technical equipment $(I_W > I_H)$. The global production indices correlation assets at thousand lei (Y) with those work productivity (X) it resulted (14), the correlation coefficient R = 0.99 and R^2 = 98,1%, indicating the high intensity of the relationship between variables

$$Y = 0{,}251 + 0{,}71X (14)$$

The link between labor productivity (X) and net assets in l000 lei (Y) was made in the form of the model 15, where R = 0.90 and R^2 =81%.

$$Y = 0{,}103 + 006X (15)$$

The connection between the first (Y) and work productivity measured by value of goods sold and collected (X) is linear, in conformity with the model 16 where the correlation coefficient is $R = 0{,}87$and the determination coefficient is $R^2 = 75{,}7\%$.

$$Y = 6{,}25X - 5{,}97 (16)$$

Study of Individual Factors of Work Productivity Growth

Work productivity level is influenced by many factors, primary and secondary, direct and indirect that overlap and sometimes act in different directions. Raising productivity is related to the existence of general factors acting in all social ordination. They refer to the fact that all appointing socioeconomic development of productive forces was accompanied by increased labor efficiency. Unitary classification of work productivity growth and their concrete analysis has great theoretical and practical influence to discover ways to increase productivity in business units. Regardless of the classification criteria of work productivity growth, in practice there is a constant intermingling between the direct and indirect factors, between the general and specific factors, between economic factors and the social and tennico material factors. Assessment of meaning and intensity of different factors action should be done using numerical quantities that reflect the essence of their quality. From this point of view there is always possible to quantify their influence. Systemic approach of intensive and extensive factors of labor productivity allows cyber representation of it. A direct connection is a sequential relationship between work productivity factors (labour technical equipment, qualifications of workers, labour organization, representing the input system), the growth of work productivity process (system set) and productivity (output accounting system). Reverse connection is the indirect link between productivity and its factors through a regulatory system that adjusts the size factor productivity growth factors as needed. Development and improvement of technical and material condition of productivity increased labour directly.

Productivity Factors Related to the Work Means

The growth of technical level of equipment, and improve their time use are key factors for increasing productivity in the textile industry, because they contribute to the modernization of production and improve product quality. In the practical application of these measures of work productivity, the textile industries enterprises act to expand production robotics to improve existing technologies and extend the moderns ones. Achieve a given level of work productivity in the textile industry is influenced by several structural factors such as increasing the share of group equipment performance, with superior technical features.

Correlation between Productivity and Technical Equipment and Electro-Energetical Power Level of Labor

Advanced technique exercises a double influence on work productivity: on the one hand, modern machines and tools, allow to each worker to perform in the same amount of time increasingly more products, on the other hand, by applying modern production technologies a shorten production

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processes, there is a high recovery of raw materials and materials, resulting in labor savings. In order to establish the correlation between technical equipment and direct work productivity, workr productivity computing relationship is expressed by the relationship 18 model 17 characterize the effectiveness of using fixed assets, and the relation 19 reflects the degree of technical equipment work. So, results that productivity is dependent on effective use of assets and the degree of technical equipment work.

$$W = \frac{Q}{N} = \frac{Q}{M_f}\frac{M_f}{N} = eH \quad (17)$$

$$\frac{Q}{M_f} = e \quad (18)$$

$$\frac{M_f}{N} = H \quad (19)$$

With the introduction of technical progress, higher tech level causes a higher value of fixed assets in production. At the same time, the effectiveness of fixed assets should increase since the introduction of more sophisticated assets, which can only be achieved when production indices ahead of those of the value of fixed assets $i_q \geq i_{Mf} \geq i_N$and at the same time$i_q \geq i_e > i_H$. If instead of global production, is considered newly created value and net labor productivity is analyzed, then the relation 20, H is the technical equipment and the work efficiency is reflected as net assets and is obtained by the ratio of net production and the values of fix assets.

$$W = eH \quad (20)$$

Another indicator of technical progress, linked to increasing fixed labor, is the level of electric power available for the work caracteriyed bz the electro-energetical consumption per worker. This indicator is experiencing a dynamic upward on the expansion of mechanization and automation of production processes. Correlating work productivity in this industry (Y) the degree of technical equipment (X_1) and effective use of fix assets (X_2), has established a multiple linear relationship 21 to be determined is necessary to resolve the model 22.

$$Y = a + bX_1 + cX_2 \quad (21)$$

$$na + b\sum X_1 + c\sum X_2 = \sum Y$$

$$a\sum X_1 + b\sum X_1^2 + c\sum X_1X_2 = \sum X_1Y$$

$$a\sum X_2 + b\sum X_1X_2 + c\sum X_2^2 = \sum X_2Y \quad (22)$$

Multifactorial Analysis of Work Productivity

Study ways to increase labor productivity in the textile industry shows that it is influenced by many factors, whose actions, most times, is overlapped so that accurately set the each is practically impossible. In these conditions, labor productivity growth reserves are unlimited, and their mobilization can have anytime, favorable effects.

Influences of various factors cannot always be quantifiable, between productivity and these links being established stochastic links that can be highlighted through statistical procedures. In order to study the action of the many determinants factors of labor productivity, we considered that these factors can be presented like a multifactorial model, (Y) is dependent on at least seven factors ($X_1 \ldots\ldots\ldots X_7$). Data analysis were used to refer to the company Rosko Textil, is given in Table 3.

Table 3. Labor productivity dynamics and its factors

Years	Y(W)	$X_1 = H$	$X_2 = e$	$X_3 = K$	$X_4 = g_d$	$x_5 = g_a$	$X_6 = g_s$	$X_7 = g_{cp}$
2009	118	141,3	83,6	98,76	59,40	23,44	43,50	79,60
2010	157	134,8	116,7	94,76	76,60	24,28	10,40	43,20
2011	192	130,7	147,5	83,10	89,00	34,85	19,40	29,70

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Productivity factors were grouped into two categories: one involving fixed assets ($X_1 = H -$ gradulendowment of labor and fixed assets, $X_2 = e -$fixed assets efficacy, characterized the report: Global Production (net) / fix assets, $X_3 = K -$the degree of work electro-energetical endowment of and others labor refers to work force $X_4 = g_d -$ share of workers exceeding standards; $x_5 = g_a -$ the share of workers working in agreement, $X_6 = g_s -$ the share of skilled workers, $X_7 = g_{cp} -$ the share of workers who have attended the training and retraining in the considered period). Multifactorial model of labor productivity 23 was solved by multiple correlation method. It was used to adjust "step by step" of nearby linking the two groups of factors ($X_1 - X_3$ şi $X_4 - X_7$) with productivity (Y) until achieving a maximum conditioning, each time adding one new factor, thus resulting in a number of 11 equations represented by relations 24-34.

$Y = f(X_1 \ldots\ldots\ldots\ldots X_7)$ (23)

$W_1 = 329{,}099 - 0{,}9667H;\ R = 0{,}06; R^2 = 0{,}36\%;$ (24)

$W_2 = -0{,}914 + 1{,}363e;\ R = 0{,}993; R^2 = 98{,}6\%;$ (25)

$W_3 = -266{,}56 + 1{,}478H + 1{,}394e; R = 1{,}00; R^2 = 100\%;$ (26)

$W_4 = 851{,}498 - 7{,}3237K;\ R = 0{,}79;\ R^2 = 62{,}4\%;$ (27)

$W_5 = -118{,}858 + 3{,}7377g_d\ R = 0{,}906; R^2 = 82\%;$(28)

$W_6 = 96{,}405 + 1{,}9738g_a;\ R = 0{,}864;\ R^2 = 74{,}6\%;$ (29)

$W_7 = -56{,}64 + 2{,}4955g_d + 0{,}8379g_a\ R = 0{,}93\ R^2 = 86{,}5\%$ (30)

$W_8 = 157 + 0{,}915g_s\ R = 0{,}412;\ R^2 = 16{,}9\%$ (31)

$W_9 = -17{,}1919 + 1{,}889g_d + 1{,}383g_a - 0{,}3622g_s;\ R = 0{,}933;\ R^2 = 87\%;$ (32)

$W_{10} = 294{,}041 - 2{,}1889g_{cp};\ R = 0{,}73; R^2 = 53{,}3\%;$ (33)

$W_{11} = 42{,}29 + 1{,}2511g_d + 1{,}5745g_a - 0{,}4041g_s - 0{,}3045g_{cp};\ R = 0{,}934; R^2 = 87{,}2\%$ (34)

Multifactorial analysis of work productivity per unit on atextile industry example allows some important conclusions for the interaction of growth factors in undertaking this indicator: increase work productivity achieved under the lower level of technical equipment, the link between these indicators are virtually negligible (R = 0.06). Effectiveness of fixed, but labor productivity condition (W_2) in proportion of 98.6% and correlated with the first (W_3), determined it totality (R = l). The degree of electroenergetical put under condition the work productivity (W_4) at a rate of 62.4%, while between indicators established an inverse correlation. Increasing the share of workers who exceed the standards and extension work in influencing the production agreement (W_5, W_6) taken both separately, but rather correlated (W_7), increasing the degree of conditioning (R = 86.5%). Increasing the share of skilled workers affects productivity growth (W_8) only in a proportion of 16.9% but with the other two previous factors, helping increase its conditioning (W_9). Finally, labor productivity in the enterprise considered (W_{10}) increased, while reducing the specific weight of the workers were skilled or perfect in that period correlating factors related to labor productivity (W_{11})on the notion of their combined high proportion (87.2 %). Besides the factors mentioned, the work productivity in the textile industry is influenced by a number of factors related to organization and scientific management of production and work and a number of factors, psychosocial (fluctuation, integration work, interpersonal relations and psychosocial climate) and politics. For this purpose, it is considered that labor productivity growth stocks refer to those tori are unactivated enough that at one time can be put out in business. Recovery of these factors depend on the conscious activity of people, imposing measures on multiple levels.

DIRECTIONS FOR FUTURE RESEARCHS

As research directions can be considered: to develop models for determining staff planning ahead using methods or development of mathematical models of work organization costs reduce

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CONCLUSION

On work productivity growth was achieved at a theoretical mathematical models to determine the correlation between labor productivity growth and output growth, the correlation between labor productivity and reduce production costs and the correlation between productivity and technical equipment and electrical power level work. In terms of labor productivity factors developed a multifactorial model of labor productivity.

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