THE ROLE OF THE TECHNICAL IMPROVEMENT IN THE DEVELOPMENT OF THE HUNGARIAN AGRICULTURE

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Key words: the measuring of the technical-economical progress, mechanization, technical development.

CONCLUSIONS

In our research work we have read the domestic and the international professional literature. Based on them and our research work we defined the agricultural technical improvement. The main tasks of the technical improvement of the agriculture in the future are the following:

- **Application of the biotechnological achievements.**
- **Improvement of the environment saving technologies, assurance of the maintainable development of the agriculture, by retaining the production bases – the soil, the biological environment, and the work power of the agricultural workers.**
- **Adaptation of the precision plant cultivation systems.**
- **The universal objective of the agrarian-technical improvements is to provide technical base for the maintainable agricultural production. It requires the development of such production technologies, which protect the environment and the landscape, the soil and water reserves, ensure the quality of the product and the economy of the production.**
- **The development of a coherent system of the electronics, informational technique and automation, the construction of the information network of the agriculture and the transfer of the connected knowledge.**

The engine of the technical improvement is the continuous investment and the introduction of the new achievements of science as fast as possible. Without investments there is no technical improvement on the merits, but at the same time the investments lead to a proper technical improvement if it is based on a proper economy developing strategy, and if it is coupled with a technical developer and organizer activity. During our researches it was proved that:

- **In the analysed time period, in the case of the examined sectors was a great difference between the area's productivities.**
- **To measure the partial effectiveness of the production factors the Cobb–Douglas-type production function is good for the examination of the importance of the production factors in the case of a proper data base.**

The key of promoting the advance is the economical acceleration of the technical progress. The non-recognition of the rate or the characteristics of the technical progress, its improper explanation may lead to great losses. Due to the special importance of the rate of the technical improvement, we need to pay special attention to all circumstances and factors, which boost the technical improvement, make the approach of the world standard possible and the catch-up with

its progress. Therefore, we need to take advantage of all opportunities, which are available for us due to our membership in the European Union.

ABSTRACT

The technical supply and technical level of the Hungarian agriculture is far behind the more developed European countries'. As per our opinion the effective, quality and competitive production of goods is only possible to implement with modern technology, which makes the current technical level necessary to be improved. Due to the current situation of the Hungarian agriculture, the clarification of the definition of the technical development and the determination of measuring the technical progress, the theme is quite topical. The technical, technological development, in the scarcity conditions so typical of the sources, is a significant factor of the increase of the potential output, and it has an important role in determining the level of the real output; their significance is outstanding at the beginning of new eras. Considering the improvement possibilities of the agrarian sector, our accession to the European Union and the importance of the technical development in the agribusiness, it makes the theme even more remarkable.

INTRODUCTION

A man thinking rationally makes plans for the future. However, our activity may only be successful if we analyse the past, as well, if we consider all factors determining the previous results. The agricultural production is an important sector of our national economy; it has a significant role in the supply of the population, in the export and in the balanced, proportional economical development. These collectively provide ground for us to pay attention to the theoretical and topical practical issues of the agriculture's development.

The dynamic development of the Hungarian agrarian sector in the 1970s was due to the technical development with a scientific base and institutional systems adequate to the economical-social relations of the time. Then nearly two decades later, in the 1990s extraordinary and significant changes occurred in the world's agriculture. In our country the property and land relations changed, the controlling institutional system transformed, the growth of the agrarian economy stopped, and we witnessed a continuous decline. The privatization of agricultural lands affected nearly three quarters of the country. After the privatization of the lands, the production has declined in terms of quantity, as well as quality. The agriculture has been fighting a general lack of income and capital. In this sector there has been a continuous failure of competitiveness and an absolute decrease of the production compared to the European standard. In the developed countries, where, due to the industrial-like agriculture, over-production replaced the lack of food-products, the multiplying, negative environmental effects of the industrial-like production have become obvious. The demand for labour power supply of the agriculture has disappeared; the industrial production and the constantly improving service sphere do not show a remarkable demand for surplus labour either; therefore the social target is more likely the development of the area's ability to retain the population, rather than the further release of labour power. This change, and the failure of the previous domestic agrarian policies, force to make reforms and to change direction in the technical progression.

We believe that in order to maintain, improve the competitiveness of the agriculture of our country, we need a continuous technical progress. As per our opinion the effective, quality and competitive production of goods is only possible to implement with modern technology, which makes the current technical level necessary to be improved. An outstanding issue of the integration into the European Union besides the agricultural production standard and quality, is the profitability, on which the technical improvement has a significant affect. Based on the above specified thoughts of ours, the clarification of the development conditions of the agrarian economy, the discovery of economical connections important in terms of growth, and the scientific base and support of the decision-making of the managing apparatus are very important.

MATERIAL AND METHODS

The technical improvement always appears in a specific production process and it generally manifests either in more or better quality products, or in the reduction of the production costs. The cultivation of plants in our country is quite diversified, the number of the grown plant species can be considered rather high. In our researches we selected four principal plant cultivation products of the production structure of today's Hungarian enterprises, where the elements of the technical progress can be tracked well, and the main features of the process can be discovered. They are the following: wheat, corn, sunflower and sugar-beet.

INFORMATION BASE SERVING AS THE BASIS TO THE EVALUATIONS

The information necessary for the calculations between 1990 and 2004, for their characterization and for the description of their condition can be found among the result data of the General Agricultural Conscription performed in 2000 by the *Central Statistical Office (KSH)*, the data of the Agricultural Statistical Abstract of KSH covering all the agricultural enterprises, the data of the Research Institute for Agricultural Economics between 1990 and 2000, and the data of test operations which have been in process for years (*Béládi – Kertész, 2001, 2003, 2005*), where the data providers are sole proprietorships and companies, which belong to the network of the agricultural test operation. The latter is representative, therefore it is very important to be aware of its most essential features.

METHODS APPLIED DURING EVALUATIONS

We are using conventional and modern statistical and mathematical-statistical methods. Among the modern mathematical-statistical methods our aim at take advantage of the possibilities of correlation and regression calculations. Among the multivariate regression and correlation connection we specify the tervariant linear connections and the so-called Cobb–Douglas-type production functions. We performed our calculations by using the EViews 3.1 statistical, econometric program package, which is based on regression calculations.

RESULTS AND DISCUSSION

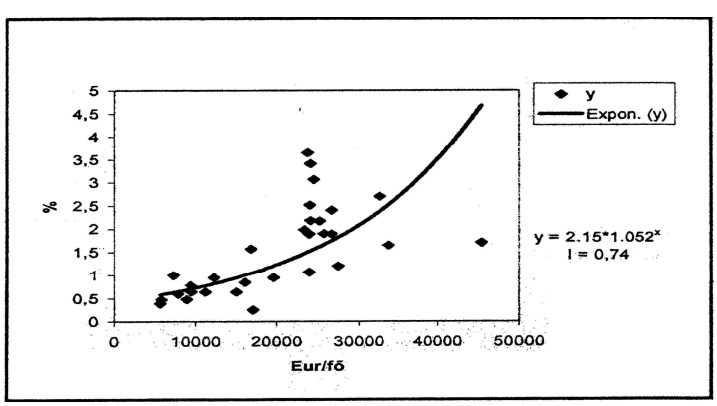
Studying the domestic and international professional literature (*Andrássy, 1998; Cummins – Violante, 2002; Dimény, 1975; Freeman – Soete, 1999; Husti, 1998*) we can state that neither in our country nor abroad has been a unified point of view developed regarding the definition explanation of the agricultural technical improvement. Some regarded the technical improvement to the tools,

processes coming from the industry, others included all processes here which had a scientific base. However, they agree on one thing: the central element of the growth-theories is the continuous technical improvement everywhere. By the agricultural technical improvement, we mean all technical, biological, genetic, human, organizational-control, informational and informatic activities of the science and direct production work, which we use to substitute the conventional with a new one, which changes the production tools, the condition system of the production, the work processes and the produced products for the society or for a smaller community in a useful way. The technical improvement cannot end in itself, it has strictly required economical purposes, and these purposes are in direct connection with the objectives of the agrarian sector. Therefore, the social-economical conditions of the technical improvement are determined by the social-political objectives. In the previous years we participated in several researches, team works, which were searching for the possibilities of measuring the technical-economical progress (*Késmárki-Galli, 2002*).

The engine of the economical growth is the continuous technical-economical reformation, the innovation, for which the high-quality basic and applied research can provide ground (*Szűcs et al., 2006*). The ecological abilities of the Hungarian economy are good, they are much more favourable than the neighbouring countries', thus than other countries' in the European Union. But at the same time the detriments arising from the technological fallback may ruin the benefits arising from the favourable ecology. Analysing the development level and the R+D activity (Research + Development) of the countries in the world, based on Figure 1, it can be stated that between its proportion compared to the GDP/person there is an $(r = 0{,}70)$ exponential type connection with high intensity (*KSH, 2002*). According to the parameters of the function, the countries in which the index number indicating the development level of the 1.000 EURO/person is higher, in average the amount spent on R+D activities is 5.2% higher compared to the GDP.

Figure 1

The exponential connection between the proportion of the GDP/person and the R+D expenditures compared to the GDP



Source: KSH (2002) it is a self-calculation based on the data of 32 countries (without the data of Luxemburg)

Our conclusion: The more powerful the economy of a country is, the more money it spends on maintaining and improving its technical level.

The opportunities of utilizing the results originating from the scientific research activities depend on the type of the results, whether they are the results of basic researches, applied researches, or experimental developments. The method of utilization of the basic research results is the decision of the financer. The client (state, enterprise, private person) either transfers the basic research results to the applied research sphere or makes them public domain (makes it available for anyone through direct sale or direct publication). The production factors (land, capital and labour power) have a special connection with each other in the agriculture. The labour power can be substituted by the capital (mechanization, agro-technique), the land and other geographical abilities may influence the level and the profitability of the production. In the production processes the production factors must be improved to become production technology; its ultimate goal in terms of the enterprise is to generate profit.

Basic formula:

Income – Expense = Profit (amount)

Price – Cost of production = Profit/unit of product

It has been either repressing or releasing the human mind for three-four centuries. It has been destroying those calculating incorrectly, or supports the more fortunate and more efficient participants to get into the regions of the economy.

Our conclusion: In the defective markets the competition between the enterprises depends on the differences of the production costs of the units. Furthermore naturally the size of the production, the improvement of the products' market position, the achievement of more favourable sale prices are important but not determining elements of the competition (*Szűcs et al., 2004*).

Analysing the economical theory of the return, we must emphasize that the economical condition of the development of all types of factor return is the application of the proper technology in the production process. In order to understand the significance of the technical progress, first the quantification of its effect has to be performed, and the necessary methodology has to be developed. To measure the success of the basic and applied researches, scientology recommends several methods (publication index-numbers, citation indexes, etc.). The measuring of the effect of the technical progress integrating into the production processes (manifesting) requires the application of more complicated mathematical-statistical methods. The separation of the return of the factors can usually be approximately calculated with the Cobb–Douglas-type production function in the case of a specific condition system. With a little modification, the C–D-type production function can be made proper for measuring the technical progress. The calculation method must be based on further simplifying assumptions even in this simplified form.

- The production process can be characterized on the different levels of the production through a production function, where the production function stands for the maximum production possibility.
- The producers either minimize their costs, or maximize their income.
- The markets are competitive and the participants of the market are price-takers, who can only change their own production, but cannot change the prices.

These conditions do not necessarily emerge in reality, but in numerous cases the actual market circumstances ap-

proach these conditions quite well. If we demonstrate the classical work-capital-land factor effect through the function $y = f(M,T,F)$, the production function expressing the technical progress, as well, can be defined as follows: $y_k = f(M,T,F,H,t)$, where:

y: profit; M: labour content (Work); T: capital tie-up; F: land; H: R+D (Research+Development) – the proportion of expenditure compared to all the sector GDP; t: the average time-requirement of the introduction of new scientific results (month, year). The modified function should be: $y_k = aMT^{\beta}F^{\lambda}H^{\delta}t^{\varepsilon}$, where the factors' index stands for their volume return. To calculate the distribution rates, we transform the function into a logarithmical version:

$$\log y_k = \log a + \log M + \beta \log T + \lambda \log F + \delta \log H + \varepsilon \log t$$

The contribution of the R+D -activity to the generated profit defined in

$$H_{p\%} = \frac{\delta \log H}{\log y_k} \cdot 100$$

The role of the time period necessary for the introduction of the research results in the profit generation:

$$t_{p\%} = \frac{\varepsilon \log t}{\log y_k} \cdot 100$$

Our conclusion: The larger difference between the effectiveness of the technologies production, and the larger surplus profit due to the technical progress, the more urgent promotion of the introduction of new technologies is (its motivation, or its force).

The specified function, besides the macro economical level, is proper for examinations on sectoral and regional level, as well, if we can develop the information base necessary for the calculations.

The main factors affecting the technical progress in the case of the emphasized domestic arable plants

We tried to measure the size of the effect of the technical progress in the depth of product size by adjusting different types of binary and multi variable regression formulas. Primarily, we have chosen the factors, which mainly carry the results of the technical improvement and their effect manifests in the increase of returns, in the improvement of quality, thus in the decrease of the production cost of the unit of product, and in the increase of the profit (income). We organized the considered factors according to Figure 2.

Figure 2

The independent and dependent variables I considered during our calculations

		Independent variable
Factors (x_i)	x_1	Land quality/Average golden crown value (GC/ha)
	x_2	Cost of the artificial fertilizer (HUF/ha)
	x_3	Wage (HUF/ha)
	x_4	Production cost (HUF/ha)
	x_5	Sale price (HUF/t)
	x_6	Overall direct costs (HUF/ha)
		Dependent variable
Connection (y_i)	y_1	Harvest average (t/ha)
	y_2	Income (HUF/ha)
	y_3	Production value (HUF/ha)

Source: Based on our calculations

For our calculations we have established a total of 72 binary regression estimations. Then in our research we established 8 multi variable regression estimations, as well. We calculated the multi variable regression estimations by products for the following variables:

$$y_2 = f(x_{11}, x_{13}, x_{16})$$

$$y_3 = f(x_{11}, x_{13}, x_{16})$$

During the preliminary calculations, the binary regression formulas and the correlation matrix prove that between the chosen independent variables the correlation is not so strong, therefore the problem of multi collinearity does not interfere the performance of the adjustment of regression formulas. Based on the correlation matrix in can be stated that surprisingly between the more significant factors, costs there is a relatively law correlation connection. Its main reason is the transformation of the entire agriculture during the examined time period. The operational relations and the organizational solutions ensuring the harmonization of the production factors have not yet consolidated. In order to be able to perform our analysis, to define our suggestions, our analysis had to be narrowed down to the examinations of connections professionally estimable. Based on all these, in our research we considered the values above $\pm 0.75 \leq r$ to be high, strong, estimable connections. The square number of the correlation coefficient is the determination coefficient *(r^2)*, which shows that the independent variable gives explanation for the value of the dependent variable in percentage, what proportion of the entire change in the stochastic connection can be explained with the *x*. In our research we consider the value $0.5 \leq r^2$ to be high, acceptable. From now onwards we pay attention to the connections reaching these values. In the cases of the wheat, the corn, the sunflower and the sugar-beet, we found the professionally estimable connections between the factors demonstrated in Table 1, and for the closeness of the binary connections and the determination coefficients with two figure accuracy.

Based on the regression line's *„b"* parameters, we can put down the following statements:

- The enterprises, in which the cost of the artificial fertilizer is HUF 1 higher, have a production value higher with HUF 6.20 in the case of the wheat, HUF 7.48 in the case of the corn, HUF 12.32 in the case of the sunflower and HUF 12.35 in the case of the sugar-beet. We could reach to a more correct result if we could examine the connection of the usage of natural fertilizer and the achieved natural production average. However, due to the problematic transformations going on in the temporary time period, we did not have the opportunity to do so. We can still state that in the case of all plants, the increase of the cost of the artificial fertilizer (behind which we may assume a natural increase) clearly increased the harvest average.
- If the sale price increases with HUF 1, the production vale for 1 hectare grows with HUF 3.51 in the case of the wheat, HUF 5.77 in the case of the corn, HUF 1.45 in the case of the sunflower and HUF 38.63 in the case of the sugar-beet. Therefore, the development of the sectors' production prices has an essential importance in terms of the successfulness of the sectors.
- Comparing the „*b*" parameters of the functions of the production value-production cost and the production value-overall direct costs, we can state that the general cost increase has a negative effect on the development of the production value.

Table 1

The parameters of the professionally estimable regression functions of the wheat, the corn, the sunflower and the sugar-beet

Connection between the factors $y = f(x)$	Parameters of the regression function in the wheat production	r	r^2	Parameters of the regression function in the corn production	r	r^2
Production value – the cost of the artificial fertilizer for 1 ha ag area	$y_3 = 16082.77 + 6.20 \cdot x_2$	0.87	0.76	$y_3 = 14197.50 + 7.48 \cdot x_2$	0.89	0.80
Production value – production cost	$y_3 = 13692.70 + 0.87 \cdot x_4$	0.88	0.78	$y_3 = 6257.41 + 0.99 \cdot x_4$	0.92	0.84
Production value – sale price	$y_3 = 8147.47 + 3.51 \cdot x_5$	0.98	0.95	$y_3 = -2739.25 + 5.77 \cdot x_5$	0.88	0.77
Production value – overall direct costs	$y_3 = 17376.14 + 1.01 \cdot x_6$	0.87	0.76	$y_3 = 10707.83 + 1.16 \cdot x_6$	0.92	0.85
Connection between the factors $y = f(x)$	Parameters of the regression function in the sunflower production	r	r^2	Parameters of the regression function in the sugar-beet production	r	r^2
Production value – the cost of the artificial fertilizer for 1 ha ag area	$y_3 = 12537.37 + 12.32 \cdot x_2$	0.94	0.88	$y_3 = 30404.05 + 12.35 \cdot x_2$	0.97	0.94
Production value – production cost	$y_3 = 10052.33 + 0.81 \cdot x_4$	0.96	0.92	$y_3 = 11045.83 + 0.91 \cdot x_4$	0.97	0.93
Production value – sale price	$y_3 = 7256.85 + 1.45 \cdot x_5$	0.96	0.92	$y_3 = -9264.39 + 38.63 \cdot x_5$	0.97	0.94
Production value – overall direct costs	$y_3 = 13554.25 + 0.95 \cdot x_6$	0.96	0.92	$y_3 = 19531.66 + 1.06 \cdot x_6$	0.96	0.92

Source: they are our calculation based on the test operational data base of the RIAE

Based on the calculations we can also state that between the harvest average and the chosen principal independent variables there is a weak or medium connection, but all in all, between the production value and the independent variables a relatively strong connection can be observed. With the support of the production functions we performed further economical calculations. We should have got the more real results in the case of the measuring of the effectiveness if we had calculate in relation to the natural effectiveness. In the analysed time period, we doesn't got proper informations because the production system and its record system was transformed. Therefore we need to calculate with the index value which raise a different economical problem, especially in the analysed time period in our country the inflation rate was very high (*KSH 1992, 1998, 2002, 2005*), thus difference of substance is between the growth of the production factors and the trend value. But we think that the calculations are utilizables in certain respect for the verification of adaptability of the methodology. Namely in the case of the examinations of connections between the index values we take it that the inflation effect is in all factors, thus at bottom it doesn't affect the function. We estimate the limit productivity and the marginal rate of the substitution, but based on our calculations – due

to the low correlation connection and the doubtful details – in the economic it doesn't or very difficulty bear such interpretation.

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