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Price transmission and its analysis in the milk and dairy sector: a survey

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Abstract

Price transmission is used by agricultural economists to examine market efficiency especially in the food sector (product lines). This article surveys accomplishments in this field since Gardner's landmark 1975 study. It concentrates especially on the approach and measures in price transmission, the dairy sector, with emphasis on competition as the most influential factor. Much of the literature claims that in developed countries market structure in food industry is characterized by oligopoly, and that the trade sector has significant and growing market power in Europe. Therefore, price transmission between farmers and retailers is imperfect, asymmetric and delayed. Certainly, besides market power, price transmission is influenced by several factors. A deciding factor is whether the current market situation is controlled by the push of supply or the pull of demand. Furthermore, statistical tests for price transmission also have problems. For this reason, the authors make the following suggestions: clearly state the purposes of price transmission analyses, compare its measures, and verify its tests on the same samples and the ways of using it in economic policy.

Key words

Price transmission, elasticity, asymmetry, competition, market power, dairy sector

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The concept of price transmission

Price transmission means a complex price impact, during which prices for several products or sectors (markets) impact on one another, determining (starting) prices that pass in either direction, causing economic interactions between the products or sectors concerned. Dhar and Cotteril (2002) refer to cost pass through rate as an alternative term for price transmission. Economists studying price transmission claim that these complex price impacts integrate different markets both vertically and horizontally (Meyer and Cramon-Taubadel 2003, Tóth 2003). If this fact is applied, price transmission analyses would be widely used in studying the effectiveness of market functions. Nevertheless, extensive studies on the national economy are difficult to find (Peltzman 2000). In a paper surveying 38 price transmission tests conducted between 1980 and 2002, apart from the food sector, only in oil product and money transfer (interest rate) sectors can these types of studies be found (Meyer and Cramon-Taubadel 2003).

Presumably it is no coincidence that price transmission studies are most frequently conducted by **agricultural economists**. The theory first emerged in US literature in the 50s (Hildreth and Jarett 1955). Nevertheless, in the book 'Agricultural Product Prices' by Tomek and Robinson (1972) the term 'price transmission' cannot yet be found, but George and King (1971) also used the term 'price transmission elasticity', and Gardner (1975) worked out an often-quoted theoretical model to examine interactions between farm prices and retail prices. In his article's title he employed the term '**price spread**', referring to a widening price margin (caused by price transmission); though in the discussion part he refers to price transmission elasticity. Wohlgenant (2001) considers farm-to-retail price spread as a synonym of marketing margin.

In agricultural economic literature, studies concentrating on horizontal price transmission can be found (eg. Bailey and Brorsen 1989, Mohanty et al. 1995, Abdulai 2000), but more typical are studies on **vertical price transmission**. The reason for this is that farmers and consumers think that in the processing and trade sectors competition is imperfect and that these sectors take advantage of their market power. They often express their opinions, prompting Congress to order the General Accounting Office to examine price changes in the dairy sector (Nicholson and Novakovic 2001).

Certainly, studying price transmission is neither the only way to determine whether joint markets are competitive, nor the only way to analyse their operation. Nicholson and Novakovic (2001) suggest studying profit and margin as well as for additional information. Still in literature the use of price transmission as an indicator for the functioning of vertical markets is widespread. The reason might be the accessibility of price data (in contrast to profit data); furthermore, working out the theory and the econometric methods of price transmission is a big challenge for economists.

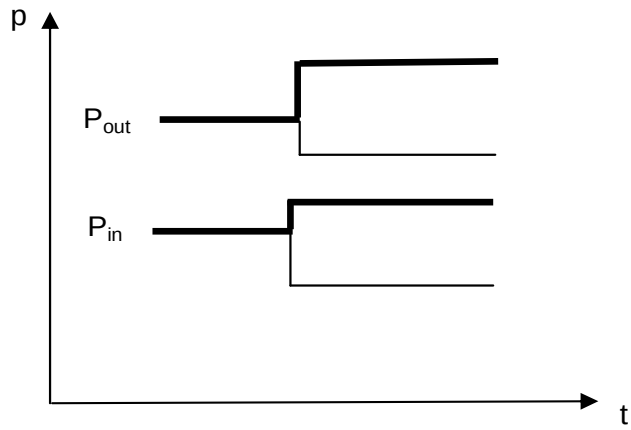
Much of the literature examines whether price transmission is symmetric or asymmetric. Price transmission is symmetric if price increase or decrease in one market (for e.g. in the raw milk market) is followed by similar changes in the other market (for e.g. the bottled milk market). This similar reaction applies to the direction, the extent, and the speed of price reactions. In other cases, price transmission is asymmetric. Some presumptions concerning price transmission are the following:

- Symmetric price transmission characterises competitive markets, while non-symmetric price transmission denotes that the market is non-competitive or imperfect.
- Perfect (complete) price transmission tends to prevail in the long run, while asymmetric or incomplete price transmission prevails in the short run.
- Another important presumption deals with the direction of price transmission. If price is determined by suppliers (for e.g. dairy farmers), cost pressures drive the process of price transmission. However, if price is determined by demand (for e.g. milk consumers), demand pressure drives price transmission. (Kinnucan and Forker, 1987).

Non-symmetric price transmission has several **types**:

- In the first type, the change in input and output price occurs simultaneously, asymmetry is caused by the difference in the extent of changes, as it is shown in Diagram 1.
- If the input price decreases by a certain amount, the output price might decrease as well, but on a smaller scale. At the same time, increase in input price causes an increase in output price, in most cases on a higher scale.

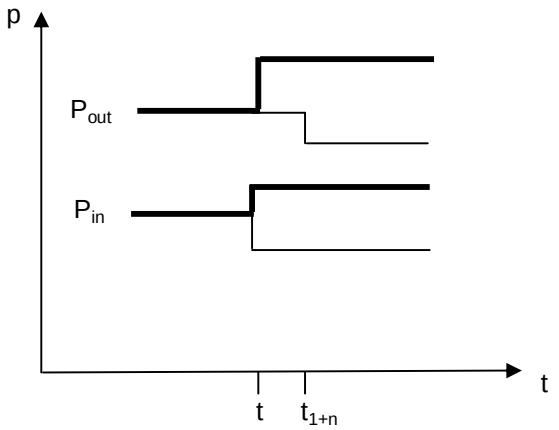
Diagram 1: Asymmetry in the extent of price change



Source: Meyer and Cramon-Taubadel 2003

- In the second type, changes in input and output prices occur at a different time, as shown in Diagram 2. The diagram shows price increasing and decreasing at the same time. An increase in input price is immediately followed by the same increase in output price. However, if input price decreases, the speed of the decrease in output price is slower. This delay enables a given sector segment to obtain an additional profit.

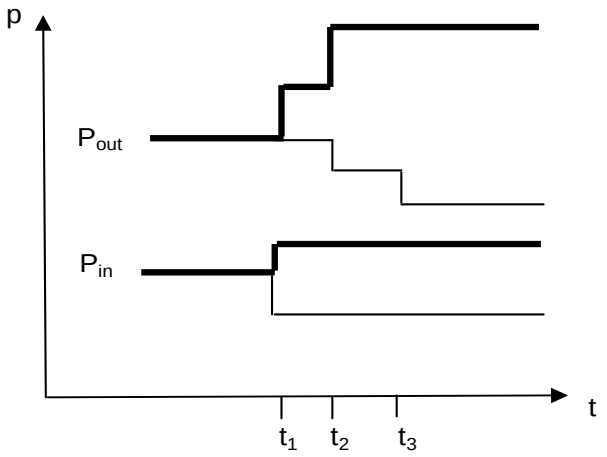
Diagram 2: Asymmetry in speed of price change



Source: Meyer and Cramon-Taubadel 2003

Usually the combination of these two types is common in practice, as shown in Diagram 3.

Diagram 3: Combination of asymmetry in extent and speed of price change



Source: Meyer and Cramon-Taubadel 2003

- In such a case, increase in input price causes an immediate increase in output price, whose change is greater in degree but also takes place over time and operates gradually. Similarly, the decrease in input price affects output price, and this change is greater and takes place over time and operates gradually.

> This asymmetry can be either positive or negative. **Positive asymmetry** means that output price follows input price at the same speed and to the same extent, but decreases to a lower extent. **Negative asymmetry** means that output prices follow the increase in input prices at the same speed and to a smaller extent, but follow the decrease to the same extent. (Kinnuchan and Forker 1987, Nicholson and Novakovich 2001)

To understand the problems of price transmission, some more concepts and interrelationships have to be discussed. The most important are the following:

Price transmission between agriculture and food consumption is highly influenced by commercial pricing mechanisms. Here, periodic **markup pricing** is typical, which was first examined in detail and tested for 22 food products by Heien (1980). Certainly, markup pricing has menu costs or repricing costs, so the commercial sector ceteris paribus has no interest in frequent price changes. This causes rigidity and inflexibility in food product prices. The concept of **price rigidity** is older than that of price transmission (Means 1935), though it is still in use. For example, Azzam (1999) studies commercial price rigidity in firms in spatial competition. Certainly, price transmission can be examined not only for agricultural raw materials, but also for the **marketing costs** of food products, usually meaning the total of processing and trading costs (Romain et al. 2002).

Another reason for price transmission being non-symmetric or imperfect is the processing or retailing sector's **market power** in the food business. New marketing theories and practices claim that within food supply chains farmers have been replaced by retailers in terms of **price leadership**. Kuiper and Meulenberg (2002) studied Dutch food supply chains regarding vertical pricing. Furthermore, the **inflation rate** can highly influence commercial behaviour. This fact has been indicated by price transmission analysis in Brazil (Aguiar and Santana, 2002). Given the high inflation rate, people could tolerate high rises in prices, irrespective of the industries' economic power. Therefore in the case of transition countries, this factor has to be taken into account. Apart from inflation, there are other factors influencing both the extent of price transmission and the impact of economic power: this is called **returns to scale**. McCorrison et al. (2000) point out that if returns to scale are not constant, it may offset the effect of economic power. From this point of view Millan (1999) examined the food market in Spain. He found that returns to scale increased in each of the 16 industries being examined, except in the bread and flour industry.

Measuring price transmission

Price transmission analyses entail qualifying speed, extent and symmetry. (Palaskas 1995).

Price transmission elasticity index is most important in demonstrating price transmission rate. As it is expressed as a percentage, it is easy to use in international comparisons. Regarding the food supply chain, usually farm to retail price transmission is examined, where price transmission elasticity – putting it in common language – shows that if farm price increases (decreases) by 1%, how much the consumer price of processed products would increase (decrease). This type of measure is usually backed by the implicit assumption that price transmission moves from the farmer to the consumer.

In the food industry, Gardner (1975) was the first to theoretically examine (by means of mathematical deduction) price transmission elasticity's determining factors regarding

competitive relations. In his model he assumed that in the food marketing industry there is one output product (x) and two inputs: agricultural product purchased (a) and other marketing input (b), the latter including both processing and commercial costs. The model included 6 equations with 6 endogen variables (x, a, b quantitative variables and P_x, P_a, P_b price variables). The excellence of the article also stemmed from the fact that before measuring price transmission elasticity, it also examined the basic price indices in the supply chain. The article examined:

- the **difference** between consumer price and farm price (P_x-P_a), called price gap by Tóth (2003)
- the ratio of these two prices P_x/P_a
- the rate of the farmer's share of the food dollar P_x/xP_a
- the percentage marketing margin $(P_x-P_a)/P_a$.

Relative to the price transmission elasticity **rate**, Gardner found that it has to be determined by two situations (and formulas): if price changes derive from the agricultural supply, E_{PxPa} is smaller than 1. However, if the price change is caused by a change in food demand, the elasticity of price transmission amounts approximately to 1. Moreover, it can be even higher (if supply price elasticity of agricultural products exceeds that of other marketing inputs).

Gardner's estimations have been confirmed by Kinnucan and Forker (1987). Using the same formulae, they found that, in the case of supply cost push price transmission, elasticity ranged between 0.40-0.50 while if demand shifted price transmission elasticity ranged between 0.75-1.50. Moreover, these authors published empirical data as well for different milk products. They managed to differentiate between cases of price increases and decreases as well as short- and long term price transmission elasticity. In each case price transmission elasticity was below 1. Coleman (1985) introduced the notion of 'perfect transmission' for price transmission elasticity as being 1.

Palaskas (1985) used 3 tests to study whether perfect price transmission applies in the long run and also in the short run. In the first test he surveyed if the pricing time series are mobile. In the second test he examined whether the time series are co-integrated, namely the two conditions necessary for long-term interaction between price time series. Therefore, he used Dickey-Fuller (DF) or the augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1979, 1981). The third test was conducted to determine if price transmission elasticity, b=1, namely perfect price transmission applies. To find out, he calculated co-integrated regression, where statistical verification of the b-coefficients rates is performed with a maximum likelihood t-test. To summarize the analysis made for 7 EU member countries and 5 product lines they found that, unlike in the long run, perfect price transmission does not usually prevail in the short run. On the other hand, price transmission elasticity rates usually exceeded 1 (ranged between 0.85 and 2.08).

To determine another important feature of price transmission, i. e. whether it is symmetric or asymmetric, different **statistical tests** are also applied. 4 group of methods have been worked out, and today the first two are called pre-cointegration approaches (Meyer and v. Cramon-Taubadel 2003), the third is called error correction models (ECM), while the fourth is called the threshold method.

The function of price transmission can simply be written as a one-variable, linear regression equation, entailing onward price imparts and for processors, symmetric, and linear pricing behaviour. In this case the dependent variable is the price of the end-product (e.g.

milk) and the sole independent variable is the price of agricultural raw material (e.g. raw milk), while the regression coefficient represents symmetric price transmission. To conduct the simplest price-symmetry test, this regression coefficient has to be divided in two, introducing two dummy variables, which differentiate between increases and decreases in the price of the agricultural raw material. The extent of the divergence between the two regression coefficients is then checked by a standard F-test. In agriculture, Tweeten and Quance (1969) introduced differentiation between regression coefficients according to price increase or decrease, by means of dummy variables (regarding supply functions).

Compared to the simplest price symmetry test, improvements have already been made in terms of the co-integration period. Instead of using original price data, Wolffram (1971) introduced the use of their **first differences**, when the recursive sums of the positive and negative price changes are the explanatory variables in the regression equation. Gollnick (1972) modified the regression equation by eliminating the **summing procedure** in the first differences. Houck (1977) and later Ward (1982) improved specification price transmission equation specification. Ward introduced **lags** in explanatory variables. Boyd and Brorsen (1988) differentiated these lags so that the **magnitude** and **speed** of price transmission could be distinguished.

Later V. Cramon-Taubadel (1998) pointed out that building the price symmetry test on the above regression equation's traditional specification is not consistent with the fact that time series are co-integrated. The regression equation's specifcation, based on the first differences, leads to incorrect specification in the long-term interaction of prices. To eliminate this problem, introduction of an error correction model (ECM) was suggested, which was first used in econometrics by Granger and Lee (1989).

The fourth group of methods include **threshold models**. Scientists began with the idea that in a product line's later stages (in the processing industry, in commerce) price reactions are not linear, meaning they only occur if the farmer's price impulses exceed a critical threshold. Tong (1983) introduced threshold models in the time series studies. Since then, the various threshold models have become more and more popular, e.g. the Threshold Autoregressive model (TAR), (Ben-Kabia et al. 2002).

After **comparing** the 4 methods in terms of the ratio of tests leading to non-symmetric price transmission, an interesting result was obtained (Meyer and v. Cramon-Taubadel 2003). 38 different papers were published between 1980 and 2002, including 197 individual tests. The number of tests and the rejection ratio for symmetric price transmission are illustrated in the table below:

	Number of cases	Price symmetry rejected (%)
All cases	**197**	**48**
Out of which:		
1. Models using first differences	93	68
2. Models using the sums of first differences	47	23
3. Error correction models (ECM)	31	45
4. Threshold models	10	80

Thus, around half the cases examined resulted in non-symmetric price transmission. However, the general ratio fluctuates according to the test method used: it ranged between 23 and 80 %. The problem stems from the fact that there is no exact tendency between the rejection rates in previous methods (methods 1 and 2) and after (methods 3 and 4) co-integration. The rejection rates did not differ significantly in the case of methods 2 and 3, and methods 1 and 4. This shows that the test methods' viability has not yet been proven. It would thus be necessary for different test methods to be proven and compared for the same cases. However, out of the 38 publications, only 3 studies met these requirements. Therefore, it is worthwhile to continue methodological research in this field.

Price transmission in the milk and dairy sector

Palaskas (1995) completed the most comprehensive study of the EU's dairy sector, which examined 2 decades and 7 countries between 1971 and 1990.The study focused on price transmission between farm prices and consumer prices and, other than the dairy sector, it also examined other product lines. The results are the following:

- The hypothesis of long-term perfect price transmission (b=1) could not be rejected in 17 out of the 35 cases (7 countries x 5 product lines). A similar 50-50 percentage ratio were found in the dairy sector as well: in 7 out of the 14 cases (7 countries x 2 product lines) long-term perfect price transmission prevailed. It also means that in the other half of the cases, price transmission was imperfect even in the long run.
- Within the dairy sector, the difference between the two product lines were significant: for the milk and butter time series, long-run perfect price transmission prevailed in 6 countries (except the UK). However, for the milk-cheese product line, it prevailed only in one country (Belgium).
- Contrary to long-run perfect price transmission, consumer prices change at a higher rate than farm prices: price transmission elasticity ranged from 0.89-1.68 in the milk-butter product line and 1.04-1.54 in the milk-cheese product line3.
- The hypothesis of perfect short-run price transmission (lagging being zero) was rejected by statistical analysis, showing that consumer price reactions to changes

[3] *It is noticed that Dhar and Cotterill (2002) explain retail price grows exceeding price transmission by the application of the market power.*

in raw material prices were not instantaneous, but distributed and delayed for months[4].

In the **USA** this problem was examined earlier by using national data. Kinnucan and Forker (1987) studied the rise and fall of raw material prices for 4 milk products between 1971 and 1981. The t-test disproved the hypothesis of symmetric price transmission for each of the 4 products. Apart from that, the price transmission elasticity rates also confirmed the presence of non-symmetric price reactions in the retail sector: taking into consideration increasing prices for raw materials, they were systematically higher than in case of decreasing milk farm prices (e.g. 0.46 instead of 0.33 for fluid milk, 0.71 instead of 0.42 for butter in the short run). Subsequent examinations of the national data also showed non-symmetric price transmission. (Nicholson and Novakovic 2001)

There are some more detailed new analyses including one for a single U.S. state instead of the whole country. These studies take into consideration the markets or marketing channels' strcture. One of these studies is by Dhar and Cotteril (2002), who examined the Boston liquid milk market from March 1996 to July 1998; which included the increase and stabilization in raw milk farm price. The study was based on data gathered from 4 leading supermarket chains (Stop and Shop, Shaw's, Star Market, De Moulas) and had 3 noteworthy aspects:

1. It calculates price transmission between sector phases differentiating between the processor-wholesaler and wholesaler-retailer phases.
2. It distinguishes between industry-wide and a company's specific price (cost) impulse (shock) and transmission.
3. The study works with 3 behaviour models in supermarket chains, and the results were published for the Stackelberg game. Farm price impulses almost perfectly (raw milk) pass through the processing and commercial phases with price transmission elasticity ranging from 0.878 to 0.999, not diverging significantly from 1.

However, self-made price transmission elasticity ranges between 0.55-0.65 between processor and wholesaler phases, and between 0.54 and 0.62 for wholesaler and retailer phases. Cross price transmission elasticity measured in companies ranges between 0.14-0.23 in farm to wholesaler phases and between 0.16-0.26 for wholesaler to retailer phases. One of the study's final conclusions is that around 1/3-2/3 of the increase in milk consumer price resulted in raw milk price stabilization which has widened the price margins for processors and traders. Another important finding is that a 100 % price (cost) transmission is a necessary, but not sufficient condition for effective competition at industry level. This statement is discussed in more detail below.

Romain et al. (2002) examined the liquid milk market of New York State between 1980 and 1997. They divided the state into two regions, the New York City Region including 11 counties, and the Upstate New York Region, which included the remaining counties. Noteworthy aspects of the study were that other than price transmission for raw milk, it also examined price transmission for other marketing costs, and it examined the problem with and without governmental regulation. During the study period, regulations were changed twice.

[4] *According to Lamm and Westcott (1981) in the USA maximum six months is necessary for milk consumer prices to follow producer prices.*

1. In 1987, NYC market deregulation opened the market to leading milk dealers in New Jersey, while earlier it was protected by a licencing system.
2. Another change was the 1991 introduction of a price gouging law stating that the retail price of liquid milk cannot be higher than double the price of raw milk.

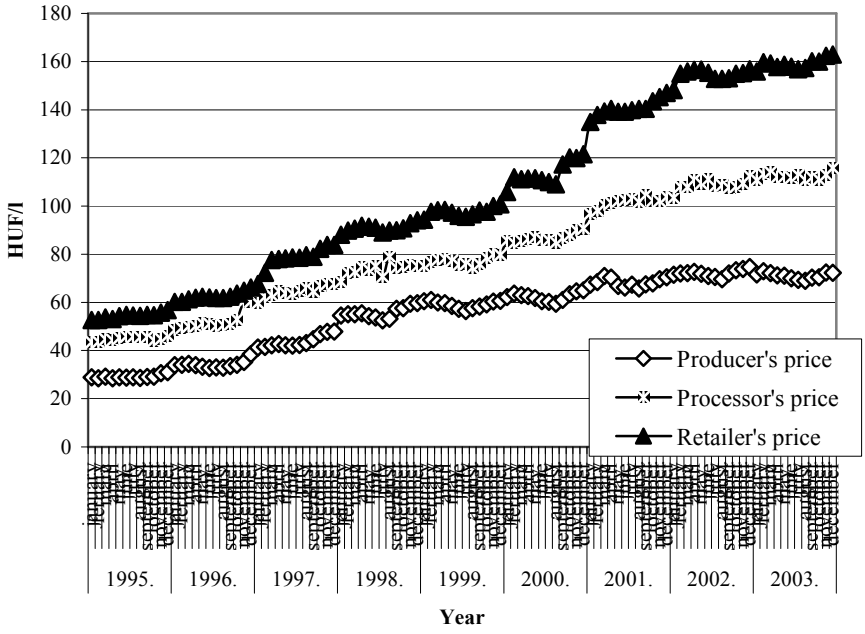
While the first change in regulations concerned the NYC market, only the second affected both. Before 1991, raw milk price transmission was essentially long-run asymmetric in both regions: if price increased, price transmission elasticity was 0.70 (NYC) and 0. 62 (UNY), but if price decreased, it was only 0.30 (NYC) and 0.49 (UNY). After introducing the price gouging law, long-term asymmetry remained significant only in the NYC market (0.52 when prices rose and 0.43 when prices fell), price transmission elasticity became symmetric in the UNY market (0.52 and 0.51). Deregulation of the NYC market significantly decreased the marketing margin.

Lag time in price transmission also merits attention. Earlier studies demonstrated shorter lag time for liquid milk; 3 months, determined by Kinnucan and Forker (1987) and 2 months by Emerick (1994). However, according to Romain et al. (2002), the period was really 4-5 months. We point out that lag time is influenced by the level of processing, as Kinnucan and Forker claim that only for milk and butter was the lag time 3 months, for cheese and ice cream it was 6 and 5 months, respectively. According to Lam and Westcott (1981) the maximum time for consumer prices to adapt to raw milk price changes was 6 months.

Restructuring and competitiveness in the **Hungarian dairy sector** has been studied by a number of persons (Szabó 1992, Gorton and Guba, 2001). Tóth (1999) even studied the price margin and its determining factors. Szabó and Tóth (1998) and Popovics (2003,a,b) studied also price transmission. Diagram 4 shows trends in Hungarian milk prices between 1995 and 2003.

Diagram 4

Prices in the dairy sector of Hungary between 1995-2003



Source: Central Statistical Office of Hungary

Price transmission and competition

Regarding relationships between price transmission and competition, or between competitive markets versus non-competitive markets, only qualitative statements and assumptions have been found in the related literature. E.g. Gardner (1975) studied price transmission that assumed perfect competition and price spread in the food product line. Kinnucan and Forker (1987), using Heien's (1980) approach, cast doubt on the competitive market assumption, explaining that marketing channels in milk product lines are concentrated.

Holloway (1991) made an oligopolic generalization regarding Gardner's model. In his formula, he worked out 3 conditions for perfect competition in consumer food markets and used this generalized model to conduct empirical research on 8 U.S food product lines. The results indicated that between1955 and 1983 there had been insignificant departures from perfect competition, including the milk sector. Most empirical studies on competition have been conducted in the **USA**, but there is still no agreement on whether food product lines are competitive or non-competitive.

Today, Clark and Reed (2002) are the strongest proponents regarding the competitiveness of U.S food product lines. They claim that neither growing marketing margins, nor higher concentration levels indicate market power. Therefore, they worked out a method to test **market power** directly. Even Meyer and Cramon-Taubadel (2003) claim

that concentration measures being used to prove market power are not perfectly correlated with the latter. They used Wohlgenant's (1999) model to study the relationship between farm prices and retail prices. This model derives from the notion that price transmission elasticity equals the farmer's share of the food dollar, but this statement applies only if the food industry is competitive and has constant returns regarding the agricultural raw materials being used. Wohlgenant's model helps to test whether price transmission elasticity equals the mentioned farmer's share of the food dollar at changing production ratios. They tested 7 food sectors at a U.S. aggregated level. The results, including those in the milk sector, did not disprove that industries are competitive in the long run (except from the fresh fruit and vegetable sector). However, the authors emphasize that further research is necessary to formulate a general statement concerning the presence of market power.

Many authors disagree with the previous statement, especially those studying only one product line in one state, as opposed to studying the entire USA. Azzam (1999) is among those who reject the statement. In his theoretical work, he analyzed relationships in terms of competition, pricing, price rigidity and price transmission in the retail sector. Regarding imperfect competition in the milk sector, Cotteril et al.'s work deserves attention.

Cotterill (2000) pointed out that the degree of vertical competition influences cost pass through rate or price transmission rate. Moreover, he showed that in the USA (and also in Europe) the food sector can be described using the **successive monopoly model**, where 'gross margin expansion via increased exercise of market power is the only fundamental strategy available to increase stock prices' in the retail sector.

In one of his new surveys presented to the Connecticut state legislation, Cotteril (2003a) proved that because milk marketing channels are non-competitive, milk prices are non-competitive as well and processors and retailers set prices on behalf of their own interest in New England. This is demonstrated by data from the state's southern region where consumer price is approx. 3 dollar/gallon, of which only 1 dollar goes to the farmer. Processing and trading costs (including a competitive profit) also amount to 1 dollar. The remaining 1 dollar of profit goes to the processors and traders. Cotteril (2003b) emphasises that this New England pricing practice does not apply to the whole USA, but it is common in many places, including Seattle and Chicago. We have to add that the current situation emerged only a few years ago, and a drastic drop in the farm price of milk also contributed to the problem.

In Europe, most of the studies regarding relationships between price transmission and competition have been conducted by McCorriston et al. from the UK. Back in 1998, they reported that market power decreases the price transmission rate. (McCorriston et al. 1998). Later they found that there is a growing literature proving that the food industry in developed countries is oligopolic. (McCorriston et al. 2001). At the same time, growing returns to scale increase price transmission rate. (Therefore, the shape of the industry-wide cost function is of high importance). They emphasized that in the case of decreasing farm prices, price transmission rate is determined by demand. In their calculations, the price transmission elasticity rating 0.51 at perfect competition dropped to 0.32 at imperfect competition (assuming constant returns to scale and a linear demand function). In another new article, McCorriston (2002) drew attention to growing market power in the food industry in Europe. Furthermore, he referred to some factors influencing price transmission elasticity, including some that have not yet been studied. (e.g. the effect of vertical contracts). In their newest article (Lloyd et al. 2003) presented a calculation that showed price transmission elasticity changed from 1, which is characteristic of a competitive situation, to 1.4 in oligopolic or

oligopsonic circumstances, when the demand function shifts. This makes Palaskas's (1995) results for price transmission rates of EU member countries easier to understand.

In Europe, empirical studies have been conducted to solve problems regarding presence of market power. In Spain, using Lerner's index between 1878 and 1992, Millan (1999) analysed the cost structure and market power of 18 food industries. Regarding almost every industry, he rejected the long-term equilibrium hypothesis. In France, Gohin and Guyomard (2000) analysed pricing behaviour and oligopoly-oligopsony power in the retail sector for 3 groups of products, including milk. They rejected the idea that French food trading companies were competitive and showed that 20 % of retail to wholesale price margin in milk products derive from oligopol and oligopson price distortions. **In Germany**, Herrmann and Möser (2003) studied price rigidity and price variability regarding 6 retailers using scanner data for 144 weeks between 1996 and 1999. The study included 20 breakfast products, out of which they studied 4 in detail. Based on the one-price law, similar price rigidity could have been expected for similar brands in the 6 firms. But, on the contrary, price rigidity varied significantly and pricing was not uniform, which, according to the authors, was indicative of market power and this fact should be considered in future price transmission research. Finally, we point out that there is already a detailed article reviewing EU competition policy for agribusiness, (Buccirossi et al. 2002), claim that the European Commission has been dealing with competition problems only since 2000. One noteworthy point is that it evaluates the position of all the 4 parties (input-suppliers, farmers, producers, traders), and, on the other hand, refers to literature already differentiating 4 competition problems (selling market power, buying power, countervailing power, double marginalization).

Some conclusions

For future research, the authors draw the following conclusions:

1. When examining price transmission, setting clear objectives is important. If the aim of the study is only to measure price transmission in a joint market, concentrating on exact quantification and diagnosis is sufficient, and thus not examining determining factors. However, if detecting market power is one of the objectives, and alternative measures as well as analysing the most important determining factors cannot be ignored.
2. Research should try to compare price transmission elasticity rates published in literature. Clarification of price transmission elasticity normative measures (b=1 versus the farmer's share of the food dollar) should be considered for the situation of perfect price transmission and perfect competition.
3. The different tests' statistical reliability should be clarified on some samples, and more econometric methods should be compared for the same sample, as is usual in other disciplines. (Butler et al. 2004)
4. To promote utilization of price transmission results in economic policy, further studies are necessary to diagnose the role of price transmission studies in market efficiency. Furthermore, to examine its relationships with the effects of government intervention.

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Organizational structure and functions of the ministries of agriculture
(Synthesis and reform experience in Central and Eastern European Countries)

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Abstract

In the Central and Eastern European countries, after the political and economical changes the inherited governmental structures do not meet the demands of modern democratic state- obsolete structure of Ministries. Despite considerable advances since then, reforms in the public/private sector remains priority for progress towards accession to the EU. To guide the necessary reforms in the public sector several governments adopted a medium term strategy for public sector reforms. An integral part of the strategy is functional analysis that will help to re-orient Ministries to carrying out their policy, regulatory and service delivery responsibilities cost-effectively, with full transparency to the Government, and with sensitivity and courtesy to the public. The study presents the methodology for conducting functional reviews and the results of the implementation mostly in the Ministry of Agriculture in several countries. The study makes comprehensive recommendations for the abolition, rationalization, privatization and transfer of functions within the agriculture sector, together with recommendations on how remaining and new functions can be structured in effective organizational units for both the medium and long term. The benefits of the functional review are to streamline decision making and implementation, and strengthen the accountability of subsidiary institutions.

Key words

Ministry of Agriculture, structure, organization, managing changes, re-structuring functions

Introduction

In the 90's, most of the Central and Eastern European Governments submitted their application to the European Union. The Ministries of Agriculture recognize that one of the most important tasks of the forthcoming years is to prepare the agriculture, fishery and forestry for EU accession. Urgent institutional improvement and stabilization of markets are necessary in order to ensure successful preparation for integration. Specifically, it is necessary to speed up implementation of the National Program for the Adoption of Acquis Communautaire (body of rules and regulations governing all aspects of community life and work) and to facilitate the development of the EU rural development agenda. During the last ten years, several Eastern and Central European Countries have made great strides to reform their agriculture to fit more closely with conditionalities of the EU and is anxiously waiting for that status to be bestowed. Thus one can say that each country, in its own way, has attained acceptable level of success in its agricultural sector. Does that mean however that a newly emerging reform economy imitates one of these structures with concomitant functions, whether it will automatically achieve success?

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General overview

Generally the Ministries of Agriculture in Central and Eastern Europe seem to carry out the same functions in every country, but in varying organization structures. They all have administrative and finance groups; policy analysis units for prices, volumes, rules and regulations; research and extension technology transfer activities; regional development offices; and health and sanitary control activities. However, their major organizational grouping may be commodity program, or function. It appears that additional units have sometimes been just added on to cover new topics, such as environmental concerns, disaster relief, new development areas, and recently biotechnology. That seems to emerge, however, that one moves from a command to a liberal structure, the effects of liberalization are masked because of the extensive system of security that is provided in other ways (Fehér et al,. 2002).

Some common themes however do emerge

1. There is a move to place certain functions in private hands (extension, processing, research). The land, processing and marketing are already privately administrated.
2. User fees are being charged for services where there is a clearly identifiable beneficiary. Because of increasing pressure on their budgets, governments have begun to look for areas in which services they provide have identifiable value to individual persons and companies. Once determined, user fees are instituted for provision of these services. Most of these opportunities are related to inspection for government mandated commodity and food standards and safety. A movement toward getting the private sector or farmer themselves, to cover the cost of research and extension is progressing in a few countries.
3. The focus of each organization, excluding the Minister's support, administration, and financing function, is quite different in the countries. For example, Hungary's focus is on production, support institution, and rural development. It can be concluded from the different structural examples that as economies develop, redundancy among units is reduced and responsibility and initiative are passed down to lower levels within the organizational structure. These facts allow to have fewer units reporting to the Minister and leads to a more hierarchical structure within each program, with sub-units embedded below unit directors.
4. The existence of organizations outside of the Ministry itself, but within the realms of the Minister's power and influence (i.e., within the Minister's portfolio) varies significantly in the studied countries. Corporations that perform many task privately and independently but always under the watchful eye of the Minister. For example in Hungary, there are the Agricultural Economics Research Institute, Agricultural Training Center, EU foreign aid offices, and Agricultural Marketing and Intervention Centers. Lithuania has got government-owned stock company carrying out the major task of agricultural product purchasing, storing and reselling.
5. Basic and/or applied research receives more and more high priority. Research and technology development are of highest priority in Poland, Check Republic, Slovenia and Hungary where the focus is on minimizing costs through increased yields. Research is critical in most of the EU member countries as well, for example in the Netherlands, which seeks to maximize value added and good environmental practices on its small land base (Fehér and Neszmélyi 2003).

6. Issues concerning the importance of the environment increase as an economy develops, especially with respect to the assignment of budget and resources used and applied in environmental protection. It appears that scarce resource is less likely to be used on environmental protection in some countries. Although this is a reality, it may be a major shortcoming of these administrations. Some other countries have often realized that neglecting environmental issues over the years has led to substantial degradations that are more difficult and costly to correct later on. Perhaps these countries need to pay more attention to environmental issues earlier on and dedicate scarce resources to the issues even though the urgency for the support of such activities appears to be lacking and the co-operation between the Ministries of Agriculture and Environment is not perfect.

In the following paragraphs I will raise some questions regarding some importance policy issues that the Ministries of Agriculture should address; these issues are:

The role of the Minister

The role of the Minister of Agriculture as a political figure differs among the mentioned countries. The Minister is appointed by the President based on the proposal of the Prime Minister and according to the interest of the ruling party. The Committees of the Parliament, interest groups and lobbyists exert influence on the way how the Minister introduces and implements agricultural policies. In some countries the Minister of Agriculture is selected from elected members of the Parliament. Each of them has varying degrees of influence and control. Most of the Ministries have strong regional structure, with Ministry offices representing geographic interests. The important fact is in this observation is that as soon as a country moves from a command to market economy system, many checks and balances come into existence. The closer one gets toward liberalization, the more the Ministers' s power is shared with the Parliament and are distributed to provinces, or regions, and various interest groups (Fehér at al.,2002).

The ministerial role becomes one of safeguarding the interests of farmers and rural inhabitants and ensuring national food safety and security while stimulating production volume and value-added through wide-ranging "incentives". It is interesting to note how command economies dictate for farmers what to do and to consumer what prices consumer what price to pay, whereas liberalized economies must benefit farmers and consumers alike, but without the use of direct controls or subsidies, employing quasi-market mechanisms of any form.

Administering Subsidies

In the absence of complete government control of production and marketing, how are subsidies introduced, distributed and monitored? All of the analyzed Ministries of Agriculture utilize highly sophisticated techniques to subsidize their clients: farmers, agribusiness, and consumers. The elaborated system of subsidies and farmer' supports has evolved over the years but has never been absent, in some countries the number of subsidy measure is more than 200. Several countries will participate shortly in the Common Agricultural Policy, managed by the EU, and will receive direct subsidies for many crops and products and will use production quotas. In the future the EU candidates countries have to prepare themselves for the adaptation to this EU systems (Fehér, and Iglói, 2003a, 2003b).

Actually all of the Ministries of Agriculture subsidize producers and farmers in one way or another, to greater or lesser degrees, under the auspices of income stabilization or the leveling out of market distortions or price volatility. They find some form of subsidy essential for achieving a dynamic, responsive, and adequate system. The trick is in designing a subsidy program that falls within the guidelines of the World Trade Organization (WTO) and that does not cause more distortions than it is designed to overcome.

The Law of Supply and Demand and Justification for Market Intervention

When markets are left to the laws of supply and demand, how much government support is offered to level out unwanted distortion and price variations? All horticulture producers in a well-established market economy system know that prices fluctuate because the volume entering the market vary. The more products that reach the market, the result is the lower price. The volume varies by season or disaster and is supplemented by imports or depleted by exports. Farmers and producers in developed, free market countries know how to plan production accordingly. But farmers emerging from transition economies have few knowledge and experience about how to operate in a non-command environment. It is also important to mention that the support level is lower in these countries than in the more rich countries. They continually seek a return to the fixed supply allocations and assignment and predetermined fixed prices of command economy.

Certain countries help their farmers to cope with the vicissitudes of the market by creating a web of polices and institutional support to mitigate the effects of uncertainties. (safety net). The closer one is to a command economy, the more straightforward and transparent are direct price controls and product subsidies. In developed economies, these controls and subsidies are more subtle, related more to production or marketing quotas, income stabilization programs, or voluntarily agreed-to marketing orders.

Safety net

What does a “Safety Net” constitute? This is a set of policies that protect the farmers (and in some cases, the consumers) from unforeseen events that would cause them undue hardship or income loss, especially when the degree of the loss could cause bankruptcy, extensive indebtedness, or extreme poverty. Supporting prices above market rates or leveling out the valleys in price fluctuations is one element of safety net. The purchase of crops or commodities by the government to increase demand is another one.

The analyses of the different Ministries of Agriculture shows a wide range of safety net activities; commodity purchase, subsidized insurance, disaster relief, loans guarantees, environmental protection programs, export market promotion programs, rural development programs, research and extension programs. Can be raised the question how much of the security blanket is taken away when moving from a command economy to a liberal free market must be replaced by “subsidies” or other forms of relief, to ensure that production meeting targets and providing for food security. For this question we have few answer other than to say that the more developed ministerial structures have a plethora of subtle support systems, whereas the less developed ministries provide more direct support, such as price supports and government purchase.

Government's Role in Moving toward Liberal Market

Does government have a role in easing an agricultural economy into greater liberalization? Government has a responsibility to guide, shape, and assist with transition from a command to a free market economy (Fehér and Neszmélyi 2003a, 2003b). This transaction is complicated, and there is no simple formula. Each Ministry in my samples seems to have designed its own unique approach, while in the process successfully maintaining a dynamic and responsive agricultural systems. Perhaps reiterating the general goals of most of the Ministries will help in determining what needs to be included in the emerging design:

- Provide enough food production to ensure reasonable consumer prices and food security for all consumers and to achieve export earnings;
- Produce agricultural commodities which are safe for consumption and do not adversely affect the environment, especially in terms of reducing or destroying the country's production capacity;
- Stimulate, create, and provide for market access to ensure the highest level of income returns for farmers and producers so that their production will be profitable and, hence leads to sustainability and expansion or increased value-added;
- Produce new technologies that are environmentally friendly so that the sector will continue to increase production and/or value-added, be productive, and safety the needs of both farmers and consumers;
- Provide for technology transfer education so that all intended beneficiaries can share equally in the proceeds of the sector and can adopt and use the new technologies generated; and
- Develop the natural resources of land, water, forests, and recreation areas so that they are not degraded; rehabilitate those resources that are degraded; and sustainably manage the country's natural resources for future generations.

Agriculture as a Strategy Sector

By nature of its strategic position in an economy – for example, as a natural resource prone to disasters, as a provider of food security, and as a subsistence provider – should the agriculture sector receive support beyond that of any other sector in a developing economy? Given the aforementioned objectives of a Ministry of Agriculture, which is mandated to serve and manage the agricultural sector, it becomes evident that this sector is a strategic resource and, as such, should be granted the ability to use government resources to quid its development. The Ministries of Agriculture reviewed in this study clearly recognize this mandate. Each has created its structure, with accompanying functions, that generated a high degree of output while protecting the future of its resource base (Fehér at al., 2002).

Reform is needed

In the Central and Eastern European countries the Public Administration Reform Programs highlighted the need to review the functions of Ministries to ensure that they were compatible with the changing needs of a free market economy (Fehér, 2000). Whilst much has been achieved in the general reform programs, there has been little co-ordinated progress

in the area of functional review of the sectorial institutions. There is now widespread agreement on the fact that ministries should re-examine their functions and structures in order to ensure that their resources are effectively targeted at the demands of EU accession and modernization in general (Fehér, 2002). Both the World Bank and other international institutes (EU, OECDE, FAO) have, raised this important issue.

During the last ten years several central government organizations or Public Administration Reform agents have commissioned studies, to develop a functional review methodology that can be used by ministries to review the relevance of their functions and associated structures (Fehér et al., 1999). The actual study is based on the different country's' experiences and summarized the main results and achievements.

In most of the countries, first the Ministries of Agriculture (MoAg) have agreed to used, to develop and to implement the new methodology and functional analysis approach. The MoAgs expect to benefit greatly from the review, since it has retained many of its pre-independence functions, and urgently needs to respond to the pressures of EU Accession. Several EU reviews suggested that MoAg needs to enhance its EU integration harmonization capacity; the absence of which has constrained its progress in meeting the timetable necessary for accession (Fehér et Iglói, 2003). Given the current fiscal constraints, many of the additional positions required for EU integration will need to be met from internally generated savings.

General principles of the method of functional review

The used and proposed functional review shall be carried out for the improvement of the existing organization structure of the executive authorities through appropriate sectors of public management. The sector approach to the functional review is based on the identification of the sector of public management as a separate type of economic activities (sector or function) or a complex of these types (Fehér et al.,1999, Fehér and Neszmélyi 2003). This in its turn shall be supplemented by a systematic vision of the administration vertical for each of the said sectors. In addition, the sector approach should cover the decomposition of public management across the appropriate sector on the level of territorial units (bodies) of the specific ministry.

In the general approach it is an important element to the identification of goals, main tasks and functions of public management in the specific sector in our cease in the field of agricultural economy. The identification should be based on criteria and indicators demonstrating their successful achievement should identify whether there are priority goals. It is important to identify the evaluation criteria for the expected outcome resulted from the achievement of this or that goal (Fehér et al.,2002).

Functions of ministries and their independent units (department) are formally described in legal competent acts. However, ministries/sectors listed in the legal acts are not enough for the functional review and further organization reform. One should take account of inconsistency between functions in practice, such as;

(a) objectively needed functions, i.e. those based on real needs of appropriate managed objects;
(b) legally established functions, i.e. those formally identified in statutory (competent) acts;

(c) actually performed functions, i.e. really performed by specific subjects of management.

Thus identification of functions and further improvement of the organizational structure require maximum allowance for the needs of vital activities of managed objects and their correlation with functions, which are, in fact, implemented. This is the only basis for legally established functions to be used as criteria for the restructuring of the appropriate subject of management.

For the purpose of the functional review it is proposed to define function as follows: the function shall be defined as, the activities associated with the specific output, which can in itself be directly connected with overall goals of the ministry. One should define the following types of outputs: service rendered to the public or defined group of consumers, prepared draft of political decision acceptable for further consideration and approval; set standards (rules), management of some type of activities; exercising control over the activities as well as supervision aimed at further use of responsible measures (Fehér at al., 1999, and Fehér 2003).

The following shall not be defined as the function: proceedings or procedures, which implementation shall not result in the said output contributing directly to the implementation of the ministry's goals.

Additionally, one should take account of the necessity and possible decentralization of some functions, i.e. their transfer to a lower level (including territorial) of the "vertical" administration. In particular, one should proceed from the fact that those functions which are, in fact, performed directly for the consumers of services, should be decentralized to the level which can ensure their best operational performance without any decline in their quality.

Aims and objectives based on the transition countries experience

The purpose of any ministerial functional review is to:

- develop in partnership with key stakeholders, a common methodology for the review of ministry functions,
- to identify savings from the removal of functions from budgetary support, both through elimination, rationalization, or privatization;
- support the MoAg's EU Accession program by helping to identify new functions, resources required to perform them and appropriate organizational structures; and
- help MoAg to improve their efficiency and effectiveness by ensuring functions which are targeted at sectoral objectives and statutory requirements.

Specific objectives of a review are to produce:

- a list A of existing or new functions that will be supported by budgetary funding; and
- a list B of functions that will be abolished or privatized, or transferred to other ministries;
- to produce a broad timetable for the implementation of revised functions, indicating responsibilities, and legislative requirements;
- an estimate of budgetary savings, based upon current remuneration levels.

- the review proposes medium and long term structures for the central ministry, subsidiary institutions and regions, in order to help MoAg implement the revised functions in the most effective manner;
- to elaborate general accountability arrangements proposal to improve the accountability of subsidiary institutions to the minister; and
- it is not realistic to define key performance indicators for each function – this activity can be included in implementation of the functional review;

Methodology of functional review

This section presents the methodology that has been produced and represents an approach, tailored to the needs of the Central and Eastern European Countries (Fehér, 2002).

This section is comprised of the following sections:

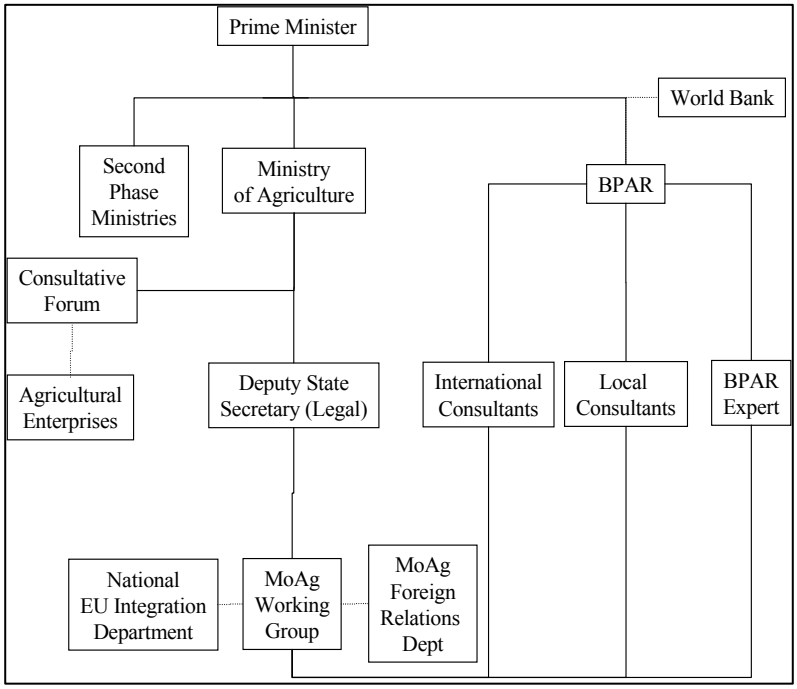
- project management arrangements;
- overall approach;
- functional analysis framework to treat functions;
- criteria used to analyze functions;
- guiding principles for re-structuring;
- data collection methods; and
- change management, consultation and communication.

Project management arrangements

The developed functional review methodology proposes to the MoA to accepted in partnership the project management structure, which was created and shown in figure 1. (Latvia cease) (Fehér at al., 1999). This figure shows the different key players who have decision making or influencing the decision. The project has been initiated by the World Bank and implemented in close co-operation with BPAR- Bureau of Public Administration Reform.

Figure 1

Project management structure



The main steps of the project

The overall approach is shown in figure 2, and comprises the following stages:

a) the agreement of the methodology by BPAR and MoAg;

b) the collection of data on existing and new functions including:

- the type of function;
- the entity performing the function;
- an estimate of the cost of providing the functions, in terms of staff and non staff costs;

c) the analysis of functions to assess which functions can be:

- created to support EU Accession or to improve effectiveness or efficiency;
- abolished, privatized or transferred to other sectors;
- consolidation of functions to benefit from economies of scale, or decentralization of functions to improve access of services;
- rationalized, including territorial rationalization;

- reduced in terms of quality or volume based upon relative priorities of the MoAg;
- streamlined by reducing tiers of management or merging of divisions which are too small to be economically viable;

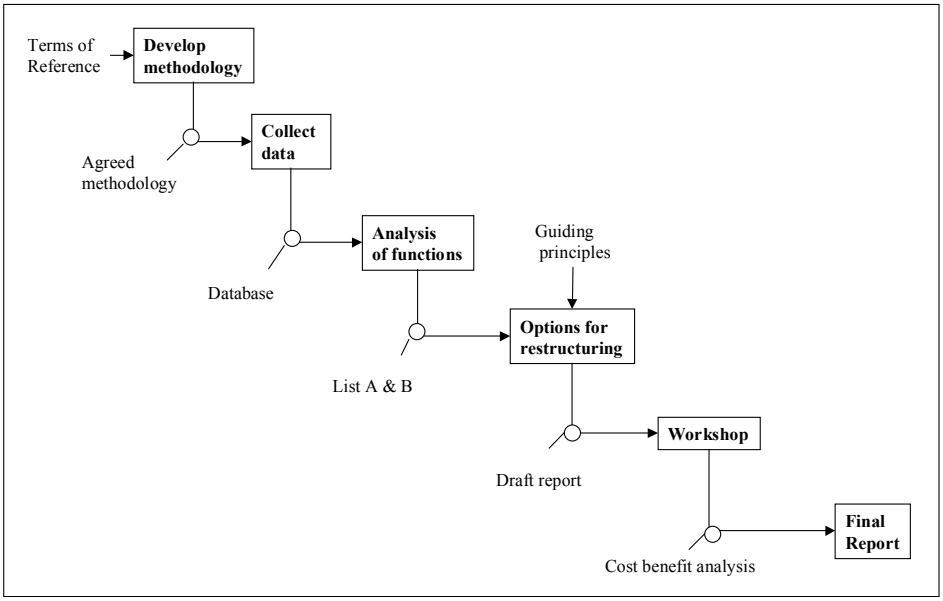
d) development of alternative options for performing functions, by grouping functions of similar type into revised structures based upon guiding principles for restructuring;

e) holding of a workshop for key stakeholders to review options;

f) final report, including List A and List B functions, and options for their structural reorganization, and cost benefits.

Figure 2

Overall approach

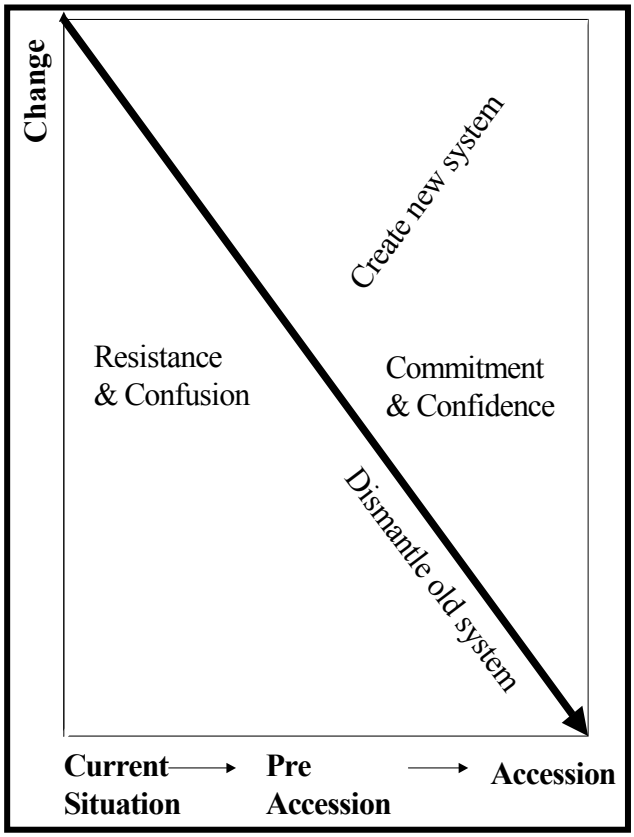


A phased approach to transition

Given the current organization and capacity of MoAg for change it was not realistic to move immediately, in one step, from the existing portfolio of functions and associated structure to that required for EU Accession. Figure 3. shows that it is necessary to dismantle the existing system and create new ones in a planned and manageable way, based on agriculture sector specificities. It is recommended therefore, that options for the transformation of MoAg are proposed for the pre-accession phase (1-3 years) and accession phase (3-5 years),(Fehér, 2001). The recommendations are included for each of these phases.

Figure 3

Phased approach

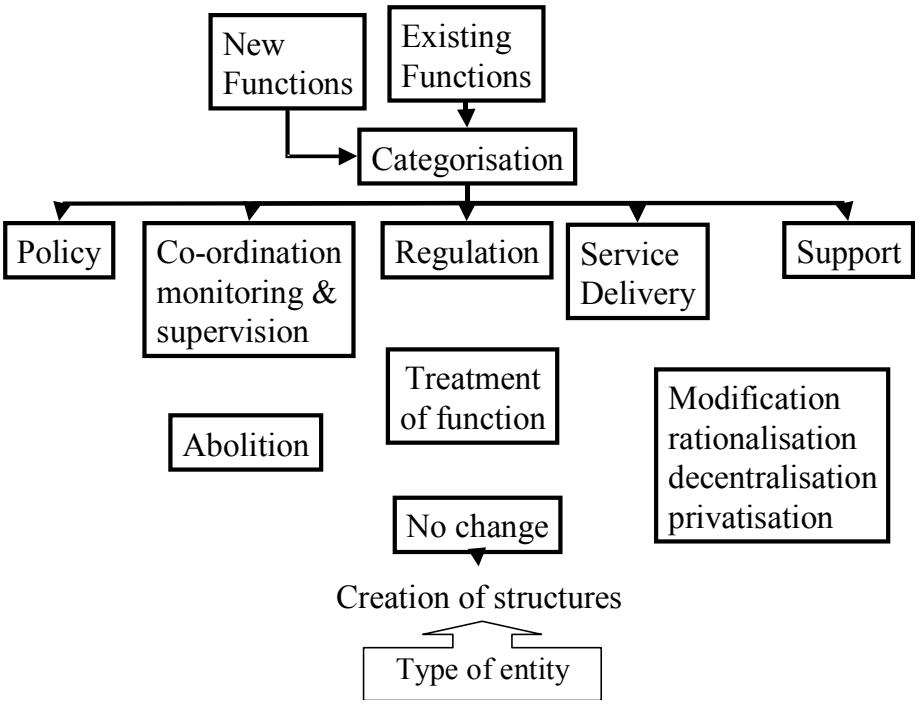


Overview of methodology

In order to determine the 'destiny' of new and existing functions, it is necessary to subject them to some series of questions that will indicate whether they can be abolished, privatized etc. This is summarized in figure 4.

Figure 4.

Overview of Methodology



Agreed definition of a function

- A function is one or more activities that produce an output.
- It was agreed that current and existing activities would be grouped as necessary into discrete functions and these would be filtered using an appropriate analytical framework into redundant, transferred, rationalized or privatized functions based upon agreed criteria.

Types of function

It is a good organizational management practice to separate functions into the following categories, shown in figure 5 (Fehér,2002, 2003):

Figure 5

Types of functions

1. **Policy functions: such as strategic planning, legal drafting, development of performance contracts, minimum standards, norms, policy analysis and evaluation, forecasting. These are functions requiring specialist skills and are usually provided by the core ministry;**
2. **Service delivery functions: such as the provision of products or services to internal (other public bodies) or external (farmers, foresters, fishermen) customers. Service delivery is normally performed by sub-ordinate or supervised bodies;**
3. **Regulatory functions: such as licensing, certification, permissions, accreditation, inspection, compliance, and financial audit. It is good practice to separate regulatory functions from those policy functions that determine the regulations, and service delivery functions that provide services to customers;**
4. **Co-ordination, supervision and performance monitoring functions: such as co-ordinating relationships between different bodies, monitoring the performance of subsidiary bodies, facilitating and enabling subsidiary bodies to reach their performance targets;**
5. **Support functions: such as financial management, human resources management, information systems, infrastructure, staff training, efficiency review and management audit; and secretarial services.**

Principles for the separation of functions

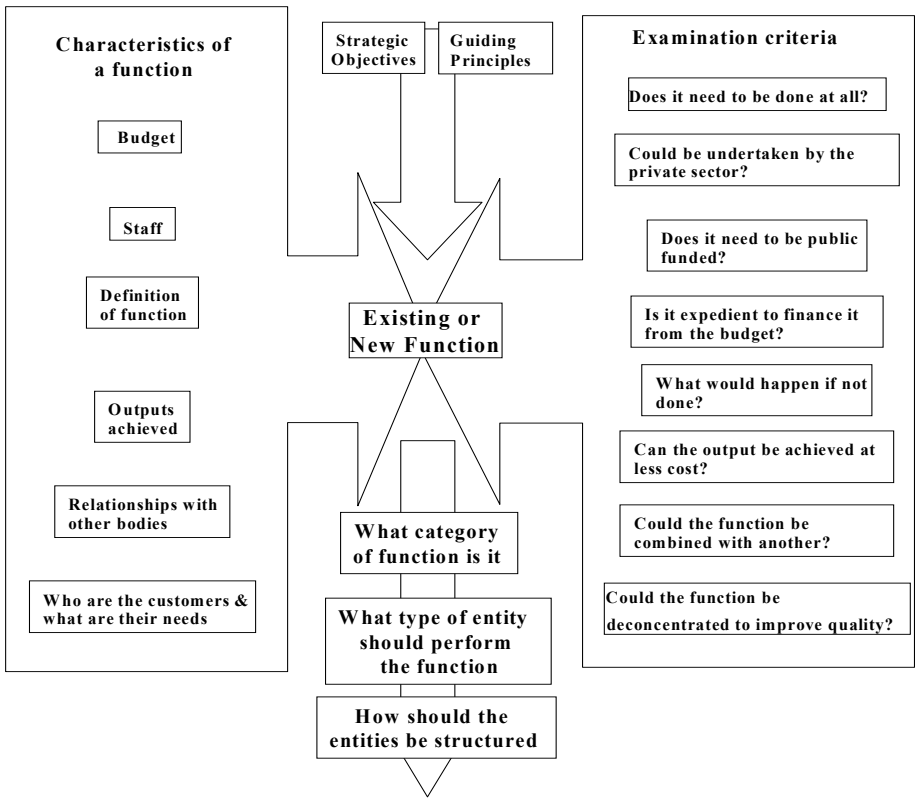
1. It was proposed and agreed that the following principles should be adopted to organize functions into organizational structures:
   a) functions of the same type should be grouped together whenever possible to produce economies of scale and maximize synergies and common types of skills;
   b) conversely, it is important to separate policy and service delivery functions, and to ensure that policy functions are performed by the central ministry and service delivery by territorial or bodies under authority of the ministry;
   c) that regulatory functions should be separated from service delivery functions to prevent conflicts of interest and corruption;
   d) support functions that enable the core functions of the ministry to be performed should be separated from all other functions; and
   e) that there should be equal responsibility for deputy state secretaries, either in terms of volume of workload or national importance of the function.

2. A functional analysis framework (shown in figure 6) has been developed that:
   a) measures the characteristics of a function, such as how much it costs, who are the customers, and what are their needs;

b) evaluates the strategic objectives of MoAg to ensure that functions are complimentary to the goals of the ministry;
c) tests what should happen to the function against a range of decision making or examination criteria; and
d) proposes guiding principles that will determine how the remaining or new functions will be organized into different organizational structures.

Figure 6

Functional Analysis Framework



Decision making criteria for examining functions

1. The analysis of functions is supported by four questionnaires that were completed by interviewing all departmental heads and directors of subsidiary bodies. They include:

   a) Form 1: identification of divisions of each MoAg Department or delegated body;

   b) Form 2: identification of existing and new functions of each division, and the categorization by function type;

c) Form 3: analysis of functions according to decision making criteria; and

d) Form 4: decision form for a division, indicating the recommended 'destiny' for an existing or new function. This enables List A and List B functions to be provided.

2. Form 3 is supported by a 'decision tree' that helps to determine the destiny of a function based upon decision making criteria that were developed jointly with MoAg and BPAR at a workshop. The decision criteria are shown in figure 7, and determine whether a function should be:

a) abolished because it is not required to protect public interests, or there is no demand for it from the public;

b) transferred to other ministries because there are greater synergies with other sectors;

c) reduced in quality of volume because it is not a priority function relative to the goals of the MoAg;

d) rationalized with other similar types of function to realize economies of scale, and improve decision making, communication, and service delivery;

e) decentralized to lower levels of government;

f) privatized into fully private companies;

g) privatized into government regulated companies and utilities;

h) incorporated into self financing state enterprises;

i) performed by government subsidized profit oriented state institutions;

j) performed by government subsidized non profit oriented state institutions;

k) undertaken by the core ministry;

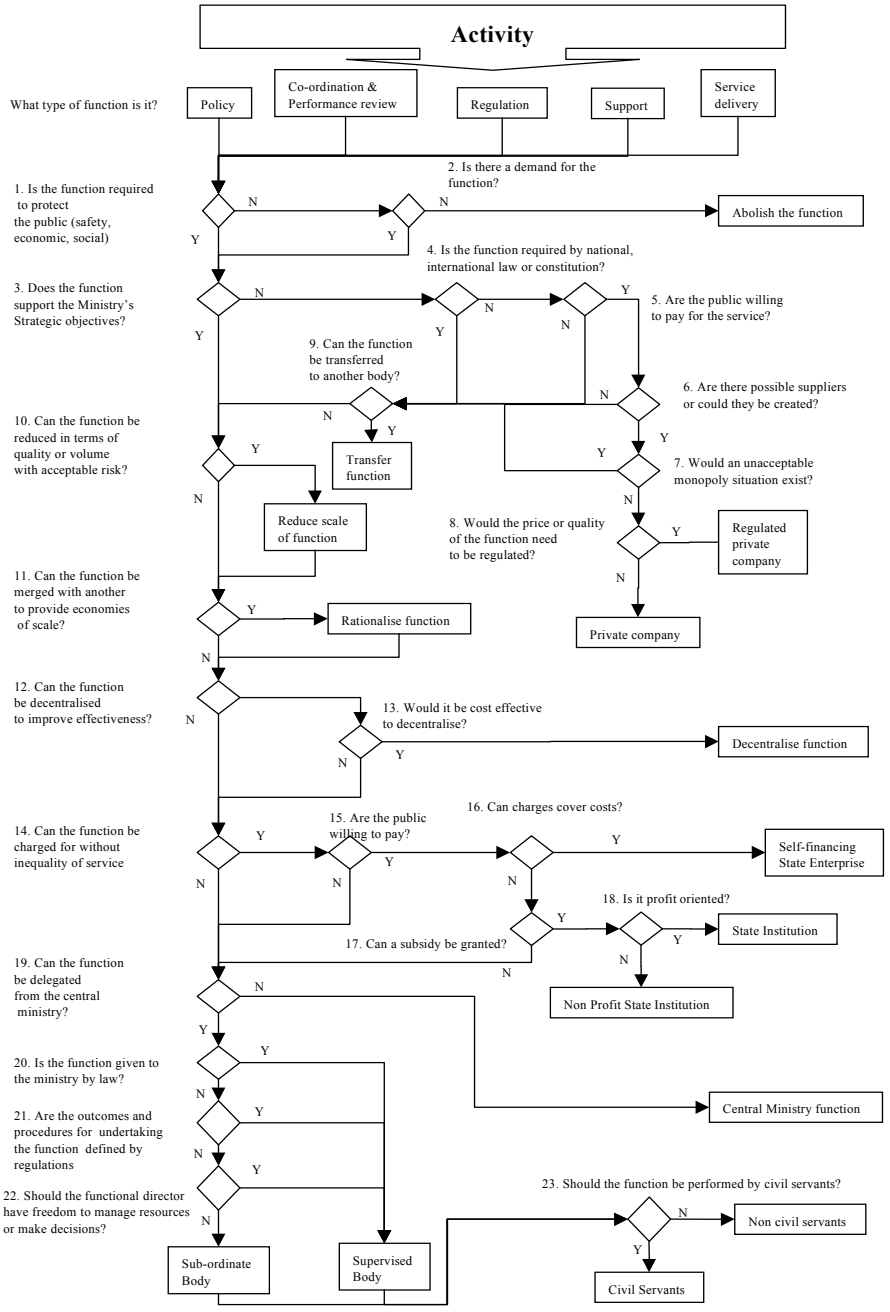
l) delegated to sub-ordinate bodies;

m) delegated to supervised bodies; and

n) delegated to agencies of the ministry.

Figure 7

Decision making criteria for treatment of functions



Re-structuring of functions

1. Once it has been decided which existing or new functions will remain (List A) it is necessary to regroup functions into organizational units. This will be done by grouping functions of similar type (i.e. policy, co-ordination, regulation, service delivery and support) into structures based upon the following key principles (Fehér, 1999):

   a) there should be no duplication or overlap of functions;

   b) functions should be privatized except when not in the public interest;

   c) remaining functions should be decentralized except when not in the public interest;

   d) there should be clear and short reporting lines;

   e) there should be viable sizes of divisions and departments (five or more experts to a division), three to five divisions in a department)

   f) policy functions should be undertaken by the ministry, unless they can be delegated,

   g) service delivery functions should be performed by subsidiary bodies;

   h) different organizational units should perform different types of functions (policy, regulation etc);

   i) structures should take into account country's history, culture and circumstances;

   j) there should be a gradual approach to restructuring, so that transitions are practical and affordable, and skills are not depleted. This implies that new structures will in part need to be influenced by current infrastructure;

   k) there should be optimum spans of command for managers;

   l) there should be equitable workloads;

   m) structures should be compatible with EU and other international law;

   n) structures should be compatible with the laws of the country. Where there are conflicts, these should be highlighted and options explored for amending legislation.

2. The modeling of options was undertaken by discussing each of the existing and new functions with ministry experts in a two day workshop based upon existing structures and international practice.

3. Estimates of staff numbers required to undertake the functions were based upon existing workload for existing functions, and international experience and different reports for new functions. Furthermore detailed workload analysis will be required following acceptance of the review.

Data Collection

1. The questionnaire forms were completed by the local consultants by interviewing Directors of all agriculture sector departments and decentralized bodies.

2. The questionnaire analysis was undertaken by using a Microsoft Excel spreadsheet created to enable calculation of savings resulting from the treatment of functions, by division.

3. Interviews were conducted over a two hour period as follows:
   a) introduction, purpose of the review, methodology, benefits, risks (15 minutes);
   b) what will happen to the data, how and when results will be processed (5 minutes)
   c) completion of form 1: departmental structure (20 minutes);
   d) completion of form 2: identification and characteristics of functions (40 minutes);
   e) completion of form 3: analysis of functions (40 minutes).

4. Form 4 was completed later in the office, and the data input into the spreadsheet.

Change Management

1. It was decided by the MoAg management team that it should be important to reduce resistance to potential change at the outset of the project rather than to wait until the review was complete. This has several advantages:
   a) it will dispel damaging rumors that are inevitably circulated during reorganizations and which threaten to undermine morale and affect performance;
   b) it provides an opportunity to reduce resistance prior to the implications of the review being known, thus saving time; and
   c) it is more likely that departmental heads will be honest in interviews;

2. At a theoretical level it is important not to wait until recommendations are known before consulting people. This will enable key decision-makers to be involved in the formulation and evaluation of options in order to help ensure commitment to decisions taken. It has to be understood within the context that it will, ultimately, be the Minister who decides on the organization of the ministry. The model of change management that was adopted is shown in figure 9 (Fehér at al,. 1999 and Fehér, 2001) and is based upon the need to:

   a) establish awareness at an early stage of the rationale for review and the expected benefits - including all key stakeholders, both within the organization and externally, such as the general public, farmers, foresters, fisherman, and their interest groups;

   b) create understanding of how the review will be taken forward, how individuals can contribute toward the options;

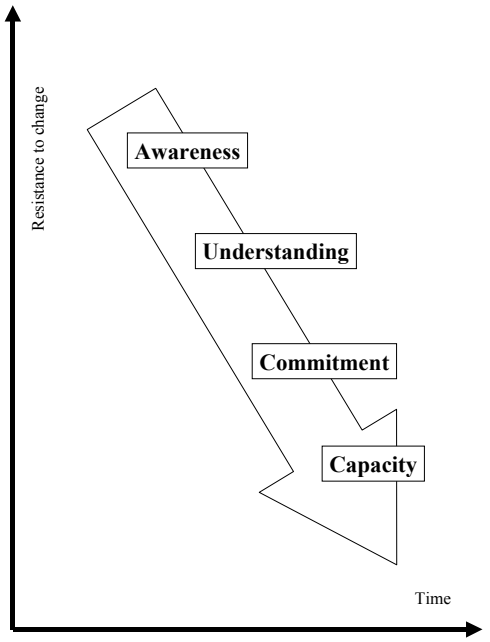
   c) create commitment by allowing key decision makers to evaluate options and voice their opinions;

   d) develop the capacity for change, once the results have been agreed.

3. The model rests on the assumption that each stage cannot be commenced and resistance reduced until the preceding stage has been consolidated.

Figure 8

Managing Change



Based upon this model, it was recommended that the following actions were taken to support change management (figure 9). These were coordinated by the Press Officer of MoAg.

Figure 9

Change Management Events

Stage	Types of event required	Issues communicated
Awareness	Press release, TV, radio	purpose of the review benefits & risks key people involved time scales contact points
Understanding	Create consultative forum Present methodology to forum	Methodology how people will be affected, how they can contribute, when they will be contacted, and how they can contribute
Commitment	Present draft proposals and seek feedback from the consultative forum	Present draft options, but clearly indicate that the Minister makes the final decision

As a result of the above model, the methodology was presented to all department heads and a consultative forum was created to review the options.

Findings and Results

The reviews on several candidate countries identified a number of key weaknesses in the current organization of the agricultural sector, including:

a) fragmentation in the development and execution of policies – there is a weak co-ordination in the development of policies between the sub-sectors of agriculture, fisheries and forestry;

b) weak co-ordination of policy development and quality control within sectors, which has led to an overlap of functions, and a lack of clarity for who is responsible for performing the ministries functions;

c) the current structure is not based upon good principles of organization, such as the separation of different types of function, or grouping of functions requiring similar processes or skills;

d) poor co-ordination of EU integration programs across the ministry, and the need for common databases and procedures for allocating EU tasks and monitoring the progress of the harmonization program;

e) the procedures for accountability and financial reporting of subsidiary bodies are poorly defined and have resulted in a lack of accountability for performance;

f) too much inspections with many variations of administrative processes that could be rationalized and simplified;

g) large number of regional bodies, that is not cost effective given improvements in mobility; and

h) the development of cross sectoral strategy, policy and implementation supervision are mixed together in the same organizations – this has slowed down the ministry's ability to respond rapidly to the demands of modernization and EU accession.

Current organization of the central ministry

The current structure suffers from three important weaknesses which prevent effective development and implementation of policies, at this critical time:

a) policy and co-ordination functions are not separated. Thus, policy makers become involved in co-ordination activities which weakens the focus on policy making. Similarly, the co-ordination arrangements for holding subsidiary bodies to account for their performance have become blurred;

b) there is a separation of the sub-sectors of agriculture, fisheries and forestry, which has resulted in poor cross sectoral co-ordination and operation of sub-sectors in isolation of the overall aims of the ministry;

c) EU integration also lacks a cross sectoral focus, as it is located in one of the sectoral divisions.

Current organization of subsidiary bodies

Currently, most of Ministries of Agriculture have a range of bodies under their authority, including:

a) supervised bodies, having their regulations separately defined in legislation;

b) sub-ordinate bodies that are generally civil service implementing bodies;

c) agencies, including joint stock companies, and other revenue generating institutions.

Much has already been achieved in reducing the number of bodies dependent upon state funding, in order to modernize the sector and to meet the ministry's market economy obligations.

The status of agencies is currently being developed in a national law, and so any revisions to the ministry structure will need to comply with this law when it is passed.

The current organization of subsidiary bodies has a number of important weaknesses:

a) there are a range of overlaps of similar functions organized in a fragmented way, that could be merged, for example plant and seed inspections, plant protection, veterinary service and border sanitary control;

b) there are a range of functions that could be undertaken by the private sector such as soil analysis, investment project plan preparation, demonstration and training stations, selection and technology research of plants;

c) there are a range of functions that could be transferred to other sectors to improve synergies with other sectors for example, higher education, agricultural school and colleges, museums, and

d) there is a weak accountability between subsidiary bodies and the central ministry.

Current Regional Structure

Currently, in most of the countries there are more than 20 regional offices, which are considered by the reviews to be too many given the improvement in mobility, and fiscal constraints of the sector. In addition, SAPARD6 funds can only be released on the condition that the number of regions is significantly reduced. It is important therefore, that headquarter centers should be rationalized through consolidation of administrative bodies, privatization or decreasing activities, even though district service delivery points can remain more or less in position.

Current Education Structure

As for territorial regions, there are too many agricultural colleges dealing with several non agriculture study programs and qualifications, and providing antiquated syllabuses. Consequently, there is an urgent need of streamlining and modernization of syllabuses.

Current Agricultural Research Structure

The heritage of disperse structure of the institutes with various branches and stations operated without setting clear priorities and did not establish well-defined programs. The state budget is insufficient to cover the total cost of agricultural R and D. The research, development and technology transfer did not focused always on vital economic issues. The client -customer contractual relationship for programs funded by industry was rare and the importance of international scientific co-operation was limited (Anderson et al,.2003).

A measure to protect intellectual property rights and appropriate technology transfer were weak and not relevant. The purpose of the strategy of the research activity is to facilitate the reform of the organizational and management structure of the R&D system by improving its legislative, institutional and organizational framework and by initiating new methods and adoption of coherent national R&D policies in the agricultural and food sector.
International integration is considered to be highly important to ensure the provision of accurate information, good management and development of technical-scientific innovation.

[6] *According to EU statistical system (NUTS-2) – principles have been defined requiring the minimum size of regions in order to provide comparable benchmark statistics.*

The expertise and experience of number of Western, Central and Eastern Europe Countries that have implemented reforms in their R&D systems in agricultural and food sector have been taken into consideration in the development of reorganization (Fehér and Neszmélyi 2003).

Conclusions

The role of institution in agricultural policy refers to how much agriculture policy depends on the particular institutional background and structure prevailing in a given country. In European context, the agricultural institutions of government vary widely. While policy formulation and implementation within countries remain relatively straightforward in institutional terms, they become more and more complex when countries are compared or when advisors have to move from one country to another, and when the EU accession is being negotiated and agreed. The process of harmonization with the EU legislative and administrative system, known as the "acquis communataire", is require significant effort and investment during the pre-accession period.

Different countries have different constitutions and hence provide different institutional environments for policy making in agriculture sector. Several countries' experience indicates that there is an increasing recognition of the role of institutions in making and implementing agricultural and rural development policies. In the agricultural sector the role of farmers associations is weak. A more democratic form of representation of the interest of all agricultural farmers is needed in a form of NGO. In several countries these organizations play an important role in the development of many functions or service related to trade, research and technology transfer, market information and training, which are organized in common by operators belonging to the same profession or to the same marketing chain. Government can support this process through different incentives and supports based on voluntary membership.

After the proposed reorganization of the central ministry, the new organizational structure meets the needs of strategic and policy development, with support and facilitation of subsidiary bodies. The new structure has an important characteristic which is the clear separation of the functions. In this case policy formulation within each sub-sector ensures that policy makers only deal with policy issues and thus respond rapidly to changing environment. Furthermore the policy administration within each sector can be managed by an operation director for the accountability relationship on behalf of each deputy state secretary. The proposed model has the following characteristics (see figures 1 and 2):

In medium term the central ministry model has several sectoral feature and benefits:

- more transparent procedures and strategic decision making;
- better staff allocation based on the sector priorities and new functions;
- better division of responsibilities and coordination of central and regional and subordinate bodies;
- stronger accountability arrangements between the central ministry and subordinate bodies;
- better regulatory environment and institutional arrangements for EU accession; and
- decentralized management systems.

In long term the central ministry structure differs from the medium term option in that:

- all policy functions for all sub-sectors are grouped together under a single Deputy State Secretary in order to ensure synergy of the same type of functions and encourage integration of cross sectorial policies;
- all coordination, administration and supervision functions are grouped together in order to provide similar synergies;
- there is a net reduction of one deputy state secretary in long term.
- relationship with subsidiary bodies will be strengthened through the use of performance agreements, developed, monitored and facilitated by relevant operations directors;
- long term structure can also accommodate the presence of deputy state ministers for each sub-sector, since they would retain a functional relationship with all departments, working through the State Secretary.

This study focused on the public sector performance in the transition countries. The reforms are recommended and the proposed functional review, methodology and actions can provide measurable benefits in medium and long term too, for the improvement of the existing agricultural organization structure. The learned lessons are relevant and positive. The qualitative impacts of the review are largely to: (a) improve the efficiency of the sector by improving the allocation of functions between institutions, (b) rationalize the duplicated functions and regional bodies to improve effectiveness and to realize economic of scale, (c) increase the involvement of the private sector through privatization of appropriate functions and (d) strength accountability of subsidiary bodies.

Transition from planned agricultural economy to a competitive market economy is a complex process, which demand in most of the transition countries important changes in the legal and public institutional structure.

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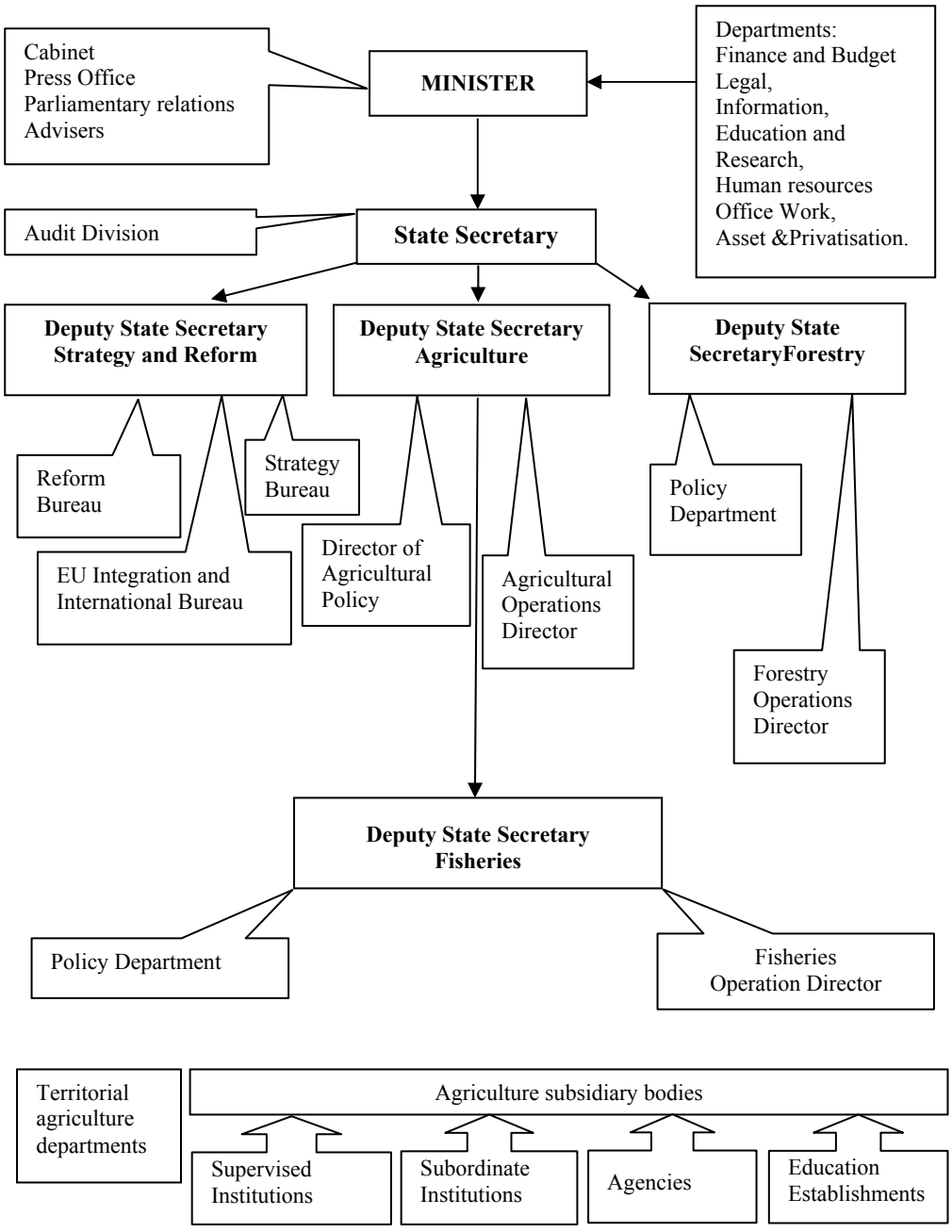
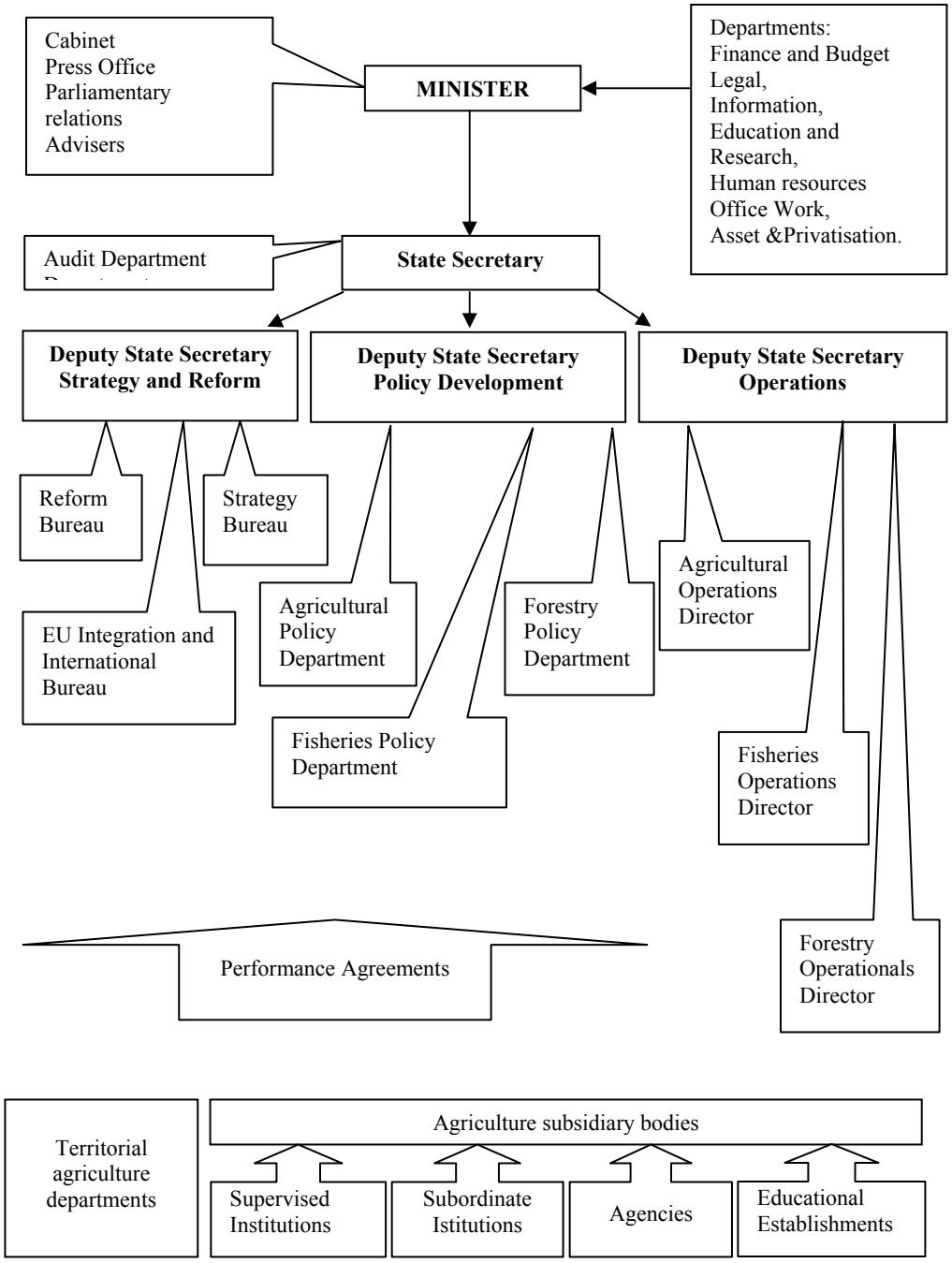
Appendix 1. Medium term structure for Central Ministry



Appendix 2. Long term structure for Central Ministry



Role and relations of marketing strategic types and groups in the Hungarian wine sector

József Lehota[7]
Nándor Komáromi
Zoltán Szabó

Abstract

International competitiveness of industrial sectors, strategic groups having different strategic purposes, target markets, and market positions, are playing a key role. Within the framework of this study, Porter's strategic typology and grouping were applied. Using a questionnaire survey and using factor- and cluster analysis, strategic groups were identified among 97 Hungarian winegrowers. To identify each strategic group, the following factors were used: rate of market orientation, the nature the competition's structure, the role of innovation, relations within the supply chain, market coverage (both geographical regarding assortment), coverage of the marketing channel, labelling and place of origin, as well as characteristics of performance indices. A significant part of Hungarian wine-growers follow a specialization strategy, and orientatation towards a different target strategic focus remains an important factor.

Key words

Strategic types and groups – market orientation-factor- and cluster analysis, - wine sector

1. Theoretical linkages among strategic types

One of the key issues of the international literature dealing with management (including marketing management) during the past two and half decades was how a company's structure, and strategy could be harmonized with the company's environment (Dess-Keats, 1987). Focal elements of the researche were analysis of the company's environment, strategic planning and strategy choice. The above linkages play a especially important role in the case of small – and medium-scale companies, where environmental analysis (market research and marketing research) and strategic planning are on a lower level.

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In the international marketing literature, two different strategic typologies are known and widespread: Miles-Snow's typology (1978) and Porter's typology (1980). Miles-Snow identifies four strategic types, which are as follows: defensive, foresight, analysing and responding. The main characteristics of the defensive types are: limited new products, as well as technological and marketing solutions. According to Wright et al (1985) the defensive strategy is rigid, non-innovative, indicating a short-term mentality, which tends to replace adaptation with costs associated with narrow product- and market specialization. The foresight company marketing strategy makes efforts to gather environmental information, and to exploit and occupy new market needs. (Hambrick, 1983). It is very important in the alias hybrid strategy, which is a mixture of the former two strategic types, to analyse the environment even though there are fewer new products and new market trends. In analysing a company strategy one needs to concentrate on defence of available product markets, meaning new products will be cautiously introduced into new markets. Companies operating ad hoc, without strategic focus or no strategy at all, may be assigned to the responding strategic types (Strandskov et. al 1998).

Another form of strategic classification was elaborated by Porter (1980) who determined 3 fundamental strategic types, which enable companies to attain competitive advantage and better market- and financial performances compared to their competitors. These three fundamental strategies are as follows: cost managing (strategy built on the leading role of cost strategy, low cost/low price) differentiation strategy (high-quality product) and specialization, focusing strategy on market segment or partial market. . In addition to fundamental strategies, also a general, so-called middle-way strategy without focus was distinguished.

The cost-management strategy (based on the leading role of cost) creates a sustainable competitive advantage in such a way that the company competes in the specific segment with the lowest price. According to Dess and Beard (1984), Keats and Hitt (1988) and Miller (1988) the success of the cost-management strategy is adventitious, depending on the environmental characteristics of the industrial sector. Possible sources for this strategy are firstly high market share, secondly far more advantageous and better access to raw materials than the average, as well as the use of efficient technology (Porter, 1980). The company following the cost-management strategy is decisively input oriented rather than output oriented. Application of the former strategy necessitates continuous monitoring and analysis of competitors (using the best possible practices: benchmarking) so that the most favourable costs are attainable, which is concomitant with strong competitor orientation. In the case of the cost-management strategy, frequent introduction of new products and technological solutions are low.

Differentiatiion company strategy is aimed at the establishment of unique market position within the given industrial sector. Tools of the differentiation strategy may be product quality/attributes, brand, reputation of the producer and production area, technology and the system of distribution. The company, applying the differentiation strategy creates its consumer value so that it assures high-quality products together with high-quality product service at premium price (Walker-Ruekert (1987). It is the differentiation strategy's key to success allowing the company to optimize the relationship between perceived product advantage and production costs compared to its competitors (Slater-Olson 2001). The above strategy is a balance between consumer- and competitor. According to Bethon et. al. (1999), Cristensen and Bower (1996), strong consumer orientation (one-sided) may be troublesome in terms of innovation and extensive introduction of new products; therefore in the case of

the differentiation strategy, technological orientation is strong. Differentiation strategy means unique products, consumer loyalty, price inflexibility and barriers to entry.

Company strategy is built on the assumption that the given company would be able to operate more efficiently in a narrow segment than competitors, operating in several segments. Specialization (focusing) strategy requires within this narrow segment strong consumer/buyer orientation (Campbell-Hunt 2000). The company, applying this strategy operates in a narrow market with fewer competitors, meaning competition orientation is weaker. This company uses relatively fewer new products and technologies, than those applying differentiation strategy since firstly the target-market is narrower, secondly the number of segments is lower, thirdly the number of competitors is lower (Zahra 1993, Campbell-Hunt 2000, Framback et. al. 2003, Lakner – Procházka, 2000).

Conditions for adaptation of the above strategic types have distinct traits in the case of small-scale companies. Size of the given company relative to the average of the industrial segment exerts an important effect on the choice of the strategy type and also on the company's market- and financial performance. In the concentrated industrial segments large-scale companies possessing high market share may force their smaller competitors into market areas where there are lower rates of growth and lower profitability. In fragmented industrial segments competitive opportunities for small-scale companies will increase, since the role of economic scale will be less. For small-scale companies, however, the possibility of choosing a less than perfect strategy will increase, particularly in unipersonal, mainly family enterprises (inadequate market information), resulting in the possible decrease of control over management decisions. Barriers to gathering information, limited planning activity, as well as limited resources are strengthening both direct and indirect effects of the indisturial sector's environment. In small-scale companies formal strategic planning, meaning strategic thinking (Sexton- van Auken 1982) and long-term orientation (Gilmore 1971). are poorer. Marketing and market research are scarcely done by small-scale companies. According to the survey carried out by Mohan and Neill (1995), less than 50% of the small-scale companies' accomplish regular and continual collection of information on market growth and market segments.

Even the choice of fundamental marketing strategies means distinct conditions for the small-scale companies. According to Pelham, (1999) mininum prices within the industrial sector are precluded for small-scale companies because of poor financial resources and lower economic scale. According to Valker-Ruekert (1987) differentiation strategy has a more favourable effect on performance, since there is a greater possibility that it could be achieved by the small-scale company with limited resources and structural disadvantages.

2. Methods: strategic components and variables

In establishing strategic groups, three key strategic dimensions were determined (Cool -Schendel 1988, Holey et-al 1992) strategic targets, foci, strategic target-markets and market position. In the case of strategic foci (Hooley et. al. 1993, Narver-Slater 1990), the following factors were taken into account: quality orientation, cost and efficiency orientation, and the increase and preservation of market share respectively.. The third dimension, applied by the former authors, namely increase of market share, was regarded as irrelevant in our research. The above factors were appraised on the Linkert's scale extending from 1 to 5.

Selection and weighting of the target market were carried out according to the dimensions determined by Porter (1980): geographical coverage of the market (domestic export and country-wide regional /local), components of the product line (wine-grape, must, canned wine, barrelled wine, and bottled wine), consumer segments (retail forms, restaurants, pubs, private sales, etc.) and brand name operation. .

In the case of market positioning,the following items were evaluated: price, position, quality position, position of product development, technological development, and purchasers' loyalty. Market position was evaluated on a scale extending from 1 to 3 (l = better than the average, 2 = average 3 = worse than the average). Taken into account regarding company behaviour were technological orientation (wine-growing, grapevine cultivation), consumer/purchaser orientation (consumer behaviour in retail purchases and catering trade), barriers to market penetration (domestic and export markets), as well as the degree of innovation and competition..

The following factors of business performance were considered: market performance indices (rate of increase in export sales, domestic sales, share of export), financial performances (profit as the proportion of sales revenue, profit as a proportion of assets). As for performance indices, determination of concrete values (%) was asked for, and probably this is why the share of non-respondents was relatively high.

Taken into consideration in establishing strategic types and groups were the strategic variables detailed above. 36 strategic variables were analysed by means of factor analyses, then through factors and clusters, and then strategic groups were formed.

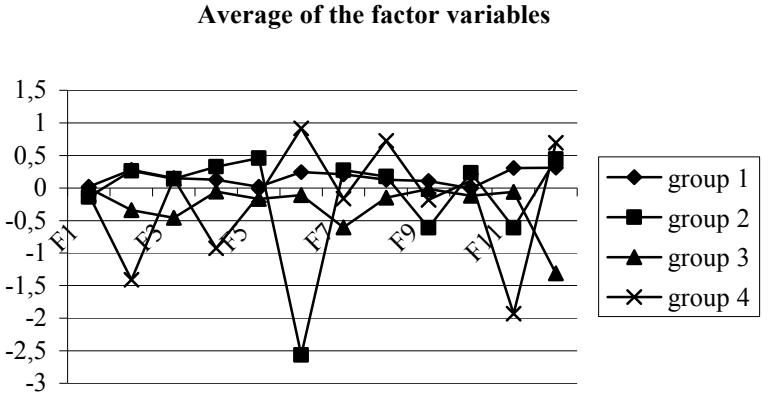
Table 1. Values of factors and strategic variables in the rotated factor matrix

Variables	1. factor	2. factor	3 factor	4. factor	5. factor	6. factor	7. factor	8. factor	9. factor	10. factor	11. factor	12. factor
Sales of canned wine	0,810											
Sales of wine in barrels	0,716											
Sales in pubs	0,621											
Must sales	0,593											
Grape-vine sales	0,593											
Trade-mark	0,423											
Bottled wine		0,756										
Designation of origin		0,728										
I-II. o. Hotels and restaurants		0,618										
Link with catering		0,609										
Role of specialized wine shops		0,560										
Producer, production area, reputation			0,849									
Creation of own sales			0,744									
Local market				0,796								
Regional market				0,755								
Wages cost					0,842							
Cost of raw material					0,829							
Quick amelioration of variety					0,480							
Link with industrial suppliers						0,851						
Technological elasticity						0,732						
Stable wine quality							0,757					
Wine-tourism							0,488					
Producer's own brand								0,818				
Product without brand								- 0,573				
Number of competitors									0,664			
Link with grape-vine growers									0,594			
Sales price									- 0,528			
Central and East European market										0,668		
West European market										0,580		
Domestic retail chain										0,513		
Domestic whole market										0,418		
Link with retail trade											0,764	
Company size											0,642	
Availability of raw martial												0,762
Familiarity with varieties												0,478

Factor weights were fluctuating between 3.96–8.21%. Factor weights pro factor were as follows: factor 1: 8.21%, factor 2: 7.56%, factor 3: 6.82%, factor 4: 6.56%, factor 5: 6.45%, factor 6: 5.65%, factor 7: 5.43%, factor 8: 5.20%, factor 9: 4.88%, factor 10: 4.66%, factor 11: 4.12%, factor 12: 3.96%. The cumulated factor value: was 69.80% which may be regarded as high.

In the course of cluster analysis, carried out on the basis of the 12 factors, 4 clusters were discernible. Cluster analysis was carried out by the K-mean method, with the magnitude of each cluster as follows: cluster 1, cluster 2, cluster 3 and cluster 4 comprised 59, 7, 22 and 7 companies, respectively, 2 companies were excluded from the sample because of extreme values of some variables.

Figure 1. Profile line of each cluster on the basis of factors



Clusters did not show significant differences according to the following factors: 1: the so-called product factor of low differentiation; 5: the so-called input factor (amount of wages, the low cost of raw materials, quick variety naturalization) 9: the so-called competition and bargaining power factor (number of competitors, linked to grape-vine growers) and 10:the factor of market geographical coverage (Central and East European, West European, and North American, domestic, retail chains, domestic whole groups).

3. Comparison and characteristics of strategic groups

The order of succession among strategic groups cannot be set up, since they represent strategic types that differ from each other, which cannot be ranked. General demographic characteristics of the strategic groups are as follows: grape-vine growing area (total and yield producing), grape for white wine, grape for red wine, degree of activity specialization, with grapes for wine (share of grape-vine and wine in total return from sales), processing of purchased and private grape-vine, export share and the type of the economic organisation. Average yield area of wine-growing companies, included in the sample amounts to 51.36 ha/company. Cluster 3 is the largest in size, 100.99 ha/company, followed by cluster 4 with 60.71 ha/company, cluster 1 with 34.34 ha/company and cluster 2 with 34.14, ha/company.

The size of private grape-vine production area extends to 0.0-800 ha/farm (total area) and to 0.0-650 ha (yield producing area). The share of the yield area in total amounts to 80% on the average of the sample, but there are significant differences among the clusters. Cluster 1: 84.8%, cluster 2: 75.1%, cluster 3: 69.3%, and cluster 4: 86.9%.

The share of non-yield producing area is more favourable in case of cluster 3 and cluster 2 than the average. The degree of specialization in grape-vine cultivation and wine-growing (share in total revenue from sales) is relatively high on the average of the sample (76.3%), in cluster 2: 90.8%, in cluster 1: 70.8%, in cluster 3: 72.4% and in cluster 4: 67.0%. The share of grapes for wine purchased by the companies amounts to 45.5% on average in the sample, anddistribution among clusters is as follows: cluster 4: 60.0%, cluster 1: 45.6%. The share of wine export in the case of companies participating in the sample is 30.2%, and in the case of exporting companies 40.3%. Export share of cluster 4 surpasses the average, that of cluster 1. and cluster 2 is average and that of cluster 3 is below average. Distribution of clusters according to economic organizations is mixed, all types of companies are present in all clusters, with the exception of cluster 2, where Rt (joint stock company) is not included. In cluster 1, the proportion of Ltd-s is decisive (59.6/%), in cluster 2 that of small-scale farms (57.1%), in cluster 3 the proportion of Ltds and joint stock companies amounts to 61.9% and cluster 4 is balanced in terms of according to economic structures.

Each strategic group was analysed on the basis of the following interrelations:

- Rate of market orientation
- Time horizon of planning
- Characteristics of the competition structure
- Role and components of innovation
- Relations within the supply chain (purchase and sales)
- Geographical coverage of the market.
- Coverage of the market according to product assortment (degree of processing)
- Coverage of the marketing channel and specialization of the marketing channel respectively
- Brand role and designation of origin
- Indices of market- and financial performance

Each factor was examined by using several variables in the questionnaire, in evaluating, however, only variables showing significant differences were taken into account ($p<0.05\%$), and in the case of identical variables, the significance level was between 0.1-0.05%.

Strategic groups and rate and type of market orientation

Market orientation was broken into 3 components, namely into technological orientation (grape-vine cultivation and wine technology), consumer/buyer orientation and consumer/retail trade/ catering) as well as into competitor orientation. With the exception of retail orientation, strategic groups differed from each other to a significant extent. On average, the order of importance of the factor was as follows: wine-technological information: 4.45, information on consumer behaviour 4.13, grape-wine technological information: 4.27, information on purchasing behaviour in retail trade 4.20, information on purchasing behaviour in catering trade: 4.09, and information on competitors: 3.77 (on a scale extending from 1 to 5). All types of information were overvalued by strategic group 1

as compared to the average, and technical orientation was especially pronounced (wine technology + 0.22 and grape-vine growing technology +0.20 compared to the sample's average) Consumer information was considered medium (+0.16), and the level of competitor orientation was average.

Strategic group 2 overvalued one single factor significantly, namely information on purchasing behaviour in catering trade (+0.49), other factors were undervalued. Competitor orientation (-1.06) and technological information (information on vine technology -0.74, technological information on grape -vine cultivation(-0,56) were distinctly undervalued. Strategic group 3 is the type nearest to the average and there the differences were relatively small, first of all information on competitors was appreciated (+0.18) and information on purchasing behaviour in catering trade (-0.17) was slightly undervalued. Strategic group 4 undervalued all factors, above all because of high export share and increase in export growth as it was the most export oriented group. Thus, it was bound to underestimate domestic market information, namely information on consumer behaviour (-1.17), information on purchasing behaviour in catering trade (-0.79) and technological information (-0.27 - -0.59 respectively).

Strategic groups and time frame planning

The frequency of drafting plans in strategic groups (1 = regularly, 2 = sometimes 3 = never) was as follows: business plan 1.47, annual company plan 1.71, marketing plan 1.87 and strategic plan 2.01. Regarding time horizon, strategic groups did not differ from each other in terms of annual company plan drafting and strategic planning. Significant differences could be found only in the frequency of shorter-term planning among strategic groups. Group 3 and group 2 held the best position as for the frequency of business plan drafting and marketing plans. The position of group 1 was average and that of group 4 was worse than the average.

Strategic groups and competition factors

Among barriers to market entry were various competition factors (domestic and export), competition tools (price and quality) and characteristics of competition structure (number of competitors, judgement of company size), all of which were studied. On average in the whole sample possibilities for domestic market penetration were found to be good (3.92) and possibilities for export market penetration were considered as weak (2.22) by wine-growers. Strategic groups did not significantly differ from each other in either factor.

Among ocmpetition factors, in terms of the whole sample, wine growers considered price competition to be strong/very strong (4.62), quality competition was regarded as medium (3.08). As for competition tools, strategic groups did not differ significantly in perception from each other.

In terms of the structural characteristics of competition, wine growers deemed the effect of the number of competitors to be strong, and the effect of company size as medium (3.33). A significant difference among the strategic groups. only occurred in terms of company size. Group 1 overvalued it moderately (+ 0.31), group 4 undervalued it moderately (-0.62), group 2 undervalued it considerably (-2.04).

Strategic groups and judgement of the innovation

The role of innovation in strategic adaptation is of great importance even in sectors where the rate of technological change is lower, than average. In addition to the overall evaluation of innovation, the importance of the adaptation of new varieties and technological flexilibity, respectively, were studied. Wine growers placed a high value on innovation towards maintaining competitiveness (4.02), and also on technological flexibility(3.98), although quick adaptation of new varieties was deemed medium in value. (3.18). Strategic groups differed significantly from each other regarding all three factors, and the main characteristics of each group were as follows:

- Strategic group 1 overvalued innovation, both its general role and technological flexibility (+0.31)
- Strategic group 2 undervalued all three components of innovation, especially the role of technological flexibility (-2.12) and quick adaptation of new varieties (-1.42)
- Strategic group 3 judged the role of innovation ambivalently: two factors were judged to be below the average: innovation (-0.39) technological flexibility(-0.31), although adaptation of new varieties was slightly overvalued (+0.20)
- Strategic group 4 also judged innovation ambivalently, the role of technological flexibility was overvalued (+0.45) and the two other factors were undervalued, this held especially true of the adaptation of new varieties (-0.43)

In addition to the attitude towards innovation, the technological positions of the companies were examined on the following scale (1=better than average 2= average and 3=worse than average), and respectively studied were change in variety, introduction of new technologies in grave-vine cultivation, new wine-growing technologies and new marketing methods. Within the whole sample, group averages are as follows: introduction of new technologies in wine-growing (1.70), rate of change in variety (1.73) introduction of new technologies in grape-vine cultivation (1.74) and new marketing methods (1.99). In relation to the three above- mentioned factors, the position of the companies was slightly better than the average, and the fourth component equalled the average. In the above variables, strategic groups did not significantly differ from each other.

Strategic groups and relations within the supply chain

Relations within the supply chain were studied in terms of purchase by using three variables (favourable availability of raw materials, good relations with grape-vine growers and good relations with industrial suppliers) in terms of sales oriented relations by means of two factors (good relations with retail trade, good relations with catering companies). The role of both factors was considered important and very important. The order of importance of each variable was as follows: easy availability of raw materials 4.61, good relations with catering companies 4.58, good relations with retailers 4.55, good relations with grape-vine producers 4.46; good relations with industrial suppliers 4.37. Based on variables included both in sales relations and suppliers relations, there are significant differences among strategic groups. The role of sales relations and suppliers relations were perceived by each strategic group in the following way:

- Strategic group 1 overvalued both suppliers relations (+0.35) and sales relations (+0.28). Within suppliers relations, good relations with industrial

suppliers were especially overvalued (+0.41) as well as good relations with grape-vine growers (+0.41) as well as the development of good relations with grape-vine growers (+0.34).

- Strategic group 2 significantly undervalued the importance of suppliers relations as compared to the average (-1.23) and sales relations were overvalued (+0.22). Within relations with suppliers, relations with industrial suppliers were decisively undervalued (-2.94) and good relations, established with catering companies, was held to be highly important (+0.42).
- Strategic group 3 generally undervalued and the role of relations,(with the exception of development) were undervalued to a medium extent (-0.54), but sales relations were average (+0.01).
- Strategic group 4 slightly overvalued the role of suppliers relations (+0.26), with the exception of good relations with grape-vine growers (-0.23), domestic sales oriented relations were unequivocally and significantly undervalued (-2.14)

Strategic groups and the geographical coverage of the market

Market extension was measured on the basis of perception toward export markets (West European, North American, Central- and East European) and domestic markets (the entire domestic, regional, and local market). On the basis of the entire e sample, the role of regional markets was as follows: entire domestic market 4.47, regional market 3.78, local market 3.74, West European and North American markets 3.32, Central- and East European markets 2.82. Regarding the geographical average of local markets, significant differences among strategic groups existed pertaining only to the entire domestic market. The market role of the entire domestic market was overvalued to a medium extent by strategic groups 2 and 4 alike, (+0.53), and it was moderately undervalued by strategic group 3 (-0.52) and a valuation made on strategic group 1 did not significantly differ from the average.

Link among strategic groups and product assortment and processing level

Processing level was measured by means of the following variables: bottled wine, wine in barrels, canned wine, must, and grapevine for wine production. On the basis of the average of the whole sample, the importance of each factor was judged by wine-growers in the following way: bottled wine 4.89, wine in barrels 2.29, canned 2.29, sales of grape-vine for wine production 2.0, must sales 1.26. Of the above levels, significant differences among groups occurred only toward bottled wine. . It was slightly overvalued by strategic groups 1 and 2 (+0.11), slightly undervalued by strategic group 3 (-0.16) and moderately undervalued by strategic group 4 (-0.46).

Strategic groups and the coverage of the marketing channel and channel specialization

Coverage of the sales channel was studied using the following factors: sales by domestic retail chains, specialized wine shops, taverns I-II. Classed hotels and restaurants, and pubs, private sales (wine-cellars) and wine-tourism. The role of each factor was evaluated by wine-growers according to the following order of importance: specialised wine

shops 4.48, wine-tourism 4.47, I-II. Class hotels and restaurants 4.46, retail chains 3.78, taverns and pubs 1.73 and own sales 1.60. As for channel coverage, strategic groups differed significantly from each other with the exception of sales by taverns and pubs as well as private sales. The main characteristics of each strategic group were:

- Strategic group 1 overvalued to a medium extent the role of three sales channels namely that of wine-tourism (+0.37), I-II. Class hotels and restaurants (+0.35) and specialized wine shops (+0.31), but the role of retail chains was average.
- Strategic group 2 overvalued the role of specialized wine shops to a significant extent (+0.53), meaning I-II., and to a moderate extent classed hotels and restaurants (+0.25) and mildly undervalued the role of retail chains and wine tourism (-0.21 – -0.18 respectively).
- Strategic group 3 overvalued the role of retail chains (+0.31), and significantly undervalued that of I-II. Classed hotels and restaurants, wine tourism and specialized wine shops (-0.78, -0.71 and -0.53, respectively)
- Strategic group 4 undervalued the role of all domestic sales channels in the following order: specialized wine shops -1.19, wine tourism -0.61, I-II. Classed hotels and restaurants -0.60, retail chains -0.49. The share of exporting companies was highest within strategic group 4 (7.4% and on the average of the sample 52.6%) and also export share of total sales was the highest.

Strategic groups and the role of brand identification and designation of origin

The role of brand identification was measured by means of the following variables: reputation of the producer's private brand, variety, producer and production area, role of designation of origin, private brand and that of products without a brand label. The importance of each factor was judged by wine-growers in the following way: a producer's own brand 4.94, reputation of the variety producer 4.77, reputation of the production area 4.73, designation of origin 4.60, private brand 2.37, and products without a brand label 1.30. Strategic groups did not significantly differ from each other regarding perception of the private brand and products without a brand label; in the case of the remaining 4 factors, however, there were significant differences. The main characteristics of each strategic group:

- Strategic group 1 slightly overvalued the reputation of the variety and that of the producer, as well as the designation of origin (+0.23 and +0.31, respectively), the two other factors were average.
- Strategic group 2 perceived three factors as average in importance; but designation of origin was slightly undervalued.
- Strategic group 3 undervalued all four factors, especially the variety's and producer's reputation (-0.69).
- Strategic group 4 slightly undervalued the variety and producer as well as product designation. Reputation (+0.27 and +0.23, respectively), and decidedly undervalued designation of origin (-0.74), but the producer's brand was considered average in importance.

Link among strategic groups and market- and financial performance

The market position of the companies was measured using three variables (price- and quality position and purchaser loyalty) and market growth was determined using two factors (domestic and export sales). As for market position, the following evaluations were made by the companies: quality position 1.13, purchaser loyalty 1.53 and price position 1.68. (1= better, than the average, 2= average 3= worse than the average). Among the market performance indices, only in price position was there a significant difference among the strategic groups. Strategic groups 4 considered price position to be moderately better than average (+0.39), strategic groups 2 and 3 considered it weaker than average (-0.18). Strategic group 1 found market position average.

In financial performance (profit as proportion of sales revenue, profit as proportion of assets), there was not a significant difference among the companies in spite of the fact, that the difference among groups in profit proportionate sales revenues amounted to 21.7%, and there was a difference of 50.4%, among the groups in asset proportionate profit rates, although the proportion of profit rates was distinctly different among the groups.

4. Conclusions: Comprehensive characterization of strategic groups and typifying

Divergences of each strategic group from the average of the whole sample (on the basis of distance) may be characterized as follows: In strategic characterization, significantly differing variables were considered in the case of each strategic group. In judging the observed variables, average differences were used as a basis.

Table 2. Characteristics of strategic groups on the basis of strategic factors

Strategic factors	1. strategic group	2 strategic group	3. strategic group	4. strategic group
1. Market orientation 1.1. Technological orientation	Slightly overvaluing	Moderately undervaluing	Weakly undervaluing	Moderately undervaluing
1.2. Consumer/ buyer orientation	Weakly undervaluing	Moderately undervaluing catering	Weakly undervaluing	Moderately undervaluing
1.3. Competitor orientation	Average	Strongly undervaluing	Weakly undervaluing	Average
1.4. Planning orientation	Average	Weakly overvaluing	Weakly undervaluing	Moderately undervaluing
2. Competition structure 2.1. Company size	Moderately overvaluing	Strongly undervaluing	Average	Moderately undervaluing
3. Innovation	Generally overvaluing	Strongly undervaluing	Moderately undervaluing expect for variety-change	Moderately under-valuing with the exception of techno-logic al elasticity
4. Relations within the supply chain 4.1. Supplier relations	Moderately overvaluing	Strongly undervaluing	Moderately overvaluing	Weakly undervaluing
4.2. Sales relations	Weakly overvaluing	Weakly overvaluing (catering strongly)	Average	Strongly undervaluing
5. Geographical reach of market 5.1. Domestic whole market	Average, domestic, global	Moderately overvaluing, domestic, global	Moderately overvaluing, domestic, global	Moderately overvaluing, Export-oriented
6. Level of product processing 6.1. Bottled wine	Weakly undervaluing	Weakly undervaluing	Weakly undervaluing	Moderately undervaluing,
7. Coverage of the marketing channel	Differentiated (specialized wine shop, catering, wine tourism moderately overvalued)	Widely specialized (specialized wine shop and catering overvalued)	Narrowly specialized (retail chains moderately overvalued)	Export specialization, domestic sales channels moderately undervalued
8. Branding and designation of origin	Overvaluing (variety, reputation of producer, designation of origin weakly overvalued)	Average designation of origin weakly undervalued	Generally weakly undervaluing	Average (variety, producer, production area's reputation weakly overvalued, designation of origin moderately overvalued)
9. Characteristics of performance 9.1 Market performance	Average	Average (price position slightly weaker)	Average price position slightly weaker	Average (price position slightly better)

As for dealing with marketing strategy, in the international literature the following fundamental marketing strategic types have become widespread: cost-management (leading role of cost), differentiatiation, specialialization strategy and the so-called middle strategy, meaning without strategic orientation. General characteristics of the cost-management strategy are the overvaluation of cost advantages, a strong tendency toward input and supplier-relation orientation, and strong competition orientation. Of the cost factors, wages and costs of raw materials were included in the study. Among the strategic groups, there were significant differences in perception toward raw material costs, although in terms of wages, no significant differences were revealed. On the basis of the average of the two factors, strategic group 1 was slightly overvalued (+0.17), strategic group 2 was average, strategic group 3 undervalued (-0.31 and -0.35, resp). Strategic groups relying on the leading role of cost, did not exist. Characteristically, in group 1 there was a slight stress on the role of costs. In international marketing literature, this strategy is not recommended for such sectors and small-scale companies, since the chances of successful application are very limited. A differentiation strategy can be achieved by companies in the case of very specific quality, high added value and high-quality product services.

According to the considerations in the marketing international literature, the following characteristics are the most important:: strong technological orientation, balanced consumer/competitor orientation, and appreciation of the role innovation. Characteristics of strategic group 1 were closest to the differentiation strategic group, with a slight tendency toward the strategy, based on the leading role of costs (overvalued cost factors and supplier relations). However, the question emerges whether successful application of such a strategy would be possible in the case of the smallest company size (66.9 of the average). The proportion of non-productive area was most unfavourable (15.2%) in this strategic group, thus growth rate expectations in the productive area will lag behind the average. This was also aggravated by the fact, that within the comptetition structure factors, the role of company size was overvalued compared to the average. On the basis of the above characteristics, strategic groups may be assigned to the “middle-way strategic type”, meaning without orientation, following the desire for a diverse market which is widely appreciated by domestic companies. Because of increasing requirements in the domestic market, growing competition from imports, limited financial and marketing resources, they risk falling behind without a solid strategic orientation. They would have minimum chance of significantly increasing concentration and company size; therefore, the only possibility of a change in strategy would be for them to mark out strategic centres of gravity and achieve the specialising strategy, associated with it.

The third possible strategic type is the specialization strategy, which tends towards a product range, geographical market coverage, and participation in the marketing channel, respectively. The following characteristics of the specialization strategy are considered the most significant by the international marketing literature: strong consumer/buyer orientation, weak competitor orientation (because of fewer competitors), relatively undervalued innovation (because of the lower intensity of competition), and fewer target segments. Among the groups, included in the survey, strategic groups 2, 3 and 4 followed specialization strategies of different types and rates, strategic group 2 was of domestic or local character, with more extended specialization (first of all in catering, secondly in specialised wine shops). It undervalued technological orientation, overvalued consumer buyer orientation in catering) and significantly undervalued competitor orientation (few competitors). Because of the high-rate of specialization, company size does entail a disadvantage for them. The group strongly undervalued innovation, since within their narrow niche there are fewer competitors,

and innovation pressure is less. Generally, it undervalued suppliers' relations and overvalued (above the average) the role of brand.

Also strategic group 3 may be assigned to the specialization strategic group. This strategic group is a domestic, global player and may be classified as a type directing specialization decisively toward retail chains. Technological orientation was less than the average, and competitor orientation was slightly overvalued because of competition among retail-suppliers. Company size was the largest, and thus the role in competition was considered neutral. Innovation was generally undervalued by this group, with the exception of variation in variety (medium price quality segment), suppliers relations were undervalued, sales orientation was regarded as average. Among trade channels, only relations with retail chains were overvalued. Brand, designation of origin and, especially private brands were slightly and moderately undervalued respectively.

Categorization of strategic group 4 was not straightforward, but it was mainly of specialization type, tending first of all towards West European and North American export markets. It might be regarded as a global player in the domestic market. It undervalued to a medium extent both technological orientation and consumer orientation. Generally, it undervalued innovation factors with the exception of technological flexibility, and overvalued slightly the importance of supplier relations, and undervalued domestic sales relations to a slight extent. Pertaining to bottled wine, downward deviation from the average was mostly seen. This group undervalued the role of domestic sales channels and overvalued that of the brand, designation of origin, variety, producer and area of production.

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Pork Market Cyclic Phenomena in Some Key EU Member States

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Abstract

The hog cycle problem has been a concern for economists since the late 1920s. This paper addresses the problem of whether the hog cycle has existed in the major pork producing EU member states over the past decade, and if so then how long is the cycle? A simplified version of Fourier's analysis was used in the analysis. It has been shown that cyclic phenomena of various lengths characterise the development of breeding stock, output and prices. Slight oscillations are typical in the pig population, while significant deviation can be observed in the case of production output and prices.

Key words

EU member states, pork market, hog cycle, Fourier analysis

1. Introduction

For centuries the Hungarian economy has been struggling with the problem of exporting low-processed products to the West while importing processed goods. For instance, for centuries grey cattle were exported, while during Maria Theresa's reign it was prohibited to establish factories. During the Austro-Hungarian Monarchy, Hungary functioned as the empire's breadbasket. The European Union again seems to want a similar role for Hungary by implying that, after accession, Hungary will be successful in the grain sector, but not in the meat sector. Nevertheless, it does make a difference whether one is selling grain in its original form or inside the stomachs of animals, and a given product's ratio of added value when sold in the market also matters. Whether the EU's "wishful thinking" comes true or not depends on the Hungarian meat sector.

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Hungary will not become a EU pork market leader. Instead, she will be in a position similar to that of a small enterprise operating in a market dominated by large corporations, surviving only in niches not covered by the big ones. In order to stay alive, one needs to understand the behaviour of these "large corporations". Therefore this paper is intended to describe market trends in some key EU member states, i.e. the industry's big players, without trying to provide explicit explanations for trends observed.

The hog cycle phenomenon – i.e. the pork market's recurring three-year periods – is common knowledge. As we will see, the duration of the period is becoming longer, and today it is safer to talk about a four-year cycle. It is important to note that in each of the relevant EU member states the market differs from the others.

2. Overview of literature

Since 1977 the growth in production has exceeded that of consumption in the EU, and for this reason, the EU introduced strict measures to prevent the import of products originating from third countries (sluice-gate price, cream skimming). In addition the European Union provided investment-related financial support to its own pork producers. Up to 1990 the EU pork industry was characterised by growth. In order to secure a balanced market, the EU had to export 1-1.5 million tons of pork each year. Prior to the Common Agriculture Policy, price trends were characterised by cyclicality running inversely to production in the key pork producing member states (Belgium, France, the Netherlands, Germany, Italy), and the cycle length within the EU was three years. As Trégaro and Lossouarn [2002] concluded, the industry players pursued a dual goal: on the one hand, to capitalise on the benefits of economies of scale (reducing the prime costs) and also to maintain the margin in case of low prices, by increasing the output. Production potential increases led to a supply and demand imblance, and as a result, producers' prices dropped. Since the 1960s the production cycles occurred in a regular pattern. In the 1990s producers' behaviour was determined by the liquidity of the enterprises and the price of feed grain. The progress of the European hog cycle was interrupted due to the outbreak of classical swine fever in 1996-1997. EU cycle duration became longer over the past years, and the fluctuations became greater primarily because of the concentration of production and almost absent speculative pig fattening. Those producing optimal economic size and who were specialised solely in pork production could reduce their production costs and thus resist price reductions better.

In 1930 three independent authors laid the foundations for the cobweb theorem to describe the progress of market process: the American Schultz [1930], the Dutchman Tinbergen [1930] and the Italian Ricci [1930]. Coase and Fowler [1937] concluded that lack of market information really influenced the trend of the hog cycle. It is difficult for the producers to exactly predict the meat industry's reaction to demand, and to predict the meat industry's way of adjusting its short term production if the size of the breeding stock starts to fluctuate. Ezekiel [1938] assumed that the supply of commodities under review would be entirely inflexible in the short term, in other words, the "period to be reviewed should be short enough to prevent any modifications in the supply in the given period, such as the supply of cotton and potatoes, as soon as the yearly produce is harvested."

New methods were used to address the problem over the past two decades compared to those used before: vector autoregression (Kaylen, 1988), demand demography models

(Rosen et al., 1989), periodically recurring production response (Hayes and Schmitz, 1987) and chaos models (Chaves and Holt, 1991; Streips, 1995). According to Kövesi [1973] the hog cycles usually happen within a four-year range. The duration of hog cycles is influenced by fattening methods, the mean fattening weight, and the pig species. Hog cycles move according to a specific mechanism. Kövesi [1973] sums up the essence of this mechanism as follows. As feed prices increase, the live pig price and the feed price ratios deteriorate, and as a result, production profitability suffers. In response to this, pig farmers will reduce production, and as a result, the live pig supply will tend to decrease. In turn, reduced production will result in reduced demand for feed, which leads to a drop in feed prices. Reduced live pig supply will induce an increase in the live pig price. Gábor Kornai, in his study published in 1981, pointed out that the hog cycle phenomenon existed even in the socialist economic environment. Bródy's [1983] fundamental work sparked a new wave in the study of economic cycles. In their paper, Vizvári et al. [1999a] demonstrated that studying the way producers estimated the future product price was a major element in creating the so-called cobweb models intended to describe dynamic market characteristics. Vizvári et al. [1999a] came to the conclusion that intuition and instinct played a greater role than carefully considered, analytic business rationale in price forecasts on family farms. Hajduné and Lakner [1999] pointed out that the imbalance in demand and supply plays a prominent role in the sizeable fluctuation in agricultural prices. Large producers – owing to their size – react more slowly and more moderately to changes in market conditions compared to small producers. The imbalance in agricultural product markets was accentuated by increased participation of small production units.

As for the pig population, one may distinguish various phases within a cycle: the *accumulation phases* and *liquidation phases*, while in price cycles the *increasing phases* and *decreasing phases*. Price cycles run inversely to production cycles, while the turning points do not necessarily intersect in time.

Of the two types of cyclical fluctuation, the shorter one is the fattening cycle and the longer the breeding cycle. The former reflects the ups and downs of the fattening activity, while the latter conforms to the "hog cycle", as shown in the pig/feed price ratio curve, which is nevertheless subject to distortion evident mainly in the shortening or lengthening of the periods. The cycle may converge or diverge depending on the slope of the demand and supply curves. These basic types illustrate that, the lower flexibility of demand compared to supply is, the higher the probability of a divergent fluctuation.

3. Materials and Methods

The Fourier analysis is an appropriate tool for examining the functions' cyclicality as this method allows for approximating within a determined range (with sine and cosine functions) those functions that cannot be described or are hard to describe with formulae using any common methodology. In this research a simplified version was used that relies solely on cosine functions but obtains good practical results. The form of the functions used was always

$$t_k = \cos(2\pi * k * t/n),$$

where n referred to the number of observations, in other words the number of retrospective time periods for which we know the quantities under review. The length of the period was either expressed in months or four-month (third-year) periods in line with EU statistics. The

variable t naturally stands for time, while k is a positive integer parameter between 1 and 14. For higher values the length of the cycle is too short to interpret.

These functions were used as the independent variables of linear regression while the dependent one was either the livestock or the market price or production. There is a cycle if the coefficient has a high absolute value. The cycle length is expressed as nh/k, where h means the length of the time period. If the cycle length is to be expressed in years, then h=1/12 where monthly data had been used, and h=1/3 where data had been given for four-month periods. Positive coefficient refers to a cycle with this length, while a negative value refers to a cycle of double length. The regression equations are summed up in the tables included in the last chapter, but references to these variables are made earlier in this document, too.

4. The pig cycle at present

4.1. Denmark

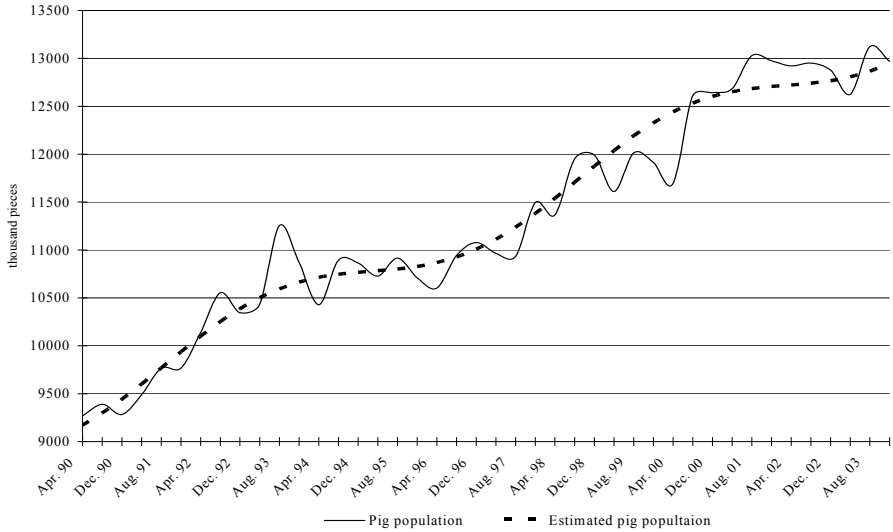
At the end of the 1970s, Danish agricultural authorities and the rest of the industry decided to try making the pig industry export-oriented. To achieve this goal it was essential to concentrate both raw material production and processing. It was recognized that satisfying sophisticated meat consumer needs could be done solely in a comprehensive production system that included the breeding-to-sale phase, too. They also considered the observance of contractual relations essential for monitoring the production chain and having adequate quality control. The successful operation of quality management systems hinged on full-scale documentation and production process control (Windhorst, H-W., 2000).

Tendencies in the pig population

The pig population in Denmark was over 13 million head in 2002, while pig for slaughter output was close to 24 million head. Animal stock increased steadily from 1990 to 2003, by some 40 percent altogether, meaning an annual increase by 3 percent.

Figure 1

The development of pig population in Denmark (April 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

Breeding stock fluctuations were observed from April 1992 to April 1997. The pig population reached its lowest in April, while the peak was reached from August to December. In April 1990 the Danish pig population hardly exceeded 9 million head (Figure 1). Trends in the Danish pig population can be described using the following regression equation:

$$Y_{pig\ population}=9325.3+92.4t-255.9t_2$$

Based on t2's coefficient in the regression calculation cyclicality is obvious in the Danish pig population; and specifically a 14-year cycle, and this corresponds to the length of the time series. The function fits well (R2=0.956) on the original curve showing changes in the pig population. Matching the functions produced an observable flattening trend, and a 6.5-7-year cycle can be observed based on both the original and fitted curves.

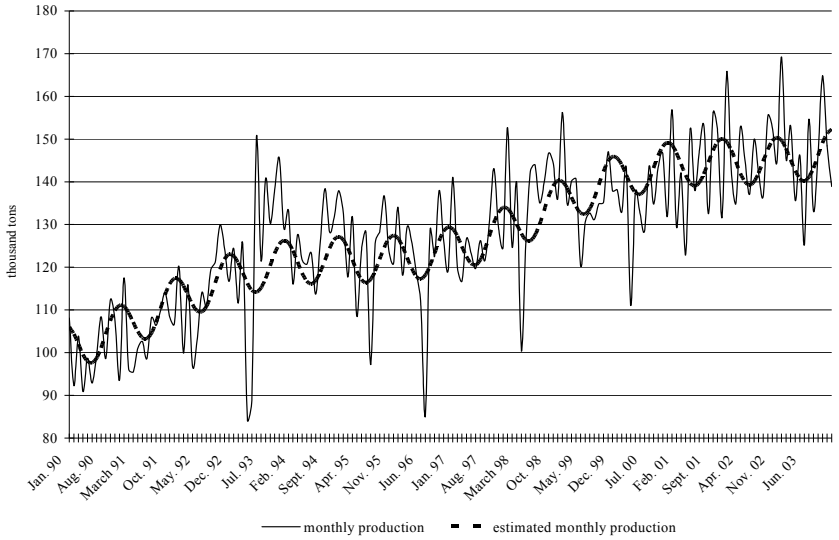
Tendencies in pork production

Danish pork production increased from 1.2 million tons in 1990 to 1.8 million tons by 2003, which means a total increase of 50 percent and an annual increases of 3.6 percent during the period.

Increase in productivity and favourable economic conditions can explain this dynamic growth. Thanks to breeding technology modernisation – as mentioned above – the indicator of pig for slaughter output per sow increased. Subsequent to the CAP reforms, grain prices dropped, leading to favourable changes in the pig for slaughter production costs. As Laursen et al. [1999] put it, the poor profitability of cereals also contributed to the increase in production, as it encouraged grain producers to increase sales for pig fattening. Following German reunification, production dropped dramatically in the eastern provinces. At the same time a fragmented production structure continued to characterise the western provinces, and consequently new export possibilities opened for Denmark.

Figure 2

Pork production in Denmark (January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

Trends in Danish pork production can be described with the following regression equation:

$$Y_{pig\ meat\ production} = 104.6+0.3t-3.5t_2+5.4t_{14}$$

Since t2's coefficient has a negative sign, this refers to a cycle of double length, which in this case means 14 years, i.e. the same as the length of the time series reviewed. Nevertheless, the positive sign of t14 variable's coefficient suggests the presence of several one-year cycles (Figure 2). The regression is satisfactory (R2=0.639). Although in a certain part of the fattening cycle the increase in slaughter pig prices continues to grow, and at this point profitability is already dropping, since the growth in production costs exceeds the increase in pig price.

Tendencies in producer prices

Based on a so-called quotation committee, which weighs the market situation, the Danske Slagterier (Association of Danish Slaughterhouses) determines the producer price for the Danish pork market. The price depends heavily on the previous week's profit. Thus the producer price follows the price of processed products but with a lag of one or two weeks, and a premium system exists at Danish slaughterhouses. Quality is measured according to two parameters: carcass weight and lean meat content. Payment categories linked to the former correspond to the range of 50-99.9 kilograms.The ideal warm-carcass weight is 67-77.9 kilograms[10].

[10] If the carcase weight is between 63-66.9 kilograms or is below 63 kg, then 0.10 DKK/kg, respectively, 0.50 DKK/kg, is deducted from the established price. The producer is punished also in the case if the carcase weight exceeds 77.9 kilograms. If the carcase weight is between 78-86.9 kilograms or is over 87 kilograms, then the sum is deducted by 0.10 DKK/kg, respectively, 1 DKK/kg.

The base price is determined on a 59 percent lean meat content[11]. The system encourages the producers to produce pigs with a carcass weight of 67-78 kilograms and a minimum 59 percent lean meat content. (The pork producer price was analysed on data available from 1990 to 2003).

The following function can be used to describe Danish pork producer price trends. (Figure 3):

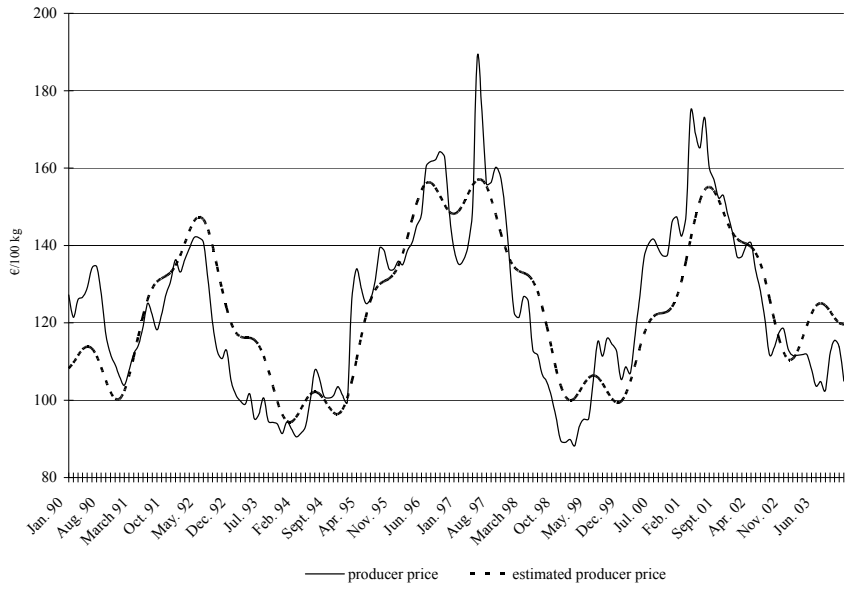
$$Y_{price}=118.0+0.1t-3.9t_1+8.4t_2-21.8t_3+4.6t_5+3.8t_6+3.8t_7-5.3t_{14}$$

The quality of the regression is good (R2=0.704). As t1's coefficient has a negative sign, a 28-year cycle can be demonstrated, however due to the shortness of the time series reviewed, the existence of this cycle cannot be verified. Variable t2's coefficient has a positive sign and suggests a 7-year cycle. Again the negative t3 coefficient indicates a cycle length of 9.33 years. t5, and t6's coefficients, as well as t7's, reveal cycles 2.8, 2.33, and 2 years, respectively. Variable t14's negative coefficient also shows a 2-year cycle. Because of the opposite signs of the last two coefficients, the two cycles with the same length sometimes reinforce, and sometimes weaken one another.

Based on the estimated price curve, an increasing phase of 2.5 years and also a decreasing phase of 2.5 years can be read from the graph.

Figure 3

Pork producer prices in Denmark (January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

[11] *Over 59 percent lean meat content the producer is rewarded with a premium of 0.10 DKK/percentage point, while if the lean meat content exceeds 65 percent, the premium amount is 0.60 DKK. Below 59 percent lean meat content a deduction of 0.10 DKK/percentage point is applied by the slaughterhouses, and in the case when over 87 kilograms the lean meat content is below 48 percent, the punishment is in the amount of 1.10 DKK.*

4.2. The Netherlands

Tendencies in the development of pig population

Dutch pork production grew rapidly between 1960 and 1985. Increase in consumption and a favourable position achieved by the industry are seen as the key factors behind this trend. The Netherlands is the sixth largest pork producer in the EU-15. Its 13.6 million pig population in 1990 dropped to 11.1 million head by 2003 (Figure 4). This reduction was primarily due to environmental reasons. In 1999 the Dutch government launched a production-reducing programme, providing state subsidies for those farms limiting production. The drop in the number of pig farms had a significant effect on this country's production potential, lowering the sow population by 22.6 percent from 1999 to 2003.

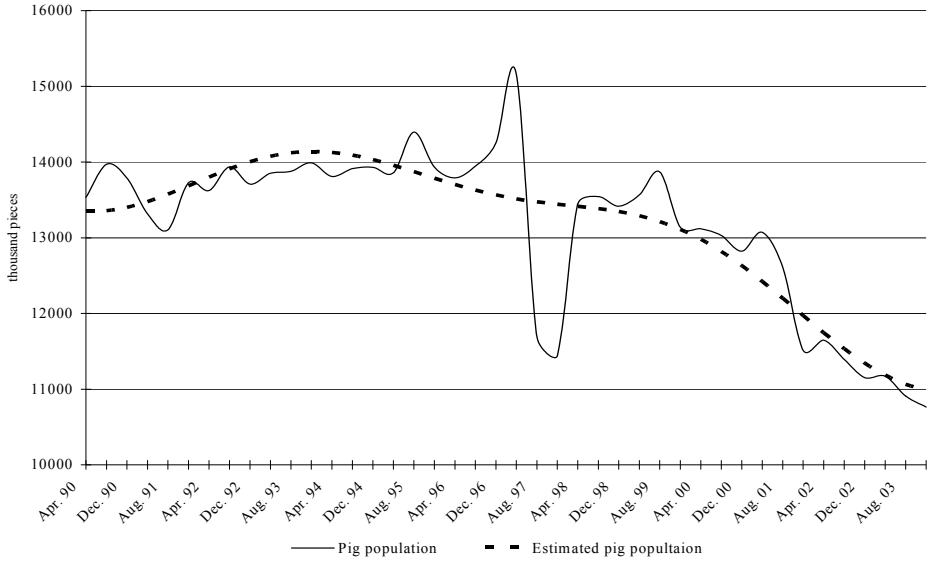
Dutch pig population stagnated from 1990-1996. The classical 1996/1997 swine fever epidemic made it difficult to show cyclical changes from 1990 to 2003. The changes in the pig population can be described with the following equation:

$$Y_{pig\ population}=14\ 389.6-57.2t-689.0t_1-313.2t_2$$

t1's negative coefficient suggests a 28-year cycle. Nevertheless its presence cannot be confirmed due to the shortness of the time series. t2's coefficient also has a negative sign indicating a 14-year cycle. The approximate function meshes well with the original data curve as R2=0.718. Some of the uncertainties observed in these calculated values could be explained by the 1996 common hog cholera which upset the entire Dutch market.

Figure 4

The pig population in the Netherlands (from April 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

Pork production tendencies

Like the pig population, pork production also grew rapidly between 1960 and 1985. After a 25-year expansion Dutch pork production had to face veterinary health, environmental and economic problems. Between 1988 and 1995 the Dutch administration launched environmental programmes, which ultimately led to production restrictions. Thus, Dutch pork production fell from 1.6 million tons in 1990 to 1.4 million tons in 2003. Recent strict environmental measures were significant in causing a 22 percent drop in output from 1999 to 2003. The balanced production trend was broken due to the classical swine fever epidemic of 1996/1997. Dutch pork production is also characterised by cyclicality.

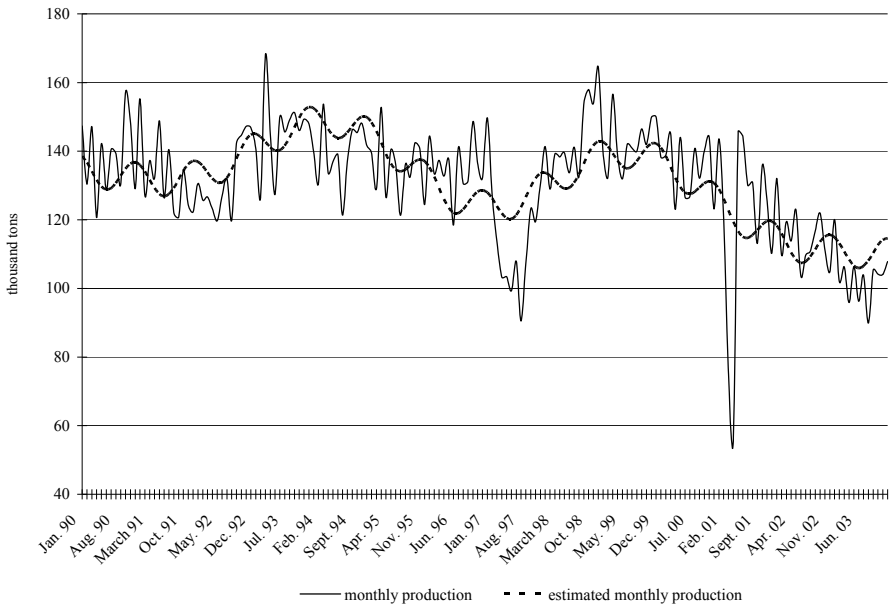
Based on t-statistics and p-values, in the regression calculations six of the 15 explanatory variables were found significant

$$Y_{pig\ meat\ production}=143.3-0.1t-6.1t_1-7.8t_2+5.6t_3+4.6t_{14}$$

As for the pig population trend, the 1996 classical swine fever epidemic also had a negative impact on production. The negative coefficients of t1 and t2 imply cycles of 28-years, and respectively 14-years, but these lengths match the length of the time series. t3's positive variable indicates a cycle length of 4.6 years. Based on explanatory variable t14, one can detect a 1-year cycle. As seen from the above, Dutch pork production falls victim to a number of simultaneous cyclic effects. The regression is characterised by a low value (R2=0.448). At the same time the estimated values tend to match the curve indicating the development in pork production (Figure 5).

Figure 5

Pork production in the Netherlands (from January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

The curve showing the trend in pork production supports our previous assumption that the production trend is influenced by multiple cyclic effects.

Tendencies in producer price trend

The price paid to a farmer for pigs reared for slaughter depends on the quantity of pigs for sale and the size of breeding stock in each Dutch farming unit.. It is hard to see clearly the trends prevailing in the Dutch pig market, thus the producers have to survive in a harsh competitive climate. The producer prices from 1990 to 2003 have been analysed, and Dutch pork prices are subject to cyclic impacts (Figure 6).

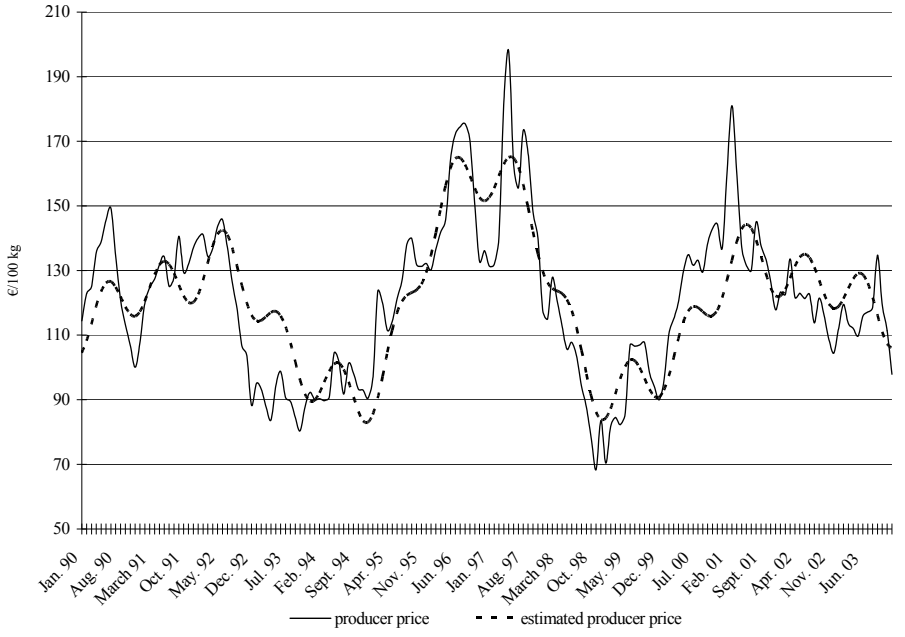
The trend in Dutch pork prices can be described with the following equation:

$$Y_{price}=119.6+0.01t+14.2t_2-22.0t_3+5.1t_4+3.1t_5+3.3t_7-3.6t_8-8.5t_{14}$$

Cycles are indicated by variables t2 and t3, as their coefficients have the highest absolute value in the regression equation. Based on t2's coefficient, the calculated cycle's length is 7 years. t3's negative variable suggests a cycle length of 9.3 years. The estimated producer price meshes well (R2=0.697) with the original price curve. The estimated price curve values clearly show a 9.3-year cycle.

Figure 6

Pig meat producer prices in the Netherlands (from January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

4.3. France

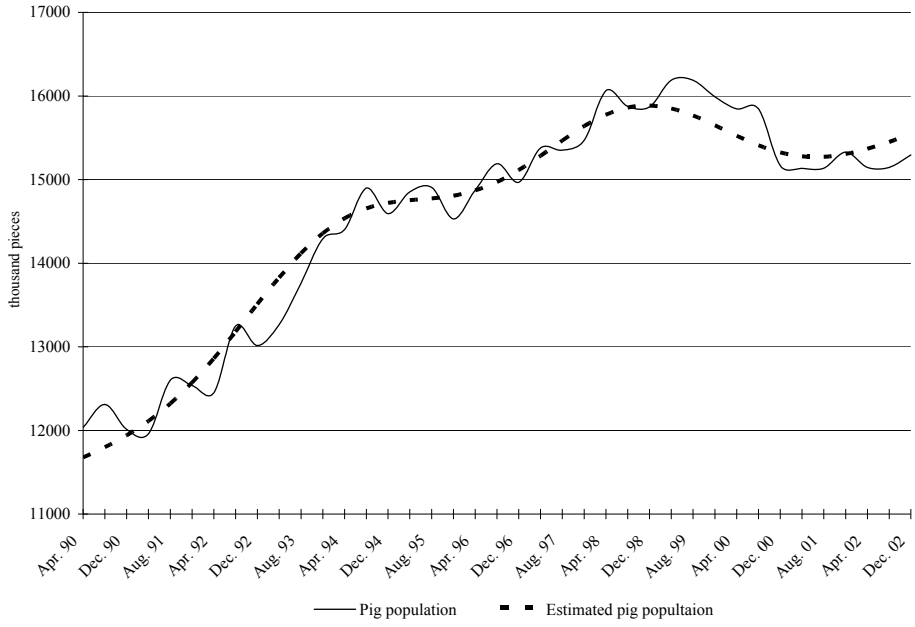
Tendencies in the development of pig population

France became self-sufficient in pork supply in the 1960s. At that time production was disorganised. But customs tariffs imposed on transactions among EU member states were gradually lifted, and this significantly helped competitor countries (Belgium, Denmark, the Netherlands) to export their products to France. Because of the bad market situation and because of pressure from special interest groups, the French agricultural administration accelerated measures to strengthen pork producing "family farms". Pig farms received national subsidies for their pigsties, for the biological fundamentals for breeding stock, and for technological improvements in animal storage. The establishment of "producer associations" (Groupement) contributed significantly to eliminating adverse market processes in the hog industry. The pig sector in Bretagne responded well to these measures, as this region, within a short time, became the largest pork producing area in France. As much as 71 percent of France's pig population is in the 'Grand Ouest' (Bretagne, Loire, the Normandy Valley and Poitou-Charentes), and is owned by 30 percent of all the pig farmers.

France's pig population increased from 12 million head in 1990 to 16 million by 1999, producing an aggregate growth of 33 percent and an annual growth of close to 2 percent. The regression equation describing the pig population trend was based on data available from 1990 to 2002.

Figure 7

Development of pig population in France (April 1990 to December 2002)



Source: Self-made calculations based on Eurostat (2003) data

Based on regression calculations the changes in pig population can be described by the following equation:

$$Y_{pig\ population}=12503.17+101.97t-839.45t_1-254.09t_2+160.59t_3$$

As in Dutch animal stock, the variable t1 indicates a 26-year cycle, however the shortness of the time series means the presence of this cycle cannot be confirmed. Likewise, t2's negative coefficient implies the presence of a 13-year cycle, but this corresponds exactly with the series time length. The t3 explanatory variable indicates a cycle of 4.3 years in length. The estimated data fit well on the points of the original curve as R2=0.958.

Pork production tendencies

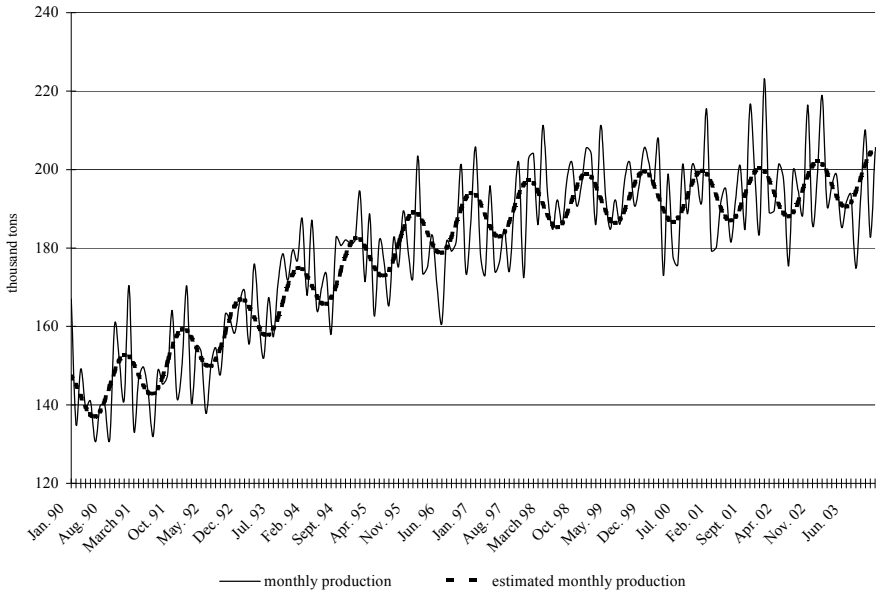
Over the past decades French pork production increased alongside the growth of the pig population.. Output grew from 1.7 million tons in 1990 to 2.4 million tons by 2003. The period from 1990 to 2003 has been analysed. Pursuant to the regression calculations, pork production can be characterised using the following equation:

$$Y_{pig\ meat\ production}=149.98+0.34t-8.74t_1+6.48t_{14}$$

The function's t1 explanatory variable describing pork production has a negative sign, indicating a double cycle length, and also suggesting a cycle of 28 years, which cannot be confirmed due to the shortness of the time series. t14 variable's positive coefficient indicates a full cycle of 1 year. In fact it is characteristic of French production.

Figure 8

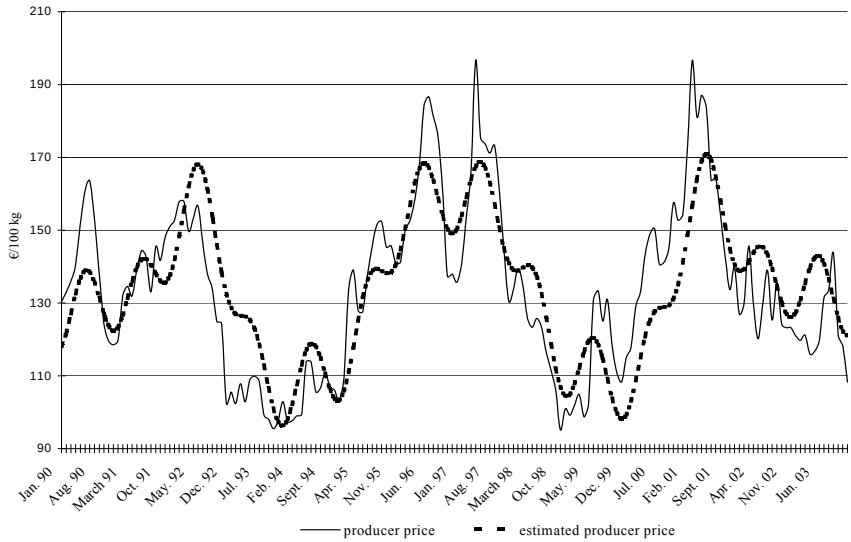
Pig meat production in France (January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

Figure 9

Producer prices in France (January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

The estimated pork production curve corresponds well with the original function (R2=0.778). It is easy to detect 1-year production cycles by looking at the matched functions (Figure 8).

Tendencies in the development of producer prices

As in the other countries, French producer prices also fluctuate radically. They were analysed based on data available from January 1990 to December 2003 (Figure 9). Their evolution can be described with the following equation:

$$Y_{price}=131.86+0.03t+10.57t_2-20.94t_3+5.79t_5+3.68t_6-5.04t_8-9.28t_{14}$$

The most important cycles belong to the variables t3, t2, and t14, since their coefficients have the highest absolute values. The length of the cycle indicated by t3's coefficient is 9.3 years. This cycle is apparent from the matched function for between June 1992 and July 2001. t2's positive coefficient refers to a 7-year cycle. The variable t14 has a negative coefficient showing a 2-year price cycle. The duration of the cycles belonging to variables t5, and t6 are 2.8 years, and 2.3 years respectively. t8's variable has a negative coefficient which refers to 3.5 year cycle. The quality of the regression is a satisfactory value (R2=0.667).

4.4. Spain

Pig population trends

Spanish pork production grew rapidly in the years preceding Spain's joining the EEC (by 6.5 percent in 1970-1986), and consequently Spain became self-sufficient in pork supply by the end of the 1980s. Following EEC enlargement, production increased by 5.8 percent every year between 1986 and 2000. The Spanish pig sector – unlike its northern competitors – was able to capitalise on its cost advantage due to its cheap labour.The Spanish pig sector

became export-oriented both in European and global markets. After Germany, Spain is now the second largest pork producer among the EU-15. In 1994 Spain's pig stock represented 15.5 percent of the EU-15 pig population and its share grew to 19.3 percent by 2002. The pig population in Spain grew by 3 percent on average, each year from 1990 to 2003, which means that the number of animals increased from 16.5 million in 1990 to 23.5 million by 2003.

According to the regression calculations, pig population trends in Spain are best described by the following equation:

$$Y_{pig\ population} = 15788.5 + 194.6t + 452.0t_1 - 639.1t_2 + 223.61t_3 + 221.0t_8,$$

Despite the high growth rate, cycles can also be observed here.(Figure 10). Both variables t1 and t2 refer to a cycle of 14-years. The variables t3 and t8 indicate cycles of 4.6-years, 1.75-years respectively. The estimated curve meshes well with the original population curve as R2=0.967.

Pork production tendencies

As with the pig population, pork production in Spain experienced rapid growth from 1990 to 2003. The output increased from 1.7 million tons in 1990 to more than 3.3 million tons by 2003, which corresponds to an average annual growth of 5 percent.

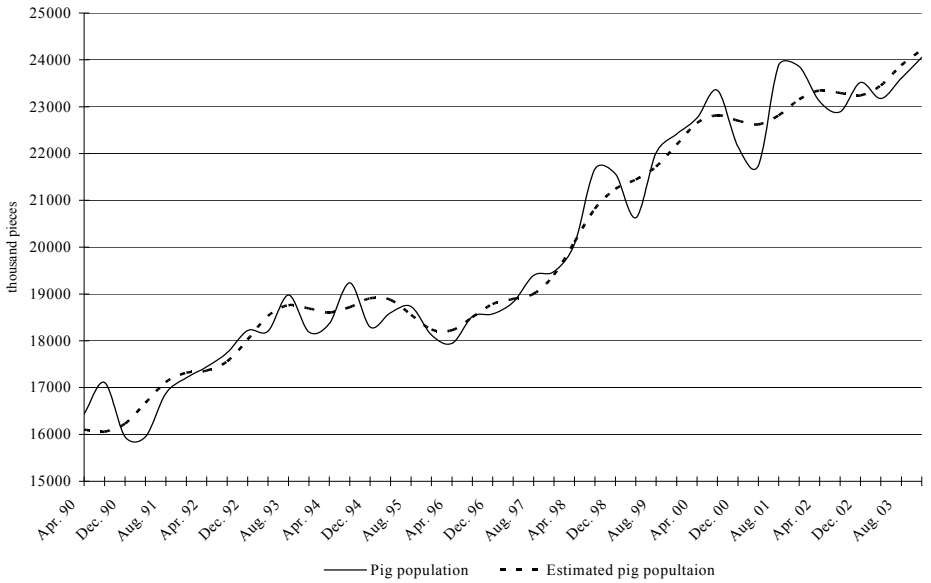
Spanish pork production is characterised by "yearly cycles", made clear by the regression equation describing production:

$$Ypig\ meat\ production = 134.8 + 0.8t + 6.1t1 + 5.9t3 + 22.6t14$$

Variables t1 and t3 indicate cycles with lengths of 14-years, and 4.6 years respectively. t14's coefficient explains the yearly output changes, which can be clearly seen by looking on the curves (Figure 11). The regression quality is good at R2=0.875.

Figure 10

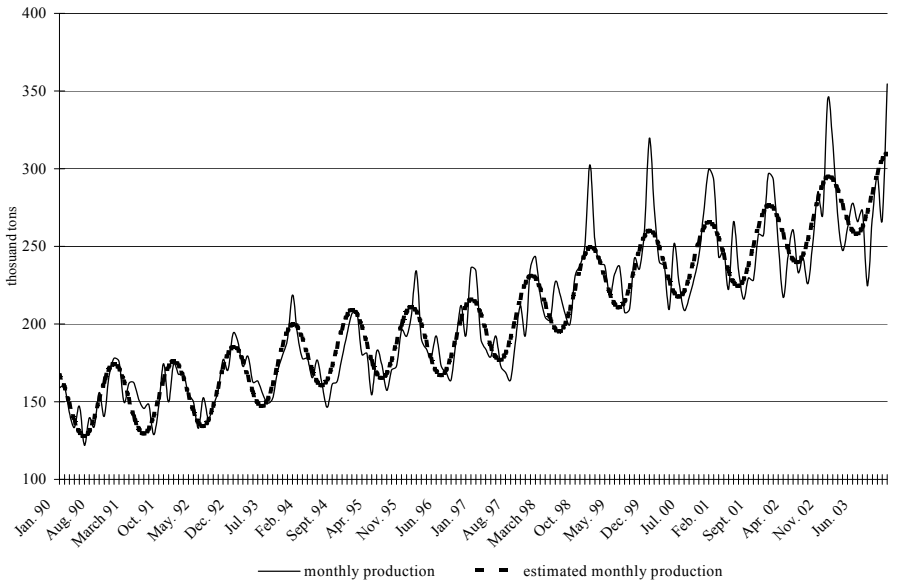
The development of pig population in Spain (April 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

Figure 11

Pig meat production in Spain (January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

The calculated values are based on estimated production figures and they mesh well with the original data, since the value of the determination coefficient of regression is high: (R2=0.875).

Tendencies in producer prices

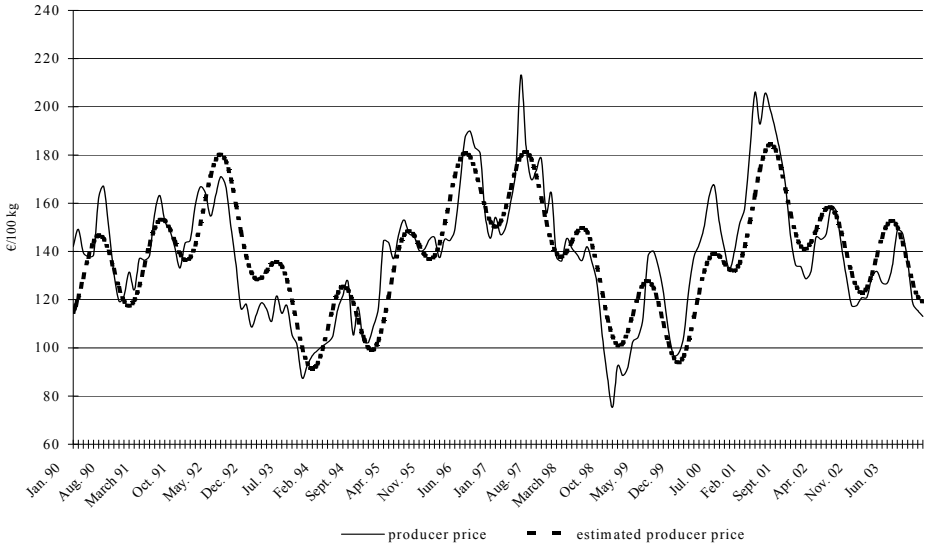
Price evolution was analysed from data for the period 1990 to 2003. Unlike the pig population and the produced meat quantity, producer prices are influenced by a number of cycles. The following equation has been derived through regression calculation in order to illustrate producer price development:

$$Y_{price}=135.06+0.04t+10.69t_2-23.55t_3+6.30t_5+3.84t_6-4.05t_8-15.75t_{14},$$

Of all the regression coefficients, the strongest correlation between time factor and pork producer price is indicated by t3, t5, t6 and t2. The cycle illustrated by explanatory variable t3 lasts 9.3 years, and occurred from June 1992 to July 2001. Variable t2 illustrates a 7-year cyclic movement observable for instance in the period from June 1993 to July 2000.

Figure 12

Producer prices in Spain (January 1990 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

The cycle lengths indicated by variables t5, t6 and t8 are 2.8, 2.3, 3.5 years, respectively. The quality of the regression is characterized by value R2=0.731.

4.5. Germany

Tendencies in pig population

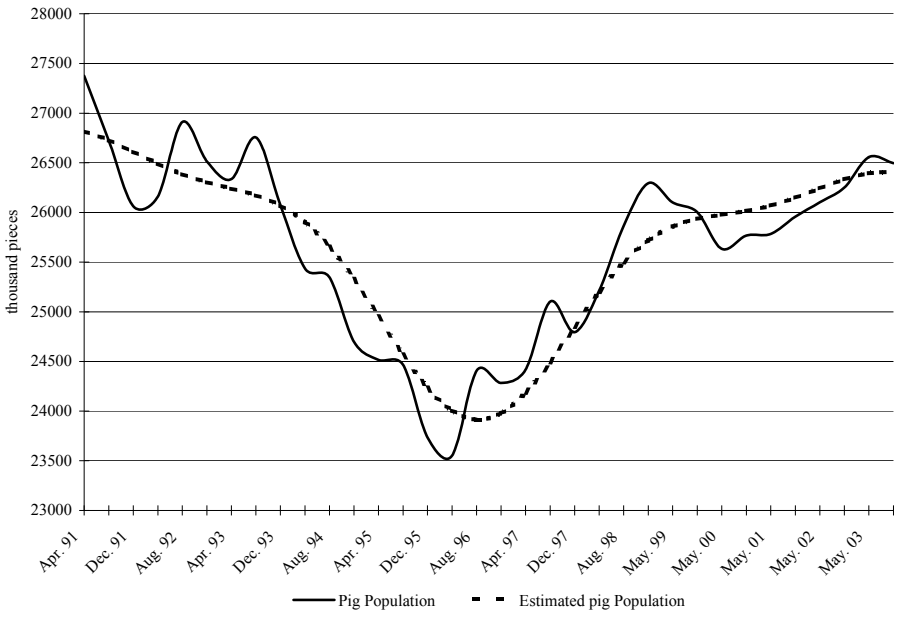
In the former West Germany pork production grew steadily until1989, despite high feed grain prices. Cheap South American manioc and soy encouraged pork production expansion in the northern provinces where farming units specialised in fattening (large-scale

production structure), while in the south farms specialised in piglet rearing (small-scale production structure). West Germany could not become independent in pork supply, mainly because the producer price often exceeded community price level.

Scharner's study [1997] described the largest East German farms' 1989 slaughter pig output. The four largest farms fattened 25-95 thousand pigs a year. In 1989 there were 12 million hogs in the eastern part, however by 1994 this dropped to 3.6 million. The reason for this was significant disinvestment in the eastern provinces' pig industry following German reunification. The pig population in the new German Federal Republic declined to a low of 23.5 million head in the year 1995 to 1996.

Figure 13

Pig population in Germany (April 1991 to December 2003)



Source: Self-made calculations based on Eurostat (2003) data

The regression equation reflects the pig population's stagnation, because coefficient t's variable has a value close to zero. Between 1991 and 1996 the pig population experienced a dramatic decline (Figure 13). The population dropped from 26.7 million head in 1991 to 24 million by 1996, representing a decline of 11 percent. In April 1996 the pig population began to increase steadily and by August 2002 the number of pigs exceeded 26.2 million head, a figure quite close to the 26.5 million in 1992. No cycles are evident from the regression equation. One reason could be that major political changes forced the market in a new direction. The quality of the regression is still satisfactory (R2=0.588). Because of the uniqueness of Germany's situation, production and producer price data were not analysed, as one can't tell exactly when the economic situation normalised over the past decade.

5. Conclusions

The overall conclusion is that cyclical phenomena of various lengths can be observed in those EU-15 states with highly developed pig farming: cyclicality characterises the pig population, pig slaughtering, and pork producer prices. A flattening trend now typifies pig populations. Based on our regression calculations and the matching of curves it has become clear that several shorter cycles are evident within a single cycle (Table 1). The longest and flattest cycles were observed in Danish pig population trends.

Table 1

Cycle durations shown in the EU member states with substantial pig meat production

Name	Denmark	Netherlands	France	Spain	Hungary
Population	14 years	14 years	13 years; 4.3 years	14 years; 4.6 years; 1.75 years	3.6 years; 4.3 years
Production	14 years; 1 year	14 years; 4.6 years; 1 year	1 year	14 years; 4.6 years; 1 year	2 years 2.6 years; 3.25 years
Producer price	7 years; 9.3 years; 2.8 years; 2.3 years; 2 years	7 years; 9.3 years	9.3 years; 7 years; 2 years; 2.8 years; 2.3 years; 3.5 years	9.3 years; 7 years; 2.8 years; 2.3 years; 3.5 years	3 years; 3.6 years; 3.7 years

Source: self-made calculations.

The fluctuation demonstrated in pork production is greater than that observed in the pig population. But the phenomenon "cycle within the cycle" is also evident in pork production. In Denmark's pork production 1-year cycles were evident within a 14-year period, and in Holland cycles of 4.6 years duration within a 14-year interval, and in Spain as well 1-year cycles were evident within a 14-year period. But the most interesting findings concern prices.

A comparison of equations describing the trend in pork procurement prices reveals that there are similarities between two specific countries, because for the most part the same tk variables and coefficients of similar magnitude and identical signs appear in them. Close correlations were evident among the countries in our review, notably between price trends in Denmark and Holland and those of France and Spain, respectively. Since Denmark and Holland produce more than they consume, economies with small production, like Hungary, need a greater commodity base when the price is high in these countries, and in turn, when the price is low in these countries, they can expect fierce competition in their market. The close relationship between the two prices is clearly confirmed by a correlation analysis with a 0.90 correlation value (r).

The regression equation's explanatory variables describing producer prices in France and Spain have the same signs, and no significant difference could be seen in the absolute values of the coefficients either. Similarly, the close relationship between the two prices is clearly indicated by the high value (0.93) of the correlation coefficient (r). No similar

correlation was evident in the case of pork production and the pig population, which is explained by the different production structures.

In the EU member states an individual cycle lasts much longer, and the hog cycle follows a flattened trend. This is partly due to predictable market regulation and partly to the concentrated production structures. In contrast, in Hungary – because of the atomised production structure – some of the market players (small-scale farmers) can be flexible when faced with changing market conditions. The ability to react fast renders the Hungarian market more sensitive to the economic environment. One of the reasons for the shorter cycles observed in the Hungarian market is precisely this lower degree of inertia.

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The chances of nutrient management in Hungary at the beginning of the 21st century: Economic and ecological aspects/considerations

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Tamás Somogyi
Zsuzsa Bacsi

Abstract

The level of nutrient replenishment in Hungary is very low compared to the international practice. Our calculations show that by the price levels of the millennium there is no realistic chance for the re-introduction of the former practice of intensive nutrient replenishment, thus there is no need to count with the accumulation of significant nutrient surpluses in the country. Locally, however, in a point-wise manner occasional excess nutrient accumulation may occur, so in the following analysis tools and methods are applied which make it possible to monitor and influence the nutrient management processes on farm level. We have improved the method of farm nutrient balance and applied it for Hungarian agricultural enterprises. The impacts of a few environmental policy tools have been modelled for the same farm businesses, which are aimed at limiting the accumulation of nutrient surpluses. In the assessed enterprises the level of nutrient accumulation was found to remain typically lower than the given threshold values.

Key words

Nutrient management, farm-level nutrient balance, environmental management, production function

Introduction

The history of chemical fertilization after World War II in Hungary can be divided to four periods (Figure 1):

- a *slow increase* until the middle of the sixties; afterwards
- a decade of extremely *fast increase*; then
- from the middle of the seventies until the end of the eighties consumption *stagnated*; and
- from the beginning of the political and economic transition of the country a period of *decline and renewed growth* followed.

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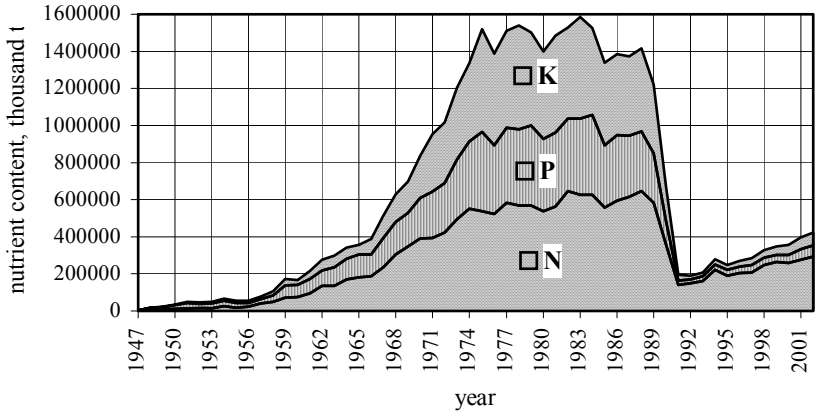
Between 1967 and 1975 the average growth rate of fertilisation in Hungary was 16,5%, which is an outstanding high value by international standards. Even faster was the rate of decrease in the fertilisation levels during the transition of the country's political and economic system. This was the period when Hungarian agriculture lost its traditional output markets in the former CMEA countries. Together with the decline of the living standards in the country the home markets also shrank, the former integration linkages broke up, a fragmented agricultural business structure emerged due to the privatisation process, and the livestock numbers fell at brutal speed. Production significantly decreased, financial problems of production as well as income and capital deficiencies became a general feature.

All this lead to a forced austerity, and it seemed natural to cut back on expenditure which did not threaten the continuity of the production process and the short term operation of the enterprises to a great extend. Besides investments, fertilisation was also involved in this, because in the former years the soils had been filled up with nutrients. Thus, after the transition period the fertiliser application by one hectare of arable, garden, orchard, and vineyard area decreased from the former 250 - 270 kg/ha level to as low as 40 kg/ha (in effective nutrient content). The abandonment of P and K fertilisation and a moderate level of N fertilisation became a general practice, and this reckless exploitation of the soils lead to negative nutrient balances as early as at the beginning of the 1990-ies (see e.g. Kádár, 1997).

Figure 1. **The sales of fertilisers in Hungary**



Source: KSH (Central Statistical Bureau of Hungary)

In Table 1 the annual fertilisation levels are shown for a few countries in the years 1992 and 2000 together with the average annual growth rates of fertilisation between the two given years. The table shows that Hungary applied the lowest amounts of fertilisation by unit area among the 14 countries both at the beginning and the end of the assessed period, although the growth rates of the period are the highest here.

Table 1. **Nutrient utilisation for 1 ha arable, garden, orchard, and vineyard area (kg nutrient content per hectare) and the rate of change in the level of fertilisation in a few countries**

Country	NPK, kg/ha (1992)	Average growth rate, % (1993-2000)	NPK, kg/ha (2000)
Austria	177	-1,89	152
Belgium and Luxemburg	424	-2,62	343
Denmark	199	-2,69	160
France	235	-1,28	212
The Netherlands	588	-3,26	451
Poland	81	3,42	106
Hungary	**38**	**8,69**	**74**
United Kingdom	303	-0,72	286
Germany	239	-0,59	228
Italy	160	-0,08	159
Spain	79	5,14	118
Switzerland	338	-4,54	233
Japan	395	-3,34	301
USA	101	0,25	103
World Total	**87**	**0,56**	**91**

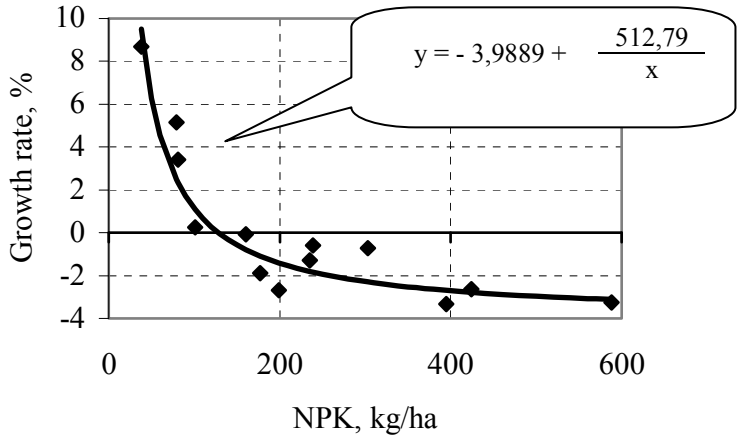
Source: KSH, and the authors' own calculations

The phenomenon is not unique. Considering the 14 countries shown in the table, while the countries with low fertilisation levels attempted to increase the level of nutrient replenishment, the countries with high fertilisation levels decreased it instead, and the countries with medium level fertilisation (150-250 kg/ha) show a very slight change, the fertilisation levels seem to stagnate here. This relationship is well demonstrated in Figure 2, and the fitted function describing the relationship between the fertilisation levels and the average growth/decrease rates. The relationship

$$y = -3{,}9889 + \frac{512{,}79}{x}$$

is considered to be a very strong one (R = 0,932) and it is significant at the level P0,1% .

Figure 2. **The relationship between the fertilisation levels in 1992, and the average growth rate of fertilisation between 1993 and 2000 by the data of 14 countries**



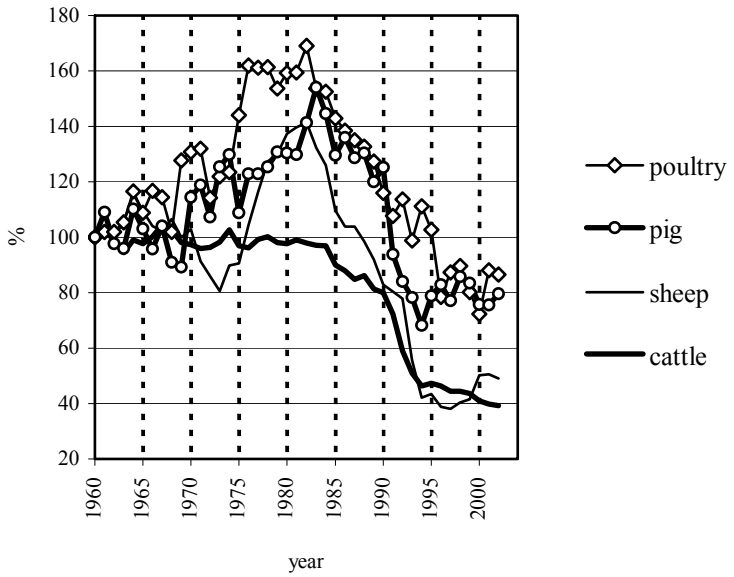
Source: KSH, and authors' own calculations

Fertiliser application in Hungary decreased to an extremely low level at the beginning of the 1990-es, and then after a decade of relatively fast growth it has been still lower than the rather low world average.

The Hungarian situation is not better regarding manure application either. As Figure 3 shows, the livestock numbers have continuously decreased since the middle of the 1980-es, and the decrease has speeded up since the system transition. Although for some livestock species a slight increase is seen in the nineties, this is far from being such a marked growth tendency as in the case of the fertilisation levels.

Thus the livestock numbers have stabilised at a very low level in the nineties, and there has been no definite and steady growth tendency in these figures since. No wonder that at the beginning of the time period assessed the amount of manure used in agricultural enterprises for one hectare of agricultural land decreased from the earlier typical level of 2,5 – 3,0 t/ha to as low as about 1,5 t/ha (Figure 4) and then it stabilised at this level.

Figure 3. **The change of livestock numbers in Hungary (1960=100%)**



Source: KSH

Considering the above no great mistake is made in saying that in the near future in Hungary there is no danger of damaging levels of nutrient accumulation in the national level (for the country as a whole). For this reason there is no justification for introducing measures aimed at limiting the average level of fertiliser application. (e.g. fertiliser input taxes). Nevertheless, locally in some farming units harmful levels of nutrient accumulation (or nutrient deficiencies) may damage the environment. Particularly threatened are the farms with high livestock densities, the livestock farms not having arable land – or having only a very small area -, in which high amounts of manure are produced without the possibility of using them within the farm itself.

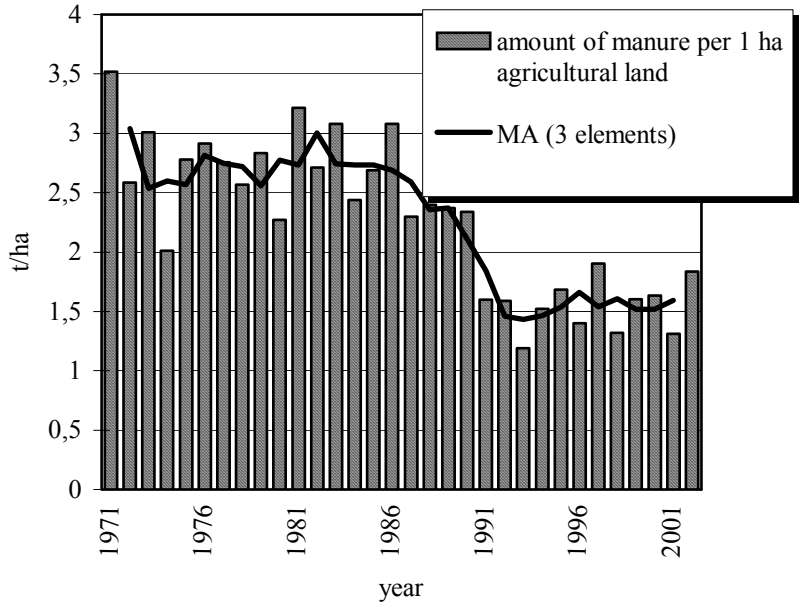
Following the country's accession to the EU the arable land area of Hungary is expected to decrease, while in this decreasing area the increased application of chemical substances, and the more intensified nutrient replenishment practices seem rather probable. This way in certain regions and farming units – differing from the general tendencies of the country – a real danger of harmful nutrient accumulation has to be faced.

This leads to the conclusion that in choosing the suitable environmental safety measures, tools and methods should be preferred which facilitate the monitoring and influencing of nutrient management on the local and farm level. Such a tool and method may be – with due consideration – the enterprise or farm level nutrient balance.

The farm level nutrient balance is a special form of the environmental balances well known from the environmental literature, and fitted to the needs of agricultural applications. Differing from traditional soil nutrient balances which compare amounts of nutrients entering and leaving the soil, the concept of farm level nutrient balance focuses on nutrients getting into the farming unit (farm, enterprise) within purchased inputs and those leaving it in sold products (or in other ways) *(*see *Isermann, 1993, Halberg et al., 1995, Breembroek et al., 1996, Doluschitz & Pape, 1998, Oenema, 1999)*. The idea gained ground in Western Europe

in the nineties, and has became increasingly used following the introduction of the Nitrate Directive ((*91/676/EEC*).

Figure 4. **Amounts of manure applied to 1 hectare of agricultural land in the farming enterprises (MA=moving averages of 3 elements)**



Source: KSH, and authors' own calculations

The most widely used version of farm nutrient balances, the "farm gate balance", is a typical farm balance based on the "black box" principle, comparing the amounts of nutrients entering the farm from the input markets to those leaving it towards the output markets, considering the difference between the two as internal nutrient accumulation or loss. For this difference, a threshold value can be defined for each nutrient, considered to be environmentally tolerable, that is, not requiring any change in the practice, nor leading to sanctions.

In the last decade an increasing number of Western European countries have introduced measures for limiting nutrient accumulations, and the relevant literature frequently discusses the topic of *indirect* environmental policy measures. In 2001 Hungary introduced the Nitrate Directive accepted by the EU member countries in 1991 (see the government regulation *49/2001. [IV.3.] Korm.).* According to this regulation certain areas of Hungary are classified as nitrate sensitive, where the rules of „good agricultural practice", and the environmentally safe management of manure are compulsory. This regulation gives only recommendations for the regulation and limitation of environmentally harmful practices of farming businesses outside these nitrate sensitive areas. However, in order to limit local nutrient accumulations the introduction of environmental policy tools should be considered in Hungary, which stimulate the decrease of environmental pollution arising from farming activities outside the nitrate sensitive areas, too.

As the aim is not the general decrease of fertiliser and manure application, but the restraining of the losses „leaking" from the nutrient cycles, the economic measures of environmental policy should also be aimed at the entire nutrient cycle, and not only on the element which is easiest to be taxed. As a consequence, instead of fertiliser input taxes the taxation of excess nutrient usage over the plant nutrient needs, that is, the taxing of the nutrient surpluses may be successful and accepted by the wider public. Choosing from the possible environmental policy measures the charge on the nutrient surpluses exceeding a certain threshold value can be linked to the nutrient balances, which measure is used in the Netherlands (see e.g. Ondersteijn et al. 2002a). The principles of the „concept of nutrient property", which is also related to the farm-level nutrient balances, has been described in our earlier papers (pl. *Urfi & Bacsi, 1999, Urfi, 2003).*

The „concept of nutrient property" is based on the assumption that nutrient replenishment has a double economic meaning. On the one hand it is an activity serving the current production process, and on the other hand it is also a way of refilling the nutrient inventories in the soil, thus in the case of positive nutrient balances – at least for immobile nutrients (P and K) - being an investment action. The correct handling of nutrient management taking into account its double economic nature could be achieved if the nutrient surpluses for phosphorus and potassium above a given threshold value were valued at the actual nutrient prices of the year, and this value were taken into account as an investment item rather than current production cost. The nutrient property computed in the above way may be included in the balance sheet of the farm enterprise as a fixed asset item – similar to buildings and machinery – and depreciation could be attached to it, too. This method of „delayed cost accounting" could, on the one hand, restrain the accumulation of large nutrient surpluses, and, on the other hand, establish a close connection between cost accounting and the economic meaning of nutrient replenishment. In the case of nitrogen, a mobile nutrient, the surpluses above the threshold could be considered as loss, damaging the environment. Accordingly, the money value of this loss could not be included in the farm accounting records, but added to the basis farm income before taxation, and to be taxed in the same way.

The environmental policy tools based on the nutrient balances are suitable for limiting the emergence of farm level nutrient surpluses, but not – or only to a limited extent – for decreasing the occurrences of point-wise pollution in the vicinity of livestock enterprises using technologies involving large quantities of slurry - outside the nitrate sensitive areas. Thus our analysis includes a tool for stimulating the environmentally conscious management, storage and utilisation of slurry, too.

Following the above considerations the research was focused on the following three objectives:

1. We intended to find out what the chances might be in Hungary for the re-introduction of cereal production technologies using high fertilisation levels typical in the eighties, with the current price structures of the millennium.
2. We applied the method of farm level nutrient balance for Hungarian farming data, and improved the method to adjust it to the Hungarian circumstances, as a tool to influence the farm level nutrient cycles.
3. We set up a model to describe the introduction of a few environmental policy measures suitable to restrain farm level nutrient accumulations, and forecast the impacts of these measures on the costs and incomes of the Hungarian farming enterprises.

Material and method

In accordance to the above three objectives the database and assessment methods of the analysis are described in three sections.

1. Analysis with the production functions of the 1980-es, and the prices of the millennium.

The essence of these calculations is to use the production functions estimated using fertilisation and yield data of the 1980-ies (actually the data of 1985) and the costs and prices of the millennium years. The aim of the analysis was to see whether at the current prices the intensive cereal production technology of the 1980-es may have any chances for success.

The fertilisation and yield data come from the database of the late Plant Protection and Agrichemistry Centre of the Ministry of Agriculture and Food Industry (MÉM NAK), and give a nearly complete, 100%-coverage of the wheat production of the four Transdanubian counties (Baranya, Fejér, Somogy, Tolna) in the year of 1985. The unit of observation was the arable field, with the average size 60 to70 ha. The main features of the database are:

Number of fields:	3085
Average yield, t/ha:	5,2
N-fertiliser, kg of nutrient content/ha:	163
K- fertiliser, kg of nutrient content/ha:	125
P- fertiliser, kg of nutrient content/ha:	104
Soil analysis values:	
– Humus (mould), %:	2,1
– NO_3+NO_2, ppm:	18,0
– K_2O, ppm:	234
– P_2O_5, ppm:	187

By the data of the above database quadratic curves of the following form were fitted: y = a + bx + cx2 , in which the dependent variable (y) was always the wheat yield, and the independent variable (x) was the N, the P, or the K nutrient content of the applied fertiliser dosage, respectively. Thus the following three production functions were established (all the relationships are statistically significant at the level of P5%):

x = N-fertiliser, nutrient content, kg/ha; y = wheat yield, kg/ha:
$y = 3403 + 13{,}9x - 0{,}018x^2$

x = P-fertiliser, nutrient content, kg/ha; y = wheat yield, kg/ha:
$y = 4271 + 10{,}8x - 0{,}019x^2$

x = K-fertiliser, nutrient content, kg/ha; y = wheat yield, kg/ha:
$y = 3289 + 20{,}6x - 0{,}041x^2$

In addition to the above natural relationships between fertiliser and wheat yield – according to the data of 1985 - the wheat prices and production costs of the year 2001 were attached. The source of the prices is the average sales price (pb) of the agricultural enterprises published by the Agricultural Research and Information Institute (AKII), coming

from their own representative surveys. The production value for 1 hectare (TÉ) is calculated as the price multiplied by the average yield:

$$\text{TÉ} = p_b\, y$$

In determining the costs the starting point was the assumption that since the 1980-es the drastic fall of the level of nutrient replenishment was the greatest change in the production technology, and the other changes are negligible in comparison to this. Again, our starting point was the average production cost per hectare of the agricultural enterprises published by AKII. Based on these data the following four cost items were determined:

- **ÁK_t**: *fixed cost without the fixed part of the harvesting costs*. This was calculated deducting from the average cost per hectare all the cost items which may change together with the change in the fertiliser amounts or the crop yields (fertiliser costs, costs of the combine harvester, costs of grain drying, haulage). A part of the cost items was available in the data by AKII, the other items were calculated relying on the standards published by the Technical Institute of the Ministry of Agriculture and Rural Development (FVMMI) (*Gockler, 2001b*), and our own data collection. Deducting the above cost items the remaining value was increased by the fertilisation cost of the two fertilisers not included in the actual production function. These fertilisation costs were calculated according to the average fertiliser dosages of the year 1985, as described above. For instance, in the case of the K-impact function the average dosages of the N and P fertilisers – as in the database of the year 1985 – were multiplied by the respective nutrient prices of the year 2001, and these values were added to the fixed costs.
- **K_b**: *the harvesting costs of the yield achievable without fertilisation*. The unit costs (costs by one unit of yield) of three harvest-related cost items were calculated according to the standards by FVMMI (*Gockler, 2001b*), or using the data collected for the purposes of the present research: λ_{h1} – unit cost of the combine harvester; λ_{h2} – unit cost of haulage; λ_{h3} – unit cost of grain drying. The value of the yield-dependent cost by unit of yield was then: $\Sigma\lambda_{hi} = \lambda_{h1}+\lambda_{h2}+\lambda_{h3}$. This amount was multiplied by the parameter value "*a*" of the impact function $y=a+bx+cx^2$ (which is the yield achievable without fertiliser application) to get the value of K_b: $\text{K}_b = a\Sigma\lambda_{hi}$.
- **VK_h**: *the harvesting costs of the additional yield resulting from fertilisation*. This is the harvesting cost of the total yield (y) minus the harvesting cost of the achievable yield without fertilisation (a): $(y\text{-}a)\Sigma\lambda_{hi}$.
- **VK_m**: *the variable cost of fertilisation*. The unit costs by unit of fertiliser nutrient content of two cost items were calculated here according to the nutrient prices of the year 2001, the standards by FVMMI (*Gockler, 2001b*) and our own data: λ_{m1} – price of the nutrient; λ_{m2} – the haulage cost of the fertiliser to the field assuming a 10 km distance. The unit cost per unit of nutrient content considered to depend on the fertiliser dosage was: $\Sigma\lambda_{mi} = \lambda_{m1}+\lambda_{m2}$. This sum was multiplied by the fertiliser dosage (x), to get the value of VK_m : $\text{VK}_m = x\Sigma\lambda_{mi}$.

Thus the total cost per one hectare of area was:

$$\Sigma\text{K} = \text{ÁK}_t + \text{K}_b + \text{VK}_h + \text{VK}_m = \text{ÁK}_t + a\Sigma\lambda_{hi} + (y\text{-}a)\Sigma\lambda_{hi} + x\Sigma\lambda_{mi} = \text{ÁK}_t + y\Sigma\lambda_{hi} + x\Sigma\lambda_{mi}$$

The difference between the value of production (TÉ) and the production cost per one hectare (ΣK) gives the function of the income per one hectare (J):

$$J = TÉ - \Sigma K = p_b\, y - ÁK_t - y\Sigma\lambda_{hi} - x\Sigma\lambda_{mi}$$

2. Farm level nutrient balances

The „farm gate balance" will provide reliable information for the environmental assessment of the farm business when no considerable changes take place either in the purchased stock or in the home produced one. A significant proportion of the nutrient accumulation or extraction reflected by the „black box" approach, however, is really contained in the changes of the unsold stocks of the business, therefore causing uncertainty in the interpretation of the farm balance. Therefore, a more refined approach was applied in our case studies, which is really a combination of the farm gate balance and the balance of the production process. Beside the "farm gate balance" (external balance), an internal nutrient balance was also calculated in which nutrient inputs used in the production process were compared to nutrient amounts absorbed in the annual yields (outputs). In the case studies of mixed farms, farm nutrient balances were divided into two separate balances of the crop enterprise and the animal enterprise, and internal nutrient flows between crop production and animal husbandry were also surveyed.

The objective of our study was to set up farm nutrient balances for nitrogen and phosphorus nutrients relying on data originating from two mixed farms:

„A" dairy and crop farm.

This farm business is run as a shareholders' limited company, its main agricultural activity is animal husbandry, while it also has crop production and agricultural service enterprises. It has a cattle enterprise specialised to dairy farming of nearly 1000 animals, for which the fodder is produced mainly by the company's own arable unit of above 1000 hectares, and by the silage coming from its 300 hectare meadow and pasture area.

„B" pig-husbandry and crop farm.

This farm business is run as a cooperative farm, and its main agricultural activity is crop farming, with additional animal husbandry, agricultural service and forestry enterprises. Besides its main agricultural activities it also deals with marketing activities for the smaller farming enterprises located in the neighbourhood. The cooperative produces arable crops in an area of more than 1700 hectares owned by the members of the cooperative, and besides selling large amounts of its arable yields it also supplies fodder for its pig enterprise of 100 sows.

The data collection was mainly based on the records kept within the traditional accounting system, therefore, the nutrient flows were followed by the „logic" of accounting. Following this way of thinking the external nutrient exchange is the nutrient flow created by the purchase of material and animal stocks, or the sale of them, while the internal nutrient exchange means the nutrient flows between the materials present in the inventories and the production processes. Thus the quantitative data of the inventory changes (such as purchases, sales, utilisation, yields of animal or crop production) were collected from the analytic

inventory records for all stock items containing the nutrients studied in the research. Preliminary research helped us to identify stock items containing the studied nutrients only in extremely low amounts. These stock items were not taken into account in the further analysis. For this reason herbicides and pesticides were not included in the present study. For the case of the mixed farms dealing with animal husbandry and crop production the inventories of purchased materials were divided into crop-purpose and livestock-purpose inventories. This division is naturally not present in the accounting records but it was necessary to facilitate the analysis of external nutrient connections of the animal and crop enterprises.

The respective nutrient contents of the various materials (e.g. crop yields, fodders, fertilisers, manures, livestock, animal produces, etc.) are attached to the quantities of these materials given by the analytic records according to the form of the stock change, relying on the studies by *Kakuk & Schmidt (1988 a and b), Füleky (1999), Kádár et al. (1981), Kádár (1992), Horn (1976), Sarkadi (1979)* and research results by *Katalin Sárdi*. Then the following values were computed:

- The **external nutrient balance (KTE)** is the difference of nutrients entering the farm with purchased materials (B) and leaving it with sold stocks (É, including perished animals) (KTE = B-É).
- The **internal nutrient balance (BTE)** is the difference of nutrients utilised by or inputted into the production processes (F) and the nutrients leaving the farm with the yields or outputs (H), and nutrients (BTE = F-H).
- The **stock change (KV)** is the difference of nutrients of closing balance and opening balance of the inventories, and is the same as the sum of external and internal nutrient balances (KV = KTE-BTE).

The balances of the main farming enterprises can be defined in a similar way to those of the „whole farm balances". For example:

- The *external nutrient balance of the livestock production enterprise* (ÁKTE) is the difference of nutrients entering the farm with purchased materials to be used for livestock production, and leaving it with the yields of the livestock enterprise.
- The *internal nutrient balance of the livestock enterprise* (ÁBTE) is the difference of nutrients leaving the farm with the yields of livestock production (ÁF), and nutrients utilised (ÁH) by or taken into the livestock production processes (ÁBTE = ÁF – ÁH).

3. Modelling the impacts of environmental policy measures

In the research the impacts of the following three environmental policy measures were assessed for the data of farms „A" and „B" in 2000 and 2001:

I. A tax applied to nitrogen nutrient surpluses – above a threshold value.

II. The nutrient property concept explained in the introductory section of the present paper. According to this concept the value of the phosphorus nutrient surpluses above a threshold value is considered to be an investment, while the value of the nitrogen nutrient surpluses above the given threshold is added to the basis income of the business to be taxed in the same way as other taxable income.

III. In the case of slurry-involving technologies applied outside the nitrate sensitive areas – when the farm lacks leakage-safe slurry storage facilities – a charge to be paid for the quantity of slurry produced.

The impacts of the above three environmental measures were assessed under the following assumptions:

I. N-surplus tax

The application of this tool is similar to the MINAS system (Mineral Accounting System, see *Ondersteijn et al., 2002a & 2002b*), introduced in the Netherlands in 1998, with the difference that in our calculations the starting point was not the external nutrient balance (the farm gate balance), but – for the reasons explained before – the internal nutrient balance, and besides, a relatively low evaporation loss was taken into account. In the analysis the following categories were established:

Adjusted internal nutrient balance (kg): This is the positive internal N-balance computed from the nutrient balance calculations decreased by 20 % evaporation loss.

Tax-free nutrient surplus (kg): This is the threshold value of nutrient surplus established for 1 hectare of arable land, meadow or pasture multiplied by the size of the area. The threshold value for arable land is 100 kg/ha, for meadows and pastures is 180kg/ha (see Ondersteijn et al., 2002a).

Tax basis (kg): This is the positive difference between the adjusted internal nutrient balance and the tax-free nutrient surplus.

N-surplus tax (Ft): The tax basis multiplied by the tax rate. The tax rate is the value published by Ondersteijn et al. (2002a), that is, 2,27 €/kg (570 Ft/kg).

Cost change (Ft): The N-surplus tax increases the total cost of the business.

Change in the company's income tax (Ft): The cost change decreases the taxable income of the farm, so 18 % of this income change - this was the income tax rate in the assessed time period – decreases the income tax paid by the business.

II. Nutrient property concept

P - threshold value (kg): The amount of positive internal phosphorus nutrient balance which is below the level of being an investment, that is, which is just below the level of accumulating in the form of nutrient property. This is computed as the farmed area multiplied by the established threshold value per one hectare of agricultural land (in our analyses this threshold value was 20 kg/ha).

Amount of nutrient property (kg): The amount of positive internal phosphorus nutrient balance exceeding the P-threshold value.

Value of nutrient property (Ft): This is the amount of nutrient property multiplied by the actual market price of phosphorus sold as fertiliser in the actual year. This value decreases the costs and increases the investments of the year analysed. From the following year depreciation can be deducted for this value.

Taxable N-surplus (kg): This is the same as the tax basis described in measure I. above.

Value of taxable N-surplus (Ft): This is the taxable N-surplus multiplied by the actual market price of nitrogen sold as fertiliser in the actual year. This value increases the taxable farm income, and 18 % of this value increases the income tax to be paid by the business.

Cost change (Ft): The costs of the business for the current year are decreased by the value of the nutrient property, and are increased by the depreciation of the nutrient property accumulated in the earlier years.

Change of the income tax to be paid by the business (Ft): The taxable income is increased by the value of the nutrient property (due to the cost changes), decreased by the depreciation of the nutrient property accumulated in the earlier years (also causing cost changes), and increased by the value of the taxable N-surplus. 18% of the change of the taxable income modifies the value of the income tax paid.

III. Slurry output charge

Calculated amount of slurry (t): This is the starting point of determining the charge to be paid. The amount of slurry is calculated in the following way: days of feeding for the livestock kept on slurry-based technology were collected by age groups from the analytic records. Daily manure amounts were attached to the feeding days by age groups based on reference values found in the relevant literature *(Kovács I. & Kovács G., 1988),* then summing up the data for the age groups the total amount of manure was determined. Assuming a 1:3 solution rate the volume of the manure was multiplied by 4 to determine the calculated amount of slurry.

Rate of slurry output charge (Ft/t): Assuming that the purpose of the charge is to motivate the farmers to use satisfactory slurry storage and management methods, the rate of the charge is linked to the investment costs of a leakage-free slurry storage facility. Relying on our own research for data (of the year 2000), the investment costs of a slurry storage facility were calculated which satisfies the requirements of the nitrate regulation *(49/2001. [IV.3.] Korm.),* and has the proper size for handling the amount of slurry produced by farm „B". The annual depreciation of the slurry storage facility (3%) was added to the costs related to the haulage and spreading of slurry over the arable land of the farm, calculated by reference values found in the relevant literature *(Gockler, 2000, 2001a)* and by our own data collection. The total cost of annual depreciation and slurry spreading was divided by the total amount of slurry produced by farm „B" in the year 2000., and then half of the resulting value per one ton of slurry was considered to be the rate of slurry output charge.

The charge value (Ft): This is the calculated amount of slurry multiplied by the rate of the slurry output charge. This amount increases the costs, thus decreasing the profits of the

farm business. At the same time the cost increase decreases the value of the taxable income of the business, and 18 % of this actually decreases the income tax to be paid by the business.

Change in the profit after taxation (Ft): The profit after taxation is decreased by the charge taken into account among the cost items, while it is increased by the value of tax decrease.

Results

1. Analysis with the production functions of the 1980-es, and the prices of the millennium.

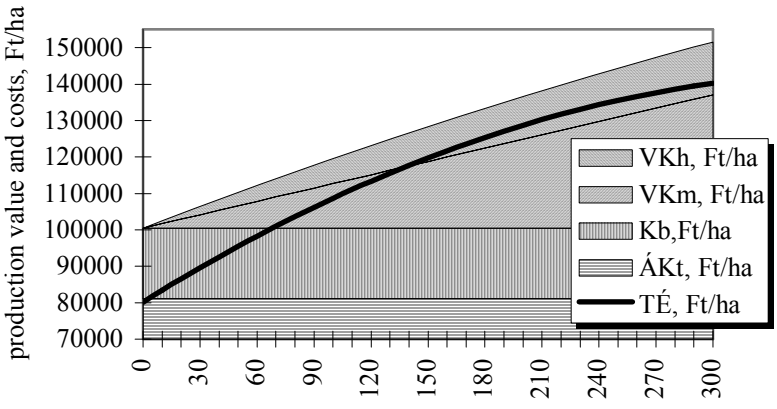
The results of the analysis carried out with the production functions of the 1980-es, and the prices of the millennium – following the usual process of calculus and optimisation – are the following for the relationship between N-fertiliser and yield:

The functions of production value (TÉ), costs (ΣK) and income of one hectare of land (J) are:

$$TÉ = 80175 + 327{,}5x - 0{,}42x^2$$
$$\Sigma K = 100501 + 200{,}8x - 0{,}10x^2$$
$$J = -20326 + 126{,}7x - 0{,}32\,x^2$$

The value of N-fertiliser per hectare (that is, x) at the maximum income level (xj_{max}) is: 196,7 kg/ha. The maximum value of the income per hectare (J_{max}) is: - 7863 Ft/ha. Figure 5 shows the functions of production value and of total cost – by components. It is clear from the figure that costs are always higher than the production value, thus the income is negative for any levels of N-fertilisation.

Figure 5. **Production value (TÉ) and costs of production by the production function of 1985 and prices of 2001.**



According to the relationship between P-fertiliser and yield the functions of the production value (TÉ), the costs (ΣK) and the income per hectare (J) are the following:

$$TÉ = 100625 + 254{,}5x - 0{,}45x^2$$
$$\Sigma K = 111471 + 194{,}4x - 0{,}11x^2$$
$$J = -10846 + 60{,}1x - 0{,}34\,x^2$$

The value of P-fertiliser per hectare (that is, x) at the maximum level of income (x_{jmax}) is: 88,4 kg/ha. The maximum of the income per hectare (J_{max}) is: - 8190 Ft/ha.

The same results for the relationship between K-fertiliser and yield are the following:

$$TÉ = 77489 + 485{,}3x - 0{,}96x^2$$
$$\Sigma K = 110664 + 188{,}0x - 0{,}23x^2$$
$$J = -33175 + 297{,}3x - 0{,}73\,x^2$$

The value of K-fertiliser per hectare (that is, x) at the maximum level of income (x_{jmax}) is: 202,8 kg/ha. The maximum of the income per hectare (J_{max}) is: - 3029 Ft/ha.

Naturally, the above calculations contain many estimation errors, so it is unreasonable to explain the results in a very detailed way. However, a straightforward conclusion may be the fact that all the three production functions gave negative values as maximum incomes. This strengthens our assumption that the price levels in Hungary at the millennium do not favour the renewal of the typical crop production technologies of the 1980-es based on high fertilisation levels. This means that the probability of harmful nutrient accumulation as a general feature throughout the country is rather small. Point-wise, farm-level nutrient accumulation, however, may occur, and thus attention has to be focused on the local, farm-level processes of nutrient flows.

2. Farm level nutrient balances

Tables 2, 3, 4 and 5 show the main figures of the farm level nutrient balances for the two farms assessed.

Table 2. **Nutrient balances and stock changes in farm „A"**

Components	KTE		BTE		KV	
	N	P	N	P	N	P
2000						
Animals, animal products	-20139	-2828	-18155	-2729	-1984	-99
Manure	-1286	-230	1623	290	-2909	-520
Fodder, straw	42508	11085	59308	12584	-16800	-1499
Cash crops	-84310	-13118	-84259	-13104	-51	-14
Seed	1118	209	1112	209	6	0
Fertiliser	212478	2403	212478	2403	0	0
Total	150369	-2479	172107	-347	-21738	-2132
2001						
Animals, animal products	-19704	-2898	-19272	-2876	-432	-22
Manure	-1049	-187	-2125	-379	1076	192
Fodder, straw	3436	11348	22355	9988	12281	1360
Cash crops	-91897	-14569	-107820	-16632	15923	2063
Seed	1430	207	1438	208	-8	-1
Fertiliser	185456	7553	185456	7553	0	0
Total	108872	1454	80032	-2138	28840	3592

Farms "A" and "B" are both mixed farms with crop and animal enterprises, so the nutrient linkages between these two enterprises are meaningful for both of them. Each of them carries out extensive inventory management activities, so the external and the internal nutrient balances are different. Both of the farms purchase large quantities of nitrogen fertilisers, while the replacement of phosphorus is negligible for both of them. In the case of farm „A", the role of animal husbandry in the utilisation of nutrients is much larger than in the case of farm „B".

For farm „A" the external nutrient balance in year 2000-ben positive, 150 tons more nitrogen was inputted into the enterprise than the amount leaving it. The actual internal nutrient accumulation was, however, even greater, because the internal nutrient balance shows 172 tons more nitrogen entering into the production processes than the amount leaving the farm within the yields. The 22 ton difference is explained by decreased stocks. In 2001 the situation is just the opposite: 109 tons more nitrogen entered the farm with the inputs than the amount leaving it, but the internal nutrient accumulation is less than that, because the internal nutrient balance is only 80 tons. The 29 ton difference is shown in the increased level of stocks. All this clearly shows that the external nutrient balance (farm gate balance) is not sufficient for the environmentally sound assessment of the farm processes, because due to the stock changes the actual nutrient accumulation is 15 % higher in 2000, and approx. 27 % lower in 2001 than the external nutrient balance.

It is remarkable, that both the crop enterprise and the animal enterprise influenced the internal nutrient balance significantly, but in different directions. The crop enterprise

extracted 143 tons more nitrogen from the production process than the amount placed into it. Just the contrary, the animal enterprise utilised only 10 percent of the nitrogen inputted into the production process, leaving a substantial positive internal nutrient balance (223 tons) (Table 3).

Table 3. The nutrient balances of crop and livestock enterprises in 2001 for farm „A"

Components	Crop enterprise				Livestock enterprise			
	N		P		N		P	
	KTE	BTE	KTE	BTE	KTE	BTE	KTE	BTE
Animals, animal products		0		0	-19704	-19272	-2898	-2876
Manure		2811		502	-1049	-4936	-187	-881
Fodder, straw		-225148		-37657	34636	247503	11348	47645
Cash crops	-91897	-107820	-14569	-16632		0		0
Seed	1430	1438	207	208		0		0
Fertiliser	185456	185456	7553	7553		0		0
Total	94989	-143263	-6809	-46026	13883	223295	8263	43888

In the case of farm „A" 225 tons of nitrogen was moved from crop production into animal husbandry with fodder and straw, where it was utilised much less efficiently than in the crop enterprise. Animal husbandry transferred only 3 tons of nitrogen back to crop production with manure. This means that ruthless exploitation of the natural resources is typical in crop production, hardly more than half of the extracted nitrogen is replaced, while the internal nutrient balance shows substantial nutrient accumulation due to the high levels and low efficiencies of nutrient utilisation in animal husbandry.

While assessing the phosphorus balances of farm „A", similarities and differences to the nitrogen balances may be identified. In the case of phosphorus, not only the internal balance of crop production is negative, but the external balance, too. This result reflects the typical, biased nitrogen-oriented practice of nutrient management practices used in Hungary in the last decade. The extraction of phosphorus in crop production significantly decreased the positive external balance of animal husbandry and completely absorbed its positive internal balance.

The external nitrogen balance for farm „B" *(Table 4)* in year 2000 is positive, 19 tons, while the internal nutrient accumulation is only 2 tons. The difference is mainly explained by the fact, that a part of the purchased nitrogen fertiliser (about 17 tons) had not been utilised at the end of the year, so this was shown in the records and stock increase. In year 2001 both the external and the internal nitrogen balances are negative.

Table 4. Nutrient balances and stock changes for farm „B"

Components	KTE		BTE		KV	
	N	P	N	P	N	P
2000						
Animals, animal products	-3956	-264	-3972	-265	16	1
Manure	0	0	-215	-69	215	69
Fodder, straw	7705	1558	11767	2303	-4062	-745
Cash crops	-149672	-24265	-153832	-25342	4160	1077
Seed	1930	338	1981	340	-51	-2
Fertiliser	162802	3461	146192	5081	16610	-1620
Total	18809	-19172	1921	-17952	16888	-1220
2001						
Animals, animal products	-3758	-251	-3859	-257	101	6
Manure	0	0	-119	-34	119	34
Fodder, straw	8208	1709	8383	1746	-175	-37
Cash crops	-174956	-27596	-185195	-29076	10238	1480
Seed	1689	306	1713	313	-24	-7
Fertiliser	158737	0	168865	0	-10128	0
Total	-10080	-25832	-10212	-27308	132	1476

In the crop enterprise, the external and the internal balances are also negative *(Table 5),* while both the external and the internal balances of the animal enterprise are positive. However, while in the case of farm „A", 68 % of the nitrogen content of crop yields was used by the animal enterprise, the same value is only 7 % for farm „B". This means that the majority of the nitrogen content of crop yields does not enter the rather wasteful animal production processes, but leaves the farm in the form of cash crops. This is the main explanation for the negative external and internal nutrient balances in spite of the fact that for this farm the proportion of nitrogen replacement in the crop enterprise is higher (86%) than for farm „B".

The impact of this biased practice of nutrient management is more obviously demonstrated in the phosphorus balance of farm „B". The reason for this is that the crop yields are transferred to the animal enterprise to a less extent, and because practically no phosphorus replacement took place in the crop enterprise. As a result of this approximately 80 % of the phosphorus extracted from the soil leaves the farm with the sold products.

The nutrient balances for farm „B" are particularly interesting considering the fact that pig husbandry involves the handling of slurry here. As the balances show, manure is not purchased and not sold either. At the same time, the figures also show that manure is present in the livestock enterprise as an insignificant amount of yield and in the crop enterprise as an insignificant amount of input. All this shows clearly and undoubtedly that slurry is not managed, stored and utilised satisfactorily in farm „B", and the majority of it is simply wasted – show as nutrient accumulation in the livestock nutrient balances. However, the negative nutrient balances of the crop enterprise counterbalance the positive balances of the

livestock enterprise, slurry pollution cannot be influenced by environmental policy measures based on whole farm nutrient balances. This fact was taken into account when selecting the environmental policy measures for the present analysis.

Table 5. Nutrient balances for the crop and the livestock enterprises of farm „B" in 2001

Components	Crop enterprise				Livestock enterprise			
	N		P		N		P	
	KTE	BTE	KTE	BTE	KTE	BTE	KTE	BTE
Animals, animal products		0		0	-3758	-3859	-251	-257
Manure		12		3	0	-131	0	-37
Fodder, straw		-12077		-2347	8208	20460	1709	4093
Cash crops	-174956	-185195	-27596	-29076		0		0
Seed	1689	1713	306	313		0		0
Fertiliser	158737	168865	0	0		0		0
Total	-14530	-26682	-27290	-31107	4450	16470	1458	3799

3. Modelling the impacts of environmental policy measures

I. N-surplus taxes

Table 6 summarises the results related to N-surplus taxes. As the table shows, under the given circumstances neither farm formed a surplus to be taxed in the two years assessed. Thus neither the costs nor the income taxes are changed in the two farm businesses.

***Table 6.* Results of the calculations with N-surplus taxes**

Item	Farm „A"		Farm „B"	
	2000	2001	2000	2001
Farm level internal nutrient balance, kg	172107	80032	1921	-10212
Adjusted farm level internal nutrient balance, kg	137686	64026	1537	-10212
Tax-free nutrient surplus, kg	157980	157980	191580	191580
Tax basis, kg	0	0	0	0

II. Nutrient property concept

Results for the calculations with the nutrient property concept are shown in *Table 7.* The figures clearly show that for phosphorus the internal farm level nutrient balance is negative for both of the farms and for both of the years assessed, so no nutrient property accumulation took place. Taxable N-surplus was not formed either, as this item is the same as the tax basis of Table 6, which is 0 for both farms and both years.

Table 7. **Results for the calculations with the nutrient property concept**

Item	Farm „A”		Farm „B”	
	2000	2001	2000	2001
Farm level internal P-balance, kg	-347	-2138	-17952	-27308
P – threshold value, kg	26700	26700	37100	37100
Amount of nutrient property, kg	0	0	0	0
Taxable N-surplus, kg	0	0	0	0

III. Slurry output charge

The calculations with the slurry output charge were carried out only for farm „B” (in farm „A” no slurry-involving technology is used). The figures show that the slurry output charge applied with the given conditions considerably decreases the taxed profits of farm „B”. In year 2000 the slurry charge would have lowered the profits by approximately 800 thousand Ft, leaving a much lower amount available for the farm than it actually had for dividends and investments. In year 2001 only a very small profit was reached, and the application of the slurry charge would have changed it to loss.

Table 8. Results for the slurry output charge (farm „B”)

	Item	2000	2001
1.	Profit after taxation (without charge), eFt	4948	215
2.	Calculated amount of slurry, t	7546,4	7850,5
3.	Rate of slurry output charge, Ft/t	128,2	128,2
4.	The charge value = cost change, eFt	967	1006
5.	Profit after taxation (with charge), eFt	4155	-791
6.	Change in the profit after taxation, eFt	-793	-1006
7.	Change in the profit after taxation, %	-16	-468

Under such income conditions it is naturally worth considering whether the introduction of the slurry output charge – which is quite justified from environmental aspects - is reasonable, and if it is, then what levels of government compensation should be attached to it. On the other hand, in the nitrate sensitive areas the farmers, who are compelled to comply with the requirements of the nitrate regulation, quite understandably feel handicapped competing in the market with the farmers of non-nitrate sensitive areas. Considering the above the introduction of the slurry output charge may be justified, but at a lower rate than the one used in our calculations, while at the same time increasing the financial support for the establishment of suitable manure storage facilities or for changing the technology.

Conclusions

Nowadays the level of nutrient replacement in Hungary is very low comparing to international standards. Based on the production functions of the 1980-es and the prices of the millennium the research was focused on determining the chances of a farming technology using intensive fertilisation practices. The independent variable was the nutrient content per hectare of nitrogen fertiliser for the first function, the phosphorus fertiliser for the second function and the potassium fertiliser for the third function, while the dependent variable was the wheat yield for all the three functions. For all the three functions the highest income was negative, and this strengthens our assumption that the price levels in Hungary at the millennium do not favour the renewal of crop production technologies based on high fertilisation levels. Thus the probability of harmful nutrient accumulation as a general feature throughout the country is rather small, therefore attention has to be focused on the local, farm-level processes of nutrient flows. One of the suitable tools for that, namely the farm level nutrient balance was improved and applied for two Hungarian farms. The different results are explained by the different production structures, and the different nutrient utilisation processes of crop and livestock production. It was established that under the Hungarian conditions the „farm gate balance" is not, or only to a limited extent, suitable for assessing the nutrient management of farms from an environmental aspect, because many large mixed farms exist in Hungarian agriculture, which maintain high levels of inventories. For this reason the application of the internal nutrient balance seems a better choice, which is the difference of the nutrient amounts inputted into the production process and those leaving it with the yields. The environmental policy measures assessed in the paper are also based on the internal nutrient balance. The impact of these measures was modelled for two farms. The results showed that in the two analysed years no nutrient accumulation required sanctioning in the two farms. It would be a mistake to draw conclusions relying on data of only two farm businesses, but as the general tendencies of nutrient replacement are like this for the whole country, it does not seem reasonable at the moment to introduce environmental policy tools requiring additional administration. The case of point wise pollution caused by slurry producing livestock farms in nitrate sensitive areas requires a different approach. This pollution cannot be sanctioned according to the farm level nutrient balances – because it can be offset by the negative nutrient balances of the crop production enterprise – so in this case a slurry output charge may be introduced which also serves as an incentive to establish proper facilities for storing and handling slurry. However, the introduction of this charge cannot be considered realistic under the present profitability situation of agricultural businesses without a considerable increase in the financial support available for the establishment of proper slurry storage facilities (which is currently 45 % of the investment costs, see *FVM AVOP, 2004*). Similar – increased – level supports should be reasonable for farms switching from the slurry based technology to a different technology involving more solid manure and less slurry output.

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Determining profit-maximizing fertilizer levels for maize production in the region of Hajdúsági löszhát

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Abstract

Based on the data of Látókép Experimental Station of Debrecen University, data of Hungarian Statistical Yearbook, and data of farms in the region an attempt was made to determine the profit-maximizing input levels of fertilization in irrigated and nonirrigated maize fields. Seven commonly used hybrids were tested at six levels of nutrient treatments. The profit-maximizing input level of fertilization was affected greatly by the input and output prices of the examined period. Analysis of profitability of crop production in production regions may help managers to plan the inputs level more precisely because the variation in natural potential favors different solutions.

Key words

Profit maximizing input level, regional policy, fertilization, irrigation, maize genotypes

Introduction

The aim of our study was to determine the profit maximizing fertilizer input levels of maize hybrids in dry and irrigated plots. First, the importance of the topic is highlighted. Later some significant precedents of determining profit maximizing input levels are discussed.

Our examination is unique because we deal with the data of 2000, 2001, and 2002; the most commonly used maize hybrids are in the focus and the validity of conclusions are limited to the area of Hajdúsági löszhát. However, the presented method can be applied to improve crop management of different production areas.

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The position and the future of crop production are the most promising aspects of Hungarian agriculture. Similarly to the late decades the most decisive component of crop production remains cereals, mainly winter wheat and maize production. After joining the European Union the crop yield will increase due to safer circumstances and incentives (Fehér, 1998). Examining the domestic crop production Bedő and Oravecz (1998) stated that according to the opinion of professional circles, producers would enjoy the comparative advantage of agroecological potential if they give preference to traditional branches of crop production in the future.

Slight increase in demand of fodder-cereals is probable in the world market, mainly an increase in maize. USDA announced that global consumption of maize is expected to increase by 1.8%. FAPRI forecasts a growing international maize market by 30% to the end of the decade. In this decade the yield of maize supposed to be significantly increased (Potori, 2002). The European Union expects moderate increase in cereal consumption and growth of livestock in Central and Eastern European countries between 2001 and 2008. In the above-mentioned period the consumption of feed-cereals grows from 44 million tons to 49 million tons (Kiss, 2002).

Both global and European tendencies show the growth of cereal and maize production. Domestic agroecological potential enables us to use the advantages of these trends. However, Hungarian regions inherited different conditions of economic development, and the differences amongst regions have increased recently (Tenk, 1998).

Ecological and economic potential of maize production differ greatly from place to place. Sustainability as a new requirement of farming came into limelight in the nineties. Sustainability is a system of farming which saves the environment, produces quality products and allows profitable production for a long time (Csete and Láng, 1999). Utilization of natural resources, preservation of natural resources and control of pollution can be explained in association with agroecological circumstances.

Because of the diversity in conditions of production and farming, every country has to carry out a research based on local characteristics to explore comparative advantage of natural potential in order to renew production technologies continuously (Csáki, 1999). Generally, foreign technologies can not be used directly because of the different conditions. They have to be adapted which makes local research indispensable. Conditions of farming are greatly heterogeneous even within a county. Analyzing the market characteristics of farmlands Karalyos (2001) founds that the price of land differs greatly, the most expensive lands have four times more highe prices than medium quality lands.

The most influential production factor of maize production is fertilization. The economy of fertilization management has been a central issue of grain production since the sixties in Hungary. The effect of fertilization on the yield was examined and analyzed based on data collection from agricultural enterprises and experimental plots (Mészáros 1972, Mészáros and Csepregi 1972, and Kárpáti 1992). The use of fertilizer increased sharply from the middle of sixties to the middle of seventies. Then after a stagnation the use of fertilizers plummeted (Urfi, 1999). In the last decade, cereal production was not effective and yield fluctuated significantly. Small amount of fertilizer application (which was 50% of that of the EU application) was the most important reason of low domestic yield (Papp, 2000).

Database and methods

Data of maize production were collected from the maize field experiment of Látókép Experimental Station, Debrecen University. The experiment is situated in the region of Hajdúsági löszhát on chernozem soil. The yield of maize and the profitability of maize production exceed greatly the domestic average, the area is one of the best maize production areas. The total area of Hajdúsági löszhát is 191066 ha (Fekete et al., 1958). Alpha, Celest, Debreceni 351, Debreceni 377, Dekalb 355, Dekalb 391 and Dekalb 440 hybrids were examined. These hybrids are available and they are popular genotypes in the farms of the region. The density of plants was 70 thousand plants per hectare in the years of 2000, 2001, and 2002. The usual technology of maize production was applied, the basic tillage was winter plowing, weeds were controlled by herbicides.

Different amounts of fertilizer inputs were used as agrotechnical factors on irrigated and nonirrigated plots. The same ratio of nitrogen, phosphorus and potassium was applied, the ratio was 1: 0.75 : 0.88. The ratio of NPK was determined in previous experiments especially to the conditions of the area. Six nutrition treatments were used, one control treatment, and five fertilized treatments. Fertilizer was increased gradually by 30 kg/ha N, the lowest level was 30 kg/ha N and the highest level was 150 kg/ha N. The calculated amount of irrigation water was spread by sprinklers. 120 mm water was applied on the 6th July and 15th July of 2000. In 2000, the precipitation of the growing season was 198 mm which was 195 mm less than the 50-year-arerage. In the growing season 75 mm water was spread on 6th August 2001. In this year the amount of rain of the growing season exceeded the 50-year-average by 11 mm. Total irrigation water of 237 mm was sprinkled on 1st July and 6th July 2002. The precipitation was 137 mm less than the 50-year-average (393 mm) in the growing season. The maize hybrids were compared on the moisture level of 14.5% of the crop.

Table 1

Input and output prices of fertilization. (2000, 2001, 2002.)

	N	P	K	Fertilizer and spreading Ft/ha
Fertilizer levels - agent kg/level	30	22.5	26.5	
Type of fertilizer	Ammonium nitrate	Super-phosphate	Potassium nitrate	
Quantity of fertilizer kg/level	88.2	118.4	44.2	
Year 2000 price per unit Ft/kg*	37	38	46	
Year 2000 input price Ft/level	3263.4	4499.2	2033.2	10596
Year 2001 price per unit Ft/kg**	41	41	49	
Year 2001 input price Ft/level	3616.2	4854.4	2165.8	11756
Year 2002 price per unit Ft/kg***	41	48.3	41.9	
Year 2002 input price Ft/level	3616.2	5718.72	1851.98	12627

* Bai et al., 2001, ** Bai et al., 2002, *** Nábrádi et al., 2003

If the goal is to maximize profit, the manager has to select from all possible input levels the one that will result in the greatest profit. Profit maximizing mathematical methods of crop production is in the great interest of researchers and agricultural management. Publications of Csáki (1975), Heady and Dillon (1961), Mészáros (1981), Szakál (1981), Székely (1981), Bierlein (1986), Downey and Erickson (1987), Kay and Edwards (1994)

Samuelson and Nordhaus (2001) served me as examples to determine the most suitable input levels. Based on the experiment we calculat the marginal value product and marginal input cost of irrigated and nonirrigated plots. The profit-maximizing input can be found if we determine the point where the marginal value product is equal with marginal input cost. If marginal value product is greater, than marginal input cost additional profit can be made, by using more input. When marginal value product is less than marginal input cost more profit can be made by using less input. Determining the input level, the following values were put into a table: input level, total physical product (TPP), marginal physical product (MPP), total value of product (TVP), marginal value product (MVP), marginal input cost, input price and output price. Marginal value product is the additional income received from using an additional unit of input. MVP is calculated from the equation (1).

(1)

$$MVP = \frac{\Delta \text{ total value product}}{\Delta \text{ input level}}$$

TVP is received if TPP is multiplied by output price of each of input level. The MIC is defined as the change in total input cost caused by using an additional unit of input. It is calculated by using the equation (2).

(2)

$$MIC = \frac{\Delta \text{ total input cost}}{\Delta \text{ input level}}$$

Total input cost is equal to the quantity of input used by times its prices. Table 2 indicates that marginal input cost is constant for all input levels. MIC is always constant provided the input price does not change as more or less input is purchased.

Results and discussion

Data to determine the profit-maximizing input levels are indicated in table 2.

Table 2

Determination of profit-maximizing input levels (average of seven hybrids)

2000 nonirrigated						
Input level	**TPP**	**MPP**	**TVP**	**MVP**	**MIC**	**MVP-MIC**
	t	t	Ft	Ft	Ft	Ft
0	4.983		124923.8			
1	7.107	2.124	178172.5	53248.68	10596	42653
2	8.523	1.416	213671.6	35499.12	10596	24903
3	8.957	0.434	224552.0	10880.38	10596	285
4	9.708	0.751	243379.6	18827.57	10596	8232
5	9.614	-0.094	241023.0	-2356.58	10596	-12952
2000 irrigated						
Input level	**TPP**	**MPP**	**TVP**	**MVP**	**MIC**	**MVP-MIC**
	t	t	Ft	Ft	Ft	Ft
0	5.712		143199.8			
1	7.604	1.892	190632.3	47432.44	10596	36837
2	9.005	1.401	225755.4	35123.07	10596	24527
3	9.772	0.767	244984.0	19228.69	10596	8633
4	10.483	0.711	262808.8	17824.77	10596	7229
5	10.157	-0.326	254636.0	-8172.82	10596	-18769
Input price: 10596 Ft/level			*Output price: 25070 Ft/t*			
2001 nonirrigated						
Input level	**TPP**	**MPP**	**TVP**	**MVP**	**MIC**	**MVP-MIC**
	t	t	Ft	Ft	Ft	Ft
0	5.991		113948.8			
1	9.239	3.248	175725.8	61776.96	11756	50021
2	10.108	0.869	192254.2	16528.38	11756	4772
3	10.342	0.234	196704.8	4450.68	11756	-7306
4	10.278	-0.064	195487.6	-1217.28	11756	-12974
5	9.727	-0.551	185007.5	-10480.02	11756	-22236
2001 irrigated						
Input level	**TPP**	**MPP**	**TVP**	**MVP**	**MIC**	**MVP-MIC**
	t	t	Ft	Ft	Ft	Ft
0	7.020		133520.4			
1	10.317	3.297	196229.3	62708.94	11756	50953
2	11.316	0.999	215230.3	19000.98	11756	7245
3	12.093	0.777	230008.9	14778.54	11756	3022
4	11.949	-0.144	227270.0	-2738.88	11756	-14495
5	11.046	-0.903	210094.9	-1717506	11756	-28931
Input price: 11756 Ft/levelt			**Output price: 19 020 Ft/t**			
2002 nonirrigated						
Input level	**TPP**	**MPP**	**TVP**	**MVP**	**MIC**	**MVP-MIC**
	t	t	Ft	Ft	Ft	Ft
0	5.272		109499.4			
1	6.675	1.403	138639.8	29140.31	12627	16513
2	7.757	1.082	161112.9	22473.14	12627	9846
3	8.196	0.439	170230.9	9118.03	12627	-3509
4	7.576	-0.620	157353.5	-12877.40	12627	-25504
5	6.812	-0.764	141485.2	-15868.28	12627	-28495

2002 irrigated						
Input level	**TPP**	**MPP**	**TVP**	**MVP**	**MIC**	**MVP-MIC**
	t	t	Ft	Ft	Ft	Ft
0	6.895		143209.2			
1	8.661	1.766	179889.0	36679.82	12627	24053
2	9.405	0.744	195341.9	15452.88	12627	2826
3	10.712	1.307	222488.2	27146.39	12627	14519
4	11.338	0.626	235490.3	13002.02	12627	375
5	11.155	-0.183	231689.4	-3800.91	12627	-16428
Input price: 12627 Ft/levelt *Output price: 20770 Ft/t*						

* Own data, Látókép, 2000., 2001., 2002, ** Magyar Statisztikai Évkönyv, 2002., 2003.

While the cost of fertilization increased continuously from 10596 Ft/ha to 12627 Ft/ha; the price of maize decreased significantly from 2000 to 2001 (from 25070 Ft/t to 19020 Ft/t) then it slightly increased to 20770 Ft/t to 2002.

The price of maize greatly influenced the profit-maximizing input level. In 2000 when the price of maize was the highest, the input level 4 gave the biggest profit. However in 2001 and 2002 when the price of maize was lower the maximum profit was gained at a lower input level (input level 2 and 3) except in one case (2002 irrigated treatment).

The general opinion in Hungary and mainly in the Great Plain is that advised fertilizer level of an irrigated plot is higher than that of a nonirrigated plot. This statement was proved in two years while nonirrigated plots gave the bigger profit at level 2, the irrigated maize production was the most profitable at input level 3. In 2002 the profit-maximizing input level of nonirrigated maize was also at level 2, but irrigated treatments were the most profitable at input level 4. In the first year of the examination (2000) the profit maximizing input level was the same in nonirrigated and irrigated treatments.

As the year is getting dryer generally the efficiency of irrigation is increasing. Comparing the precipitation of the vegetational period of maize with the 50-year-average it was found that the first and third years were significantly dryer than the second year. The precipitation of the second year was close to the average. Despite the relatively dry weather in 2000, the profit-maximizing input level of irrigated plots was not at a higher level than the input level of nonirrigated plots. The reason of this may be that the effect of irrigation does not only depend on the quantity of used water, but the timing of the irrigation, the phenological stage of maize and the effects of other meteorological elements affect in complexity.

Table 3 indicates the profit-maximizing input level of each hybrid. Fertilizer reaction of irrigated hybrids in case of Alpha and Celest was outstanding because the profit maximum of these hybrids was at a highest level in irrigated plots than it was in nonirrigated treatments in every year. The profit-maximizing input levels of Debreceni 351 and Dekalb 355 were the same in irrigated and nonirrigated treatments averagely. In case of Debreceni 351, and Dekalb 440 the profitability of fertilization was increased moderately by the effect of irrigation.

Stability of profit maximizing input level of a maize hybrid from year to year is a risk diminutive factor of the production. In this respect the most stable was Alpha because the profit maximizing input levels were the same in every year in irrigated and nonirrigated plots. At Celest and Debreceni 377 hybrids through-the-year stability was smaller, and the

profit maximizing input levels of Debreceni 351, Dekalb 355, Dekalb 391, and Dekalb 440 fluctuated greatly during the three years of the examination (Table 3).

Table 3

Profit-maximizing input levels of the examined hybrids

Hybrid	Irrigated/ nonirrigated	Profit-maximizing input level		
		2000	2001	2002
Alpha	Irrigated	4	4	4
	Nonirrigated	2	2	2
Celest	Irrigated	5	3	3
	Nonirrigated	4	2	2
Debreceni 351	Irrigated	5	1	3
	Nonirrigated	3	1	2
Debreceni 377	Irrigated	4	3	3
	Nonirrigated	4	3	3
Dekalb 355	Irrigated	2	3	4
	Nonirrigated	4	1	4
Dekalb 391	Irrigated	3	1	4
	Nonirrigated	3	2	2
Dekalb 440	Irrigated	4	2	4
	Nonirrigated	4	2	3

Finally, the profit maximizing input level of averages of hybrids and years were evaluated (Figure 1-2). The profit maximizing input level is the point where the MVP = MIC. The examined hybrids gave the highest profit when level 3 fertilizer was applied in irrigated treatments in three years. Profit maximizing input levels of dry treatments was found at level 2. These results indicate that if irrigation water is given during the vegetation period more fertilizer should be applied to make the maize production more profitable.

Figure 1

The averages of hybrids and years. Irrigated plots. Látókép. 2000-2003

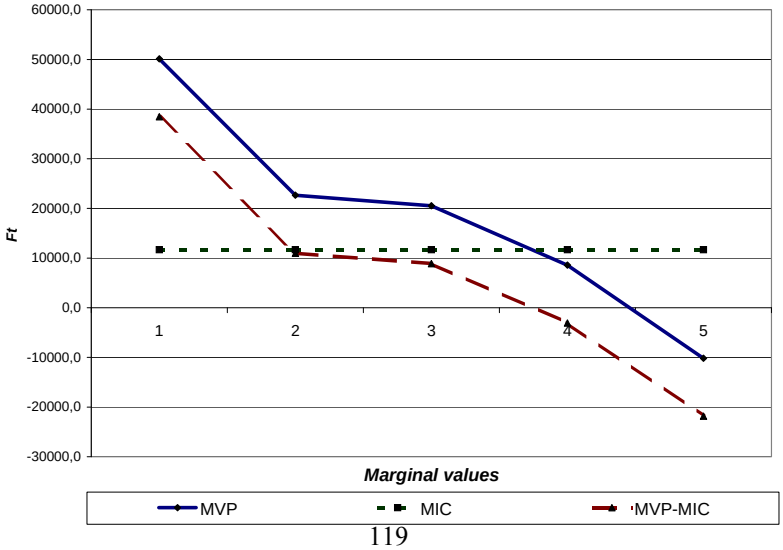
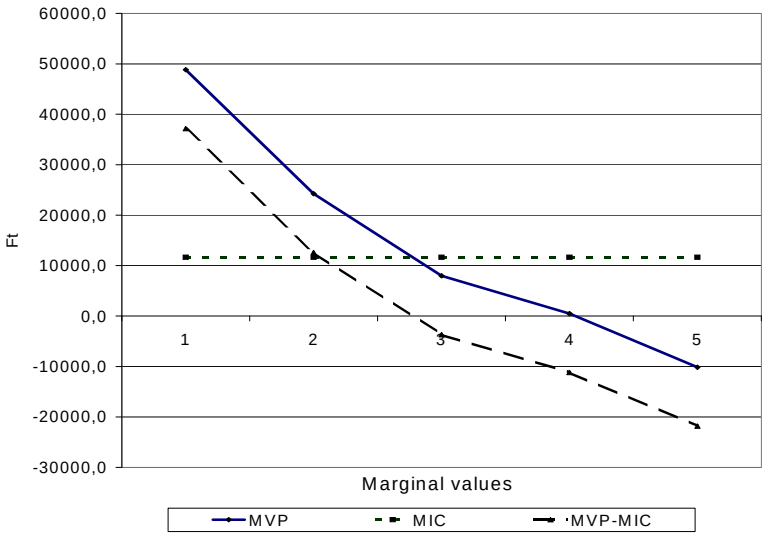


Figure 2

Averages of hybrids and years. Nonirrigated plots. Látókép. 2000-2002



Taking into account the suggestions about the fertilization of maize, we can see that authors advised higher dose of fertilizer in the seventies and eighties. However getting closer to 2003 we can find much more moderate doses. Láng and Német (1977) suggested applying 170-180 kg/ha N, 70-80 kg/ha P, and 140 K for maize. At the end of nineties Sárvári and Szabó (1998) examining numerous factors of maize production found the optimum of fertilization at 60-120 kg/ha N, 45-90 kg/ha P, and 53-106 kg/ha K. Jakab (1999) evaluating an experiment of maize genotypes determined the most suitable fertilizer rate, which was 40-120 kg/ha N, 25-75 P, and 30-90 K. In our study determining the most profitable input fertilizer level we found the optimum at 30 kg/ha N, 22.5 P, and 26,4 K in nonirrigated plots and 60 kg/ha N, 45 kg/ha P, and 52,8 kg/ha K in irrigated treatments. The comparison of our results with other authors showes that we suggest lower fertilization levels for maize. The reason that we suggest lower level of fertilization than earlier studies is that both production and economic factors were taken in consideration.

There are many available data from experiments of maize fertilization. However, managers do not count the most profitable level of fertilization when the decision is made on nutrient supply. When the optimum nutrient supply for maize is determined the aim is often to have maximum yield and precise effects of prices are not forecasted. Taking into accounts the input and output prices managers could have decreased expenses of nutrient supply in the years in question.

Summarizing the results, we found that fertilization significantly affected the profitability of maize production, but input and output prices modified greatly the profit-maximizing input level. Irrigation increased the efficiency of fertilization in two years. The statements above are concluded from the average of seven hybrids, but the utilization of fertilizer and mainly the irrigation response of the examined genotypes differed considerably.

Conclusions

The profit maximizing input level of maize fertilization was 30 kg/ha N, 22.5 P, and 26,4 K in nonirrigated plots. The values we determined as optimums are lower than the generally suggested fertilizer ratios.

Irrigation increases the profit maximizing input level of maize. The profit maximizing input level of irrigated maize was 60 kg/ha N, 45 kg/ha P, and 52,8 kg/ha K.

Profit maximizing input levels of maize hybrids depends differently on water supply. Alpha and Celest hybrids had an outstanding fertilizer reaction in irrigated plots.

Through-the-year stability of profit maximizing input level is effected greatly by the genotype of maize. The most stable hybrids were Alpha, Celest, and Debreceni 377 in the time period of the examination.

Determination of profit maximizing input levels of crop production can be a useful tool in the hands of managers to make up-to-date decisions and to increase their profitability.

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Supply of technical resources at private farms in the region of the Northern Plain

Károly Vizdák[15]

Abstract

The article deals with the analysis of the state of supply for technical resources at private farms in the region of the Northern Plain, with special emphasis on essential regional and microregional questions regarding EU accession. The examinations were performed with mathematical – statistical methods (factor analysis, discriminance analysis), taking into account which complex indices can be formed on graphic description and on the exploration of those causes. Thus it makes possible drawing conclusions which the performed analyses using basic indices are not suitable for.

Key words

Private farms, technical resources, factor analysis, discriminance analysis, regional analysis, comparisons of microregions

Introduction

One of the conditions of competitiveness and effectiveness of agricultural production – besides other factors – is the state of supply concerning technical resources, including machinery, building-, and structure-stock.

There was a lot of research work and studies done on various examinations of the technical make-up of Hungarian agriculture /(Magda – Szabó, 1992), (Szűcs et al., 1994), (Wachtler – Magyari, 1996), (Peszeki, 2000)/.

Takács (2003) stresses that a major cause of competitive backwardness in Hungarian agriculture is the unsuitable technical state of supply. The examination of machinery on farms – in his opinion – takes place through key pieces of machinery. On farms – even in terms of progress– tractors are considered to be essential in his point of view. In his research he showed that there were significant differences concerning the degree of supply and capacity which went beyond even regional differences and which could be equalized only with a conscious, systematic and comprehensive concept for technical development which covered the whole country, supported by the government and which was based on professional and scientific knowledge.

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Husti (2002) in his studies pinpoints more important aspects by presenting some specific mechanisation problems in Hungarian agriculture (the composition of power machinery, its average usage time, average engine performance, number of iterms projected per area unit, etc.). Relying on the data of General Agricultural Census (GAC 2000) supplied by the Central Statistical Office (CSO), he establishes that domestic agricultural machinery does not meet the requirements of quality production. Most of the machines are too old, and the scope of machinery does not adjust to altered land structure. The present state of mechanisation is already a limiting factor to progress, which presents worries regarding the imminent accession to the European Union.

Systematizing the main aspects (which promote the repair of machinery, and the reduction of competitive advantage), he establishes that some of the aspects should be performed on entrepreneurship level, while the other part should be carried out at a social-, political-, and economic level.

Fenyvesi et al. (2003) claims that Hungarian agriculture can participate in the European Union's market with its competitive production methods through innovation. There are needs for modern inputs, flexible and utilizable technological solutions as well as machinery, and know-how for the successful operation of agricultural systems. Regarding present conditions, backwardness in mechanisation means stagnation.

Husti (2002) and Fenyvesi et al. (2003) show that the technical equipment and technological standard of Hungarian agriculture are far behind those of developed countries'. Effective and quality production based on modern technology can only be achieved with modern techniques, and thus necessitates an improvement in the present technical standard. This can demonstrated by the low machine hauling power capacity in Hungary compared with the developed countries. The index of tractor density at present is 20.6 tractors/1000 ha, i.e. a tractor covers an average agricultural area of 50 hectares. This index is only 1/3 of EU average and only 1/5 of Germany and Austria.

Németi (2003), after examining the structure of resources and the activities of private farms according to the extent of arable land, concluded that production equipment and the structure of private farms (animal sheds, spare parts; hen-houses, square metrse; wine storage tank, hl; tractors; and lorries) were full of contradictions.

In Hungary radical social changes and the process of joining the EU have put the examination of questions on regional and microregional level into the foreground. For this reason the analysis of processes and dispararities (exploration of inequalities, etc.) possess increasing significance in terms of scientific research, and mathematical-statistical models have an increased role. Fehér (2003) shows that the effective harmony of programmes and arrangements toward agricultural and regional development policy require the necessary planning, and exploration of methods, parameters and relationships influencing the regional economies other than only knowledge and modelling of branch and industrial competitiveness. Dobos (2003) claims that models are significant instruments in regional knowledge and calculations. The disparities in area established on the complex indices call attention to the graphic description (on the basis of which the groups of similar microregions can be formed), related to the descriptions of the basic indices. These pieces of information are necessary, however, regarding accession to the EU.

In the course of my examinations, I stressed the **analysis of the standard of technical equipment** in the region of the Northern Plain based on the topic of the state of

supply concerning private farm resources, with special respect to the problems of significant regions and microregions regarding EU accession. The number of private farms in the region of the Northern Plain in 2000 was 220,000, which was 23 per cent of the functioning private farms in the country.

The completed examination aimed at answering the following questions:

- to determine with which indices the standard of state of supply concerning technical resources can effectively be characterized;
- with full knowledge of pertinent relationships, to determine the complex index characterizing the standard of state of supply concerning technical resources, and to examine how the values of this take form per microregion;
- to explore how the complex index of the state of supply's standard concerning technical resources impacts;
- to determine in what and to what extent standard microregions with differeing state of supply in technical resources contrast with each other;
- to show if there is statistically provable difference in the standard of state of supply concerning power machinery (stressing the density of tractors) between private farms and agricultural enterprises;
- to determine which characteristics and to what extent they determine the present differences in the state of supply concerning power machinery particularly in the density of tractors.

Data base and methods

My observations were carried out on the grounds of mathematical statistical method analysis on the basis of GAC 2000 publications for the Northern Plain titled " Agriculture of Hungary 2000", "Agricultural machines and structure-stock 1991-2000" and "Agriculture of Hungarian regions, 2000. Northern Plain" compiled by CSO.

We can express the standard of **the state of supply concerning technical resources** of microregions with a complex index only b7 taking various aspects equally into consideration, the numerical values of which we can obtain by relying on factor analysis /(Sváb, 1979), (Bacskay, 1983, 1984), and (Dinya, 1987)/. The factor analysis in the observation of social and economic phenomena can be used in various ways for the analysis of professional problems frequently divergent from one another. In the course of the analyses, **classification and type formation** were the application objectives, when there was a possibility of categorising microregions on the basis of complex conception (= the standard of the state of supply concerning technical resources) characterizing with a more observational variable. (Observations possessing similar factor values can be grouped by means of uncorrelated factors formed from variables, as factor value is a number without unit of measurement, and can be understood as a relative score, characteristic of the observational units.)

The **process of observation** consisted of the following steps:

- The determination of the index system characteristic of microregions
  Out of the CSO data I chose 15 items of the basic index of microregions, which are the followings (Table 1):
  - the state of supply concerning power and labour machinery – index 6
  - the state of supply concerning animal sheds – index 5

- the state of supply concerning other technical resources (storage establishments, greenhouses, foil tents) – index 4

During the formation of the circle of the indices it was important that I not work excessively with a large index, and that the indices should characterise the microregions more comprehensively.

- The compilation of the database
  I used the data of 23 microregions in the region of the Northern Plain in 2000 for my observations. The size of the basic data matrix was m x n = 23 x 15. (The observed variables can be seen in Table 1.)
- Computerized processing with factor analysis
  The processing was carried out with the usage of factor analysis programme on a Intel Pentium 233 computer at the Department of Economics, Agricultural College Faculty of Tessedik Sámuel College.
- The evaluation of the result of the factor analysis
  I obtained a lot of information on the observed indices through factor analysis (the average and variance, correlation matrix, factor weight matrix and factor value matrix)
- The formation of the complex index of the state of supply concerning the standard of technical resources
- The determination of spatial differentiation of the state of supply concerning the standard of technical resources

Table 1

The significant indices of the microregions of the Northern Plain (private farms, 2000)

Indices (variables)	Average	Dispersion	Relative dispersion, %
1. < 20 kW tractor stock, piece, per 1000 ha agricultural area	8,57	7,36	85,88
2. 21-60 kW tractor stock, piece, per 1000 ha agricultural area	22,28	5,99	26,88
3. > 61 kW tractor stock, piece, per 1000 ha agricultural area	4,10	1,27	30,97
4. Combine stock, piece, per 1000 ha agricultural area	2,13	0,93	43,66
5. Plough stock, piece, per 1000 ha agricultural area	24,06	7,59	31,54
6. Lorry capacity, ton, per 1000 ha agricultural area	17,85	5,99	33,55
7. Horned cattle rooms per possessing farm	6,58	0,94	14,28
8. Swine rooms per possessing farm	7,91	2,81	35,52
9. Sheep rooms per possessing farm	106,69	71,33	66,85
10. Poultry-pen, m^2, per possessing farm	9,30	1,46	15,69
11. Milking house, milking stand, per possessing farm	9,67	5,55	57,39
12. Wine storage, hectolitre, per possessing farm	14,66	15,26	104,09
13. Vegetable- and fruit store, m^3, per possessing farm	21,89	11,24	51,34
14. Barn, m^2, per possessing farm	41,33	17,44	42,19
15. Greenhouse, foil tent, m^2, per possessing farm	467,64	612,37	130,94

During the comparison of the **standard of the state of supply concerning power machinery** (pointing out the state of supply concerning tractors) of private farms and agricultural enterprises I applied the method of **discriminance analysis** /(Sváb, 1979), (Forgácsné Kovács – Törökné Matits, 1986), (Vizdák, 2002)/ with the application of so-

called complex classification (classification based on further criteria) for the exploration of variables having significant effect on the separation of groups and on differences between groups.

During the examination I chose three indices with which I intended to show the differences in the state of supply concerning power machinery. These indices by their nature are suitable for judging the standard of mechanisation:

- tractor stock, item, per 1000 ha agricultural area;
- combine stock, item , per 1000 ha agricultural area;
- lorry capacity, ton, per, 1000 ha agricultural area.

Three factors came into consideration during the analysis of the state of supply concerning tractors being examined separately from other power machinery:

- 1000 ha agricultural area having < 20 kW tractor stock, units;
- 1000 ha agricultural area having 21-60 kW tractor stock, units
- 1000 ha agricultural area having > 61 kW tractor stock, units.

The discriminance analysis chosen as the method of analysis is usually applied when it is known that every observational unit before the analysis belongs to two or more distinct groups, and it is obvious in which group some observational units can be listed . In our case we can follow the existing difference of indices characterizing the state of supply concerning power machinery and tractors according to the economic form (by separating the two economic forms /private farms, and agricultural enterprises/) after I had applied the method in such a way that it would discriminate in terms of the economic form. Thus I obtained a synthetic index which followed the expressed variables in the divergent units of measurement, and these were expressed in quantitative, but contracted value without unit of measurement (Z = discriminance function value), by it.

The steps of the process of the examination were the followings:

- The compilation of basic data matrix
- The basic calculations
- The calculation of the significance of variables
- The determination of a discriminance equation
- The evaluation of the results

Results (and their discussions)

I determined the index groups forming the complex index of the standard of state of supply concerning technical resources on the basis of factor weight matrix (Table 2). In table I only showed the greatest factor weight of each index, which supplies information regarding which factor the index should be listed in.

Table 2

Factor weight matrix
(The region of the Northern Plain, private farms, 2000)

Indices (variables)	Factors		
	I	II	III
1.	**0,69467**		
2.	**0,89019**		
3.	**0,67793**		
4.		**0,84805**	
5.	**0,86005**		
6.	**0,82476**		
7.	**-0,41884**		
8.		**0,64878**	
9.		**-0,79250**	
10.			**0,79479**
11.			**0,76865**
12.		**0,68301**	
13.	**0,59591**		
14.		**-0,60248**	
15.		**0,57074**	
Information content (%)	**35,56**	**19,54**	**12,49**
Cumulated information content (%)	**35,56**	**55,10**	**67,59**

As FI, FII and FIII factors contain the essential technical resources indices, they can together express the complex standard of the state of supply concerning technical resources. On the basis of the data of the factor values matrix, I determined the sum (Table 3) of the factor scores belonging to FI, FII and FIII factors, which shows, per microregion, in what direction and how large the differences are in the standard of the state of supply concerning technical resources compared to each other and to the average of the microregions in the Northern Plain region. The values of the standard of the state of supply concerning technical resources change at the observed intervals:– 3.5 and + 4.0.

The distribution of the microregions according to the state of supply concerning technical resources can be studied and illustrated most suitably by placing the microregions into categories, and I accordingly formed five categories:

	The standard of the state of supply concerning technical resources	Number of microregions
very poor	below – 2.0	2
poor	– 2.0 – 0.5	6
average	– 0.5 – 1.0	10
good	1 – 2.5	3
very good	above 2.5	2

Table 3

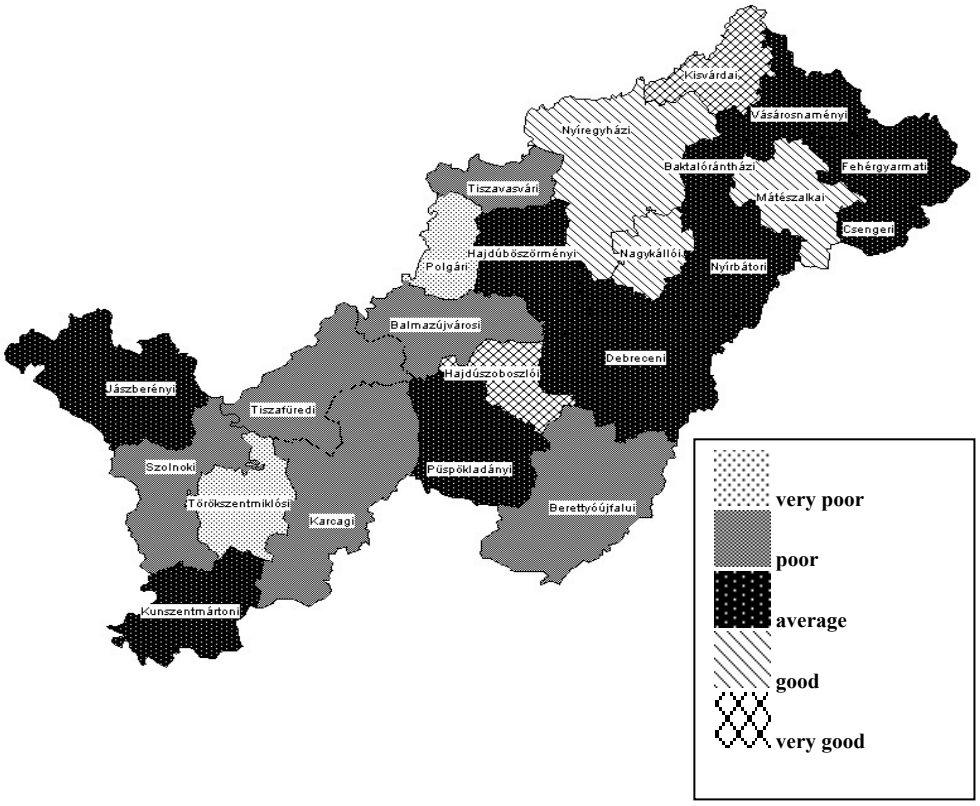
The standard of the state of supply concerning technical resources (The region of the Northern Plain, private farms, 2000)

Name of microregions	Factor values			The value of the complex index (the total of factor values)
	F_I	F_{II}	F_{III}	
Balmazújvárosi	-0,810873	-0,868077	-0,196853	-1,875803
Berettyóújfalui	-0,466104	-0,131821	-0,203345	-0,801270
Debreceni	-0,371392	-1,048490	1,070810	-0,349072
Hajdúböszörményi	-1,128580	-0,895753	1,720080	-0,304253
Hajdúszoboszlói	-0,836117	1,619310	2,294650	3,077843
Polgári	-0,653376	-0,997050	-0,856010	-3,506436
Püspökladányi	-0,897158	0,495124	0,015850	0,613816
Jászberényi	-0,208372	1,826780	-0,703421	0,914987
Karcagi	-1,049900	0,769701	-0,487040	-0,767239
Kunszentmártoni	-0,450747	0,811225	0,357123	0,717701
Szolnoki	-0,813188	0,375868	-1,335850	-1,773170
Tiszafüredi	-1,212250	0,700896	-1,327150	-1,838504
Törökszentmiklósi	-0,941257	0,311706	-1,500300	-2,129851
Baktalórántházai	1,292460	-1,239490	-0,125080	-0,072110
Csengeri	1,289230	-0,150241	-0,651370	0,487619
Fehérgyarmati	0,859192	0,246633	-0,764000	0,341825
Kisvárdai	2,084170	1,856270	0,061765	4,002205
Mátészalkai	1,570230	0,074339	-0,295462	1,349107
Nagykállói	1,011510	-0,480951	1,141930	1,672489
Nyírbátori	0,463383	-0,368879	-0,200283	-0,105779
Nyíregyházai	0,770095	-0,065397	1,247560	1,952257
Tiszavasvári	-0,289780	-1,010040	0,065923	-1,233896
Vásárosnaményi	0,788728	-0,831667	-0,329526	-0,372465

On the basis of the categorisation of the microregions I prepared the map (Figure 1) of the standard of the state of supply concerning technical resources of the Northern Plain microregions based on where the standard differences between microregions can be clearly seen. (I placed the microregions belonging to the different categories of the state of supply on the map and through this I obtained a clear picture, where cluster microregions of better or poorer state of supply concerning technical resources standard. .)

Figure 1

The standard of the state of supply concerning technical resources of private farms in the region of the Northern Plain



Source: Agriculture in Hungary, 2000 – regional data, private counting

I determined numerically these groups' traits, and to what extent they revealed a numerically opposite picture relative to each other (Table 4) with the average of the microregions' traits having a very good, or a very poor standard regarding state of supply concerning technical resources.

The values of discriminance function Z derived during the analyses relating to the exploration of the existing differences in the standard of the state of supply concerning private farms' power machinery and those of agricultural enterprises can be seen in Figure 2. ZA where values reflect the private farms' traits, while ZB values relate to the agricultural enterprises. When I discriminated on economic form with factors influencing the state of supply concerning power machinery which I personally observed, it became clear that in the indicated point of time in all the 23 microregions ZB was smaller than ZA. Clearly ZA-ZB values show the direction and degree of difference (as contracted, dimensionless index).

Table 4

The mean values of the characteristics of the standard of small regions with different state of supply concerning technical resources (The region of the Northern Plain, private farms, 2000.)

Indexes	The mean of the standard of very weak state of supply concerning microregions	The mean of the standard of very good state of supply concerning microregions	Index: The mean of the standard of very weak state of supply concerning microregions = 100 %
1.	4,20	16,10	383
2.	16,80	30,70	182
3.	3,10	6,25	201
4.	1,90	2,30	121
5.	17,80	30,35	170
6.	10,75	25,45	236
7.	7,25	6,55	90
8.	9,10	8,40	92
9.	60,20	106,00	176
10.	7,85	10,20	130
11.	6,95	15,75	227
12.	32,40	11,10	34
13.	11,00	46,15	419
14.	33,80	41,15	122
15.	73,10	793,35	1085

The difference between the two average values ($\overline{Z}_A - \overline{Z}_B$) (the D2, or the so-called Mahalanobis generalised distance), and the percentage of ranging wrongly calculated out of this (in group A, 0 individual = 0% and in group B, 0 individual = 0%) shows that the two groups greatly deviated from each other (Table 5 and Figure 3). Observation of the significance of D2 generalised distance with F-test shows the multivariate mean values of the two groups (private farms and agricultural enterprises) significantly differ (on P = 0.1% level).

Table 5

The frequent distribution of Z values calculated from the discriminance equation (the state of supply concerning power machine)

$Z = 0{,}297035X_1 - 1{,}369649X_2 - 0{,}115561X_3$

($n_A = 23$; $n_B = 23$)

Z	A	B	List
← – 6,49	-	-	B
-6,48 – -4,49	-	4	
-4,48 – -2,49	-	3	
-2,48 – -0,49	-	15	
-0,48 – 1,51	-	1	
1,52 – 3,51	8	-	A
3,52 – 5,51	9	-	
5,52 – 7,51	-	-	
7,52 – 9,51	3	-	
9,52 – 11,51	1	-	
11,52 – 13,51	1	-	
13,52 – 15,51	1	-	
15,52 →	-	-	
Total	23	23	

Since I observed at the same point in time both economic forms' state of supply concerning power machinery indices per microregion, it became possible for me to present the extent of differences (Figure 2) with the ZA and ZB image of the values.

It turns out on Figure 2 that, after taking into account the examined variables, the private farms' standard of the state of supply concerning power machinery in all the 23 microregions was higher than that of the agricultural enterprises.

On the basis of Figure 2 in connection with the differences, the followings can be established:

- The straight lines in the standard of the state of supply concerning power machinery mark the existing degree of difference on the basis of the values ZA and ZB.
- The starting point (ZB) and end point (ZA) of certain straight lines can be compared to the average (perpendicular line $\overline{\overline{Z}}$) of the standard of the 23 microregions' state of supply concerning power machinery .
- The relationship of the length of the straight lines to each other in the degree of the state of supply concerning power machinery, regarding private farms and agricultural enterprises, allows comparison between the microregions.

Beyond the conclusions drawn with the usage of the values of ZA and ZB, the elements of weighted coefficient vector [W*] (= coefficients of discriminance equation) assume an important role which permits one to judge the role of individual indices. The values of the elements of weighted coefficient vector on the basis of collective treatment of the 23 microregions are the following:

- state of supply concerning tractor	+ 0.297035
- state of supply concerning combine	– 1.369649
- state of supply concerning lorry	– 0.115561

The signs show the observed indices' divergence (which are the joint relations of innumerable factor) according to the economic form. There is a positive divergence in the private farms toward tractor state of supply, while the divergence is negative in combine and lorry state of supply compared to the agricultural enterprises.

The divergences between privates farms and agricultural enterprises in the examined indices of the state of supply concerning power machinery – as can be seen at Table 6 – can, in the first place, be attributed to the seeming difference in the state of supply of tractors, and thus it is the most clearly discriminating variable. The difference in the tractors' state of supply is 3.9 times greater than in combines' state of supply, and 17 times greater than that of lorries.. After it had become clear from the analyses that the divergence formed in the indices of power machinery state of supply on private farms and agricultural enterprises could in the first place, be attributed to tractor state of supply. I completed the examination of this separately according to the output categories using discriminance analysis method. Figure 4 shows the Z-values of the calculated discriminance function. ZA values relate to private farms, while ZB values relate to the agricultural enterprises. It can be observed from these that ZA values are greater than ZB values in all of the Northern Plain microregions.

Supply of technical res

Name of microregions

The differences of individual Z values calculated with the discrimimance equation (the state of supply concerning power machine)

Figure 2

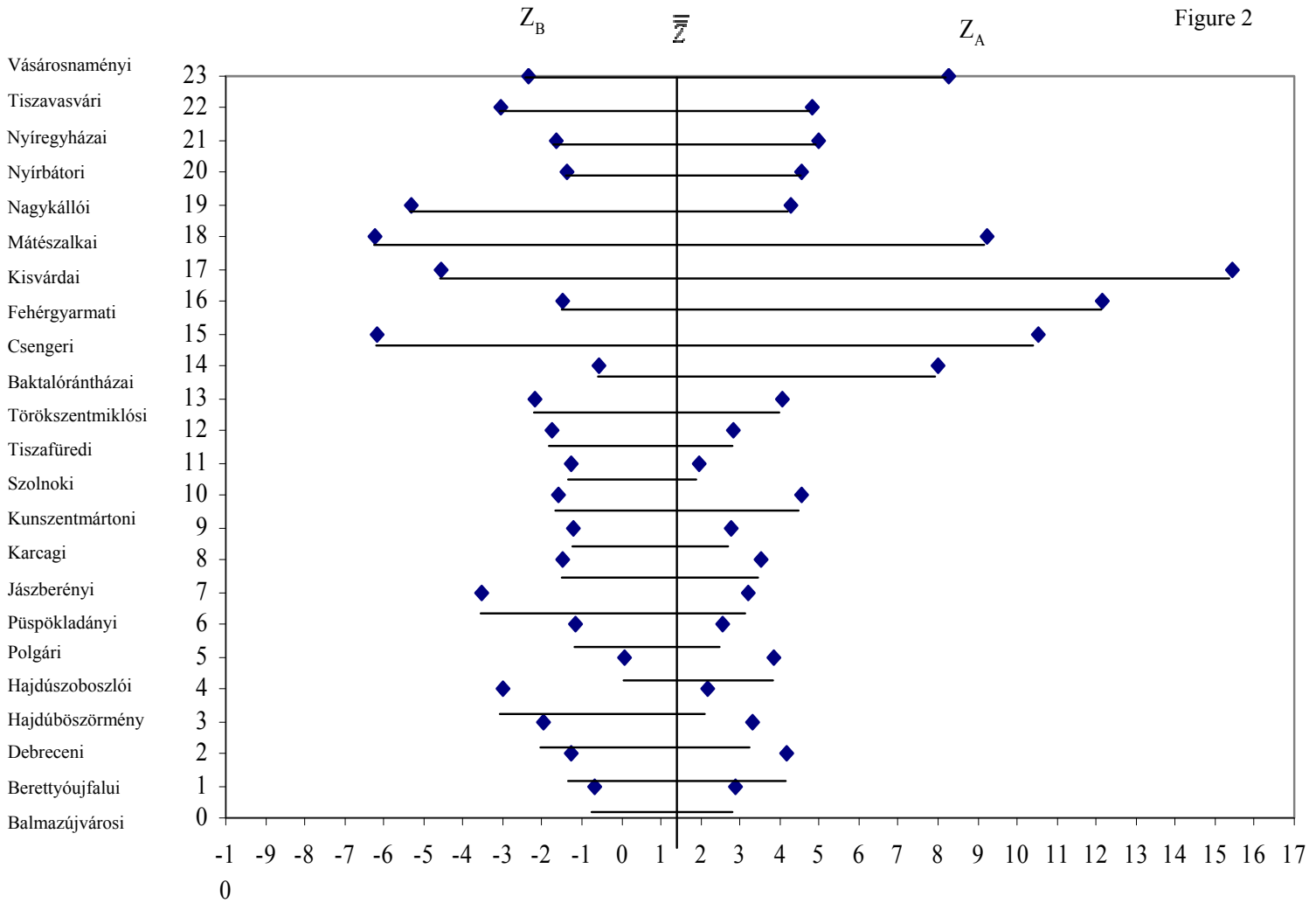


Figure 3

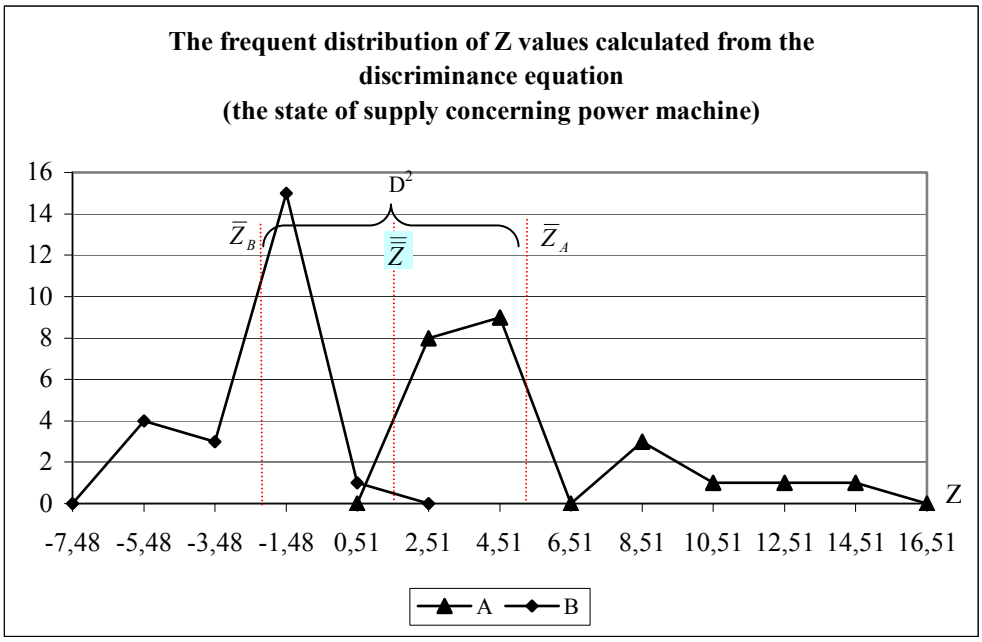


Table 6

The direct, indirect and total effect of the variables on the formation of D2 generalized distance
(the state of supply concerning power machine)

Variable	Direct	Indirect	Total
	effect		
1. Tractor stock, piece, per 1000 ha agricultural area	1,255	-0,494	0,761
2. Combine stock, piece, per 1000 ha agricultural area	0,315	-0,120	0,195
3. Lorry capacity, ton, per 1000 ha agricultural area	0,200	-0,156	0,044
Total:			1,0000

The difference (D2) between the average values of $\overline{Z}_A$ and $\overline{Z}_B$, as well as the percentage of grading wrongly calculated from it (in group A, 3 individuals = 13% and in group B 0 individual = 0%) shows that the groups are appropriately separated (Table 7 and Figure 5). The examination of the significance of D2 generalized distance with F-test shows that the multivariate mean values of the two groups (private farms, agricultural enterprises) significantly differ (on level P = 0.1%)/.

Table 7

The frequent distribution of Z values calculated from the discriminance equation (the state of supply concerning tractor)
$Z = 0{,}125632X_1 + 0{,}322460X_2 - 0{,}410861X_3$
($n_A = 23$; $n_B = 23$)

Z	A	B	List
← 0,18	-	-	B
0,19 – 2,18	-	17	
2,19 – 4,18	3	6	
4,19 – 6,18	9	-	A
6,19 – 8,18	5	-	
8,19 – 10,18	3	-	
10,19 – 12,18	2	-	
12,19 – 14,18	1	-	
14,19 →	-	-	
Total:	23	23	

The representation of ZA and ZB values graphically show the divergences in every microregion (Figure 4). The difference present in the state of tractor supply –indicated in the data on Table 8 – amongst the indices examined can be explained with the tractor stock belonging to 21-60 kW category, constituting the most strongly discriminating variable. The impact of the state of supply concerning 21-60 kW tractors on the divergence is almost four times greater than the tractor state of supply in a <20 kW category. (There is no significance of the tractor stock belonging to a > 61 kW category in the formation of divergence.)

Table 8

The direct, indirect and total effect of the variables on the formation of D2 generalized distance
(the state of supply concerning tractor)

Variable	Direct	Indirect	Total
	effect		
1. < 20 kW tractor stock, piece, per 1000 ha agricultural area	0,090	0,123	0,213
2. 21-60 kW tractor stock, piece, per 1000 ha agricultural area	0,715	0,072	0,787
3. > 61 kW tractor stock, piece, per 1000 ha agricultural area	0,081	-0,081	0,000
Total:			1,000

The differences of individual Z values calculated with the discriminance equation (the state of supply concerning tractor)

Figure 4

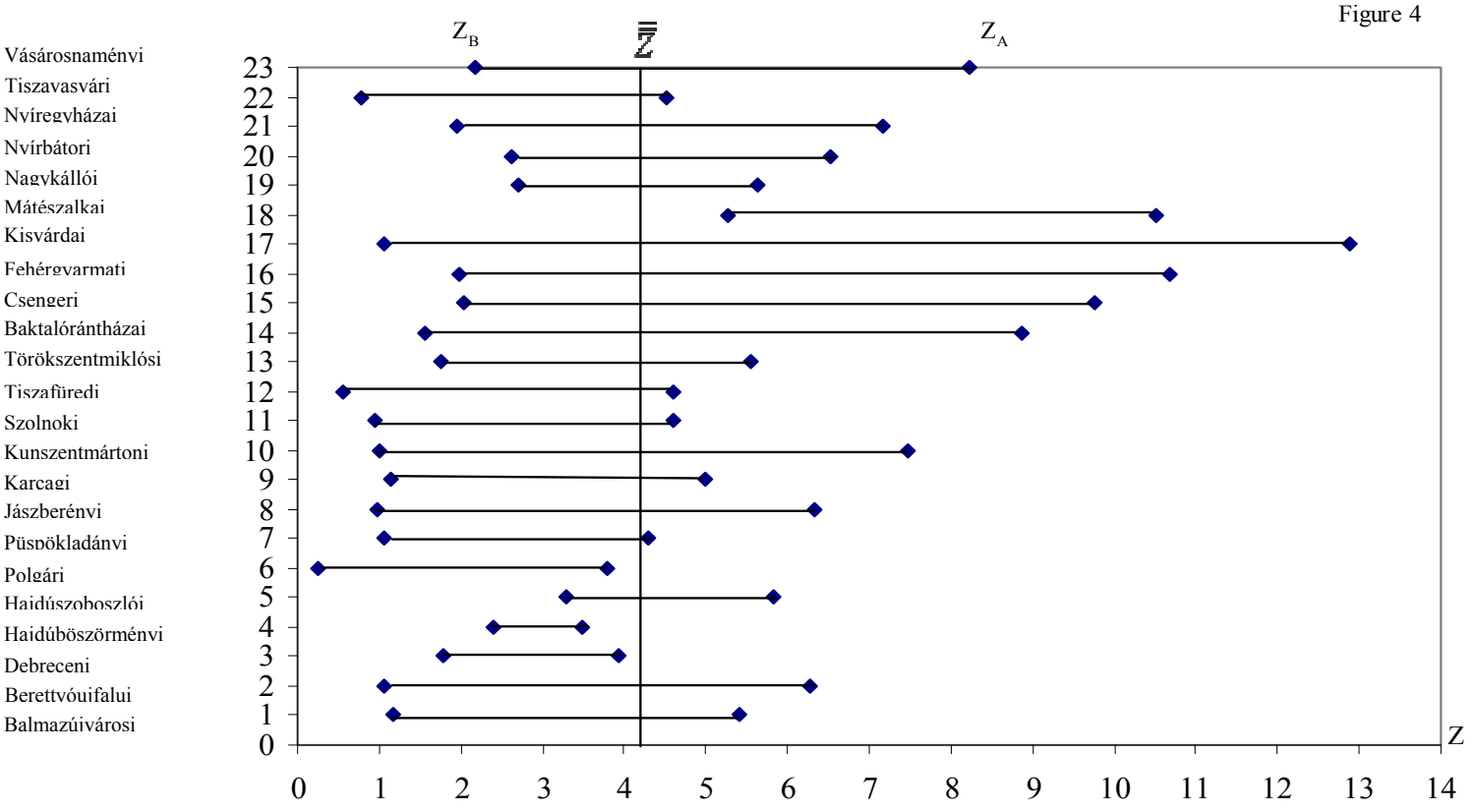
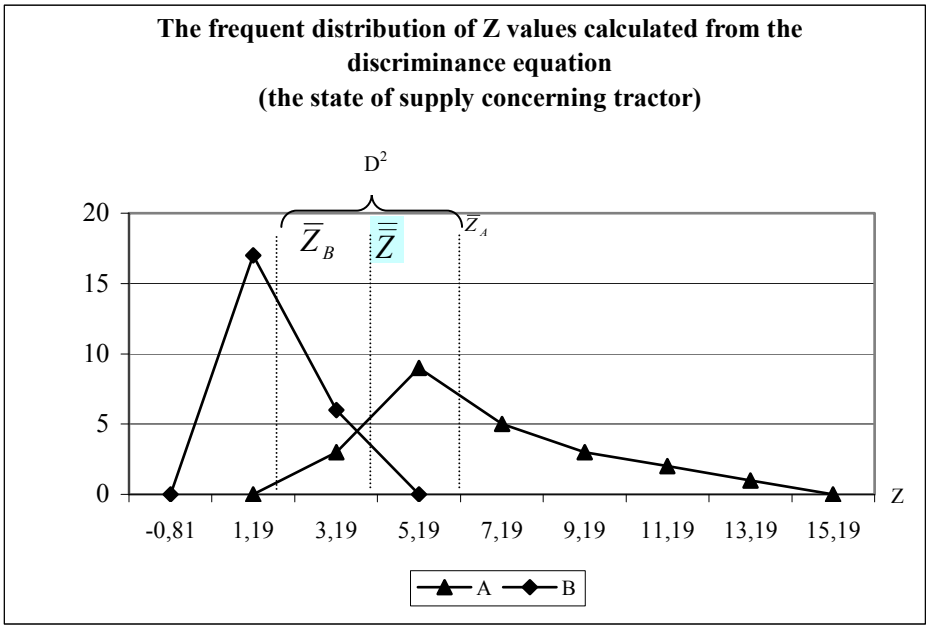


Figure 5



Conclusions

- Complex indices, taking different aspects into consideration, by means of mathematical- statistical methods (factor analysis, discriminance analysis) applied in the course of the examinations were formed (factor value, the relative score significance of the observational units; Z = discriminance function-value), showing the graphic representation of area differences present in the standard for technical resources state of supply could be achieved as opposed to the usual representations (according to the basic indices) in the bibliography, and it made revealing the reasons for the differences possible.
- On examining the 23 microregions in the Northern Plain it can be established that the technical resources state of supply on the private farms are in more than 43 per cent of the microregions (10 microregions) compatible with the regional average. Nearly 35 per cent (8 microregions) belong to the poor and very poor category and 22 per cent (5 microregions) reach the good and very good standard.
- On analysing the particular aspects of different state of supply standard in the microregions, it can be seen that the two most advanced microregions are situated in Hajdú-Bihar county (Hajdúszoboszlói) and in Szabolcs-Szatmár-Bereg county (Kisvárdai). The two really poor microregions are in Jász-Nagykun-Szolnok (Törökszentmiklósi) and Hajdú-Bihar (Polgári) counties. In Jász-Nagykun-Szolnok it is only possible to identify two microregions with average standard and under.
- Comparing the characteristic average values regarding the standard of microregions with different technical resources state of supply, it can be established that the divergence lies in the range of 21 and 283 per cent for

different groups of machines in relation to the indices of inadequately supplied microregions and benefiting the well-supplied microregions. In regard to building and structure capacity, the difference lies in the interval of 22 and 985 per cent except for a farm possessing the capacity of horned cattle and swine as well as wine storage, which surpasses the values of the well-supplied microregions.

- On the basis of the standard of the state of supply concerning resources it can be observed that the Z values calculated from the three variables (the state of supply concerning tractor, combine and lorry) are higher in private farms (in all the 23 microregions). (In the case of the agricultural enterprises these values are below the main average of $\overline{\overline{Z}}$ in all the microregions.) The greatest divergences can be seen in Szabolcs-Szatmár-Bereg county, where projecting differences can be observed in the case of seven microregions (Kisvárdai, Csengeri, Mátészalkai, Fehérgyarmati, Vásárosnaményi, Nagykállói, and Baktalórántházai) on the basis of the drawn, dimensionless index (Z discriminance value).
- The lorry stock of 4.4 per cent, the combine stock of 19.5 per cent, and the tractor stock in 76.1 per cent account for the apparent differences in the state of supply concerning power machinery on the basis of the results of the completed examinations. Thus the tractor state of supply is the most strongly discriminating variable.
- On the basis of the analyses the divergences in the tractor state of supply can be attributed to the tractor stock of a < 20 kW output in 21.3 per cent and in 78.7 per cent with 21 – 60 kW output. Therefore, the most strongly discriminating variable is the tractor state of supply of 21 – 60 kW output, at the same time the tractor stock belonging to the a > 61 kW category do not possess discriminating effect.
- The Z values established in all the microregions on the basis of (< 20 kW, 21 – 60 kW, and the state of supply concerning > 61 kW tractor) the three variables expressing the standard of the state of tractor supply are greater in the private farms. The divergences in this case are most striking in some microregions (Kisvárdai, Fehérgyarmati, and Csengeri) in Szabolcs-Szatmár-Bereg county.

Acknowledgements

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A Market-Conscious Technology Development Model

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Abstract

In the beginning of the 1990s investment in agricultural machinery slowed, then reached rock bottom, before gaining speed in the middle of the decade and then growing rapidly. This led to problems in machinery supply and modernization. According to past experience, in the absence of cohesive agriculture production, meaning vertical relationships that were established in terms of products (methods designed to coordinate the work of those involved in production) the competitiveness of agricultural production will greatly decrease. We must learn to mesh research and development with agricultural production to bring about market success. Improvement in Market-conscious technology is designed to optimize agriculturalists' market success and efficiency, as well as to increase their flexibility and adaptability.

Key words

Innovation, Market-Conscious Technology Development, Research, Marketability

Introduction

Post-Soviet era political changes inspired transformations in Hungarian agriculture and in Eastern European agriculture as well. (Schlüter, 1999). Changes concerning land-ownership are noteworthy, but the advent of new forms of production and ventures (private enterprises, limited partnerships, public limited companies, household farms) are equally important. Today successful development of agricultural production is enhanced by methods designed for production specifics. The creation of a product requiring a substantial investment of time and resources will be needed in a rapidly changing market. Production efficiency depends on a number of difficult to measure factors (biological, chemical, or unpredictable factors such as meteorology or other natural phenomena). One must also consider the fact that each given sector operates in a relatively large market area, but many producers are basically isolated from each other. In little time the market for consumer goods ceased, and Hungarian agriculture was forced to meet demands for high quality products. Agricultural production has also been affected by the absorption of the commercial food and processing industry by foreign multinationals.

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Recent achievements provide significant help in overcoming difficulties: biological bases with beneficial qualities, agents that protect and nurture plants, the most recent agronomical findings, and modern technology. Presently nearly 60 types of agricultural machinery and other equipment are available. But modern methods of production are only partly able to reduce negative effects.

Regulations can cause a sharp rise in expenses, causing a need for research and development, which can achieve further economic results. Today a production method is needed that is equally capable of handling expected diversity and differences in land usage as it is of meeting the demands of a rapidly changing market.

Systems of Agricultural Production

The effect of producer organization on agricultural production efficiency is greater than any other factor. National agricultural production "reached an unexpectedly high level" in the 1970s and 80s, mostly through production systems based on factory farming (Dimény, 1973). These "unexpected" results can mostly be attributed to the autodidactic nature of these systems. Production systems are to be viewed as vertical connections formed for products, the effects of which are felt in the whole of Hungarian agriculture. "Dimény's Model" which classifies this period's agricultural production system as based on meeting market demands. Since a commercial product's amount could be annually raised, the goal was to raise output and intensify production. Apart from domestic needs, export-oriented production was also accomplished, making higher targets more achievable. The products' quantity was higher than demand so market expansion became possible.

System managers wanted constant growth as they were obliged to do so by domestic and foreign producers. The need for constant growth in production was strengthened by an expanding rate of consumption. The extent of their efficiency can be seen in product-optimization involving not only the production of raw materials but the processing and in some cases the distribution as well. Numerous production systems employed modern marketing methods to design and package their products. A growing relationship formed between commerce and the processing industry (i.e. oil industry, sugar industry, refrigerating and canning industry, dairy industry). During this time, Hungarian agriculture completely mechanized its basic production technologies and before long a varied system of mechanization standard appeared.

Integration affected not only large-scale production, but household production as well. Flexible production in household garden plots played a major role and, for some products, a determining role in meeting changing consumer demands.

Factory farm agricultural technology progressed by economically meeting concrete demands by producing expected quality which balanced out the fluctuation of agricultural revenues.

Following the Post-Soviet political changes, the structure of agricultural production, property relationships, and market conditions changed considerably. An increase in production and effective progress in rural areas can only be achieved by finding new methods of organization and management.

In order to develop Hungarian efficiency in production, we need a system, apart from the above-mentioned, which

- facilitates optimal regional production,
- provides quick market flexibility,
- involves the whole nation
- efficiently enhances innovation.

In the future, agriculture will play an important role in ecology, in the preservation of the environment, and in balanced rural development, as well maintaining the rural population. In the future, along with the food industry, agriculture will play an equally essential part in the production of natural commodities as well as energy sources. Agricultural products such as industrial raw materials produced from plants high in starch, protein, oil, sugar and fiber open new perspectives in the production of environmentally and nature friendly consumer goods, packaging materials, panels used by the construction industry, textiles used by the clothing trade, car parts and accessories as well as different products of the chemical industry.

As a result of structural changes at the beginning of the 1990s, investment in agricultural machinery slowed considerably, bottomed out, then from the middle of the decade began to grow rapidly. This tendency led to problems in machinery supply and modernization. Until today all efforts to fill the gaps caused by cancelled investments and modernization have proven unsuccessful. In order to improve the market competitiveness of Hungarian agriculture a much greater emphasis is to be placed on the modernization of machine stock, as well as on the volume of necessary machinery investments in order to improve equipment supply.

A Market-Conscious Model Developed For Cohesive Agricultural Production

Cohesive agriculture production (vertical connections established for cohesive agricultural production) entails systems coordinating those involved in agricultural production. Based on past experience, the absence of cohesive agriculture production means the marketability of agricultural products greatly decreases.

A Market-centered approach for agricultural technology is a model that is bolstered by innovation. The model's main characteristic is continual innovation devised for cohesive agricultural production, based on the well-coordinated work of research centers. This system's goal is to increase the effectiveness of a given consumer product by innovation. Innovation's success is based on a number of factors. According to recent findings, critical points were reached during the implementation of well-planned research projects and during the actual implementation of research/development results. The source of the problems is partly due to the fact that in order to establish stable agricultural production, research is needed in a number of scientific fields, and sadly producers are not connected to research which is being carried out. As a result, research at times becomes simply an end in itself. The lack of shared interests and responsibilities causes even the most promising research results to be rarely or never implemented at production level. Thus it is vital to develop a system integrating research/development directly into effective agricultural market production.

An important attribute of the above mentioned production system (based on autodidactic methods for fast implementation of domestic and international results) is the

role of machinery. Machinery technology not only influences the cost and the effectiveness of production (on average mechanization is responsible for 40% of the total costs of production), but enhances the speed and quality of production as well.

These effects are interconnected, making possible top-notch factory management, planning and design. Facts are easily communicated through technological and economic information stored in the machinery operating system.

Market-conscious technology's goal is peak effectiveness and efficiency, as well as the enhancement of flexibility, and adaptability by agricultural producers. This goal can only be reached if producers are provided with free access to information containing the latest data on productivity and marketing linked to local factors and conditions. In order to achieve this goal the setup of a comprehensive national information system is needed, which combines the traditional consultation (e.g. presentations, films, publications) as well as electronic information while integrating the already existing systems.

Another goal of this method is (fig 2.) further integration of sectoral research institutes for each given field with agronomical institutions (universities, the Hungarian Academy of Sciences, research institutes); agricultural producers, company research centers, factories (machine and artificial fertilizer factories) and innovative producers (demonstrational and experimental farms). Technological progress is applied and in order to reach the desired goal it integrates basic as well as applied research and development. The results are passed on to the producers through an information system. Economics is highly stressed among the research fields. Based on the work of agronomical research institutes and taking into account the above factors, coordinated research programs have been started.

The coordination of agricultural production processes is complicated, mainly due to isolation of those involved in production. This problem can be solved through the principal of gradiance. According to this principal, suitable technologies are to be developed and are linked to several factors. The main task is to create a system involving all production components. These components or activities entail not only basic agricultural raw material production, but all production processes in rural areas (e.g. handicraft, tourism, small-scale industry).

From the perspective of developing a system, it is imperative to adhere to a plan. Primarily, the value of a venture is to be determined from a marketing angle, because cohesive management is an integral part of marketing strategy. Determining factors vary: world market indicators in the case of stock market and industrial products, but in other cases local sales indicators are relevant. In some instances the location of services are paramount (e.g. entertainment and tourism). In the case of each given product or service the acceptable price categories are to be determined by previous market analysis and with consideration of – the national specialties (marketing advantages) – and appearance of Hungarian products. Naturally, in most cases the packaging design should not to be determined centrally as careful consideration of local conditions and possibilities is necessary.

The increase of production abroad is limited by our biological possibilities. The utilization of our unique ecological conditions can result in marketing advantages. Not only unique products (hungaricums) are considered an asset, but well-known Hungarian varieties used in tilled cultures (e.g. well-known Hungarian wheat and corn varieties) as well as improved varieties and those derived from gene technology. Agro-technological benefits determine the effectiveness of production, some of which can be influenced: soil quality, technological parameters (e.g. plant protection, time of sowing and harvesting), but others

cannot be altered (e.g. weather, effects of nature). Agro-technological requirements contain every element of effective production, the rotation of crops, all necessary criteria and specifics to each given variety. Economic relationships regarding the above are important as well. The effectiveness of farming is influenced by a number of factors, such as the volume of production, the type of venture as well as a number of other circumstances. Specifically the field of economic engineering deals with the subject, able to determine the optimum machinery-linkage separately from other farming characteristics (factory size, machine stock, type of venture etc.)

Because mechanization is a major element in technological progress, its effect is fairly easy to determine. Its effect on farming is two-fold: firstly, through machine technology, and secondly through the loss caused by inadequate machinery. In agriculture a lot of equipment is not used efficiently, but at the same time the absence of such equipment can or could cause great loss. Often using equipment is possible on even an individual level (e.g. herb harvesting machines).

It is essential that the producer be informed as to what can and is needed to be done concerning his/her current machinery, and if it can be used at any level in production.. If not, the system should consult the producer and aid in decision-making: perhaps the producer should invest in new machinery, or current machine stock needs updating; certain machines should be leased or rented; the producer should join a machinery cooperative, or perhaps should choose another venture.

The entire system is designed to aid the development and the effectiveness of the producer's work. From the perspective of mechanization, the producer is faced with two choices: either his/her machinery meets the standard of the chosen production process (minimal standard) or it doesn't. In the latter case the producer is forced to act through either stock or organization development as mentioned above. Naturally, another possibility is to choose an entirely different product group or activity. The main point is that the producer is able to make a decision having all the necessary information, for example:

- Stays independent, but will choose an activity with greater risks or less profit
- Lessens his/her independence, but increases stability and/or profit

The main points of the suggested method are illustrated in Chart 1. In each field of the profession the question comes up: In a practical and suitable way can one fundamentally and beneficially alter production, meaning that each segment is involved in research as well as development. In the process each institution in a given field determines goals based on well-defined tasks. As market demands are constantly and rapidly changing, each project should be started with a precise economic model.

Present tendencies can be characterized by a vertical, downward direction, as shown on Chart 1., but in the future this direction can be modified and even directed upward. In market analysis, the trend can predict new quality-parameters, determining the production model, or it can confirm the existing product's quality. In each study field boundaries for production movement within the production development model can be enlarged by research projects.

Table 1

Marketing Conscious Developing of Farm Technologies

Professional fields	Production-market	Research-development
Economy, Marketing	Concrete properties	Continuous market model
Place of product	Concrete geographical site and size	Possibilities of extensive Production
Biology	Available Hungarian sorts of wheat	Extending of productive characteristics
Agro-technology	Prescribed and controlled tech-nology for quality production	New concepts of agricultural processes
Technical processes	Minimum programme By available machines Enlarged programme By newly developed machines developments, investments storage facilities, driers etc.)	Reduction of soil load Conservation tillage Reduction of operations Distribution of fertilizer Decreasing of energy requirement Precision tillage Cost decreasing economical analysis

(Source: Fenyvesi et al., 2003)

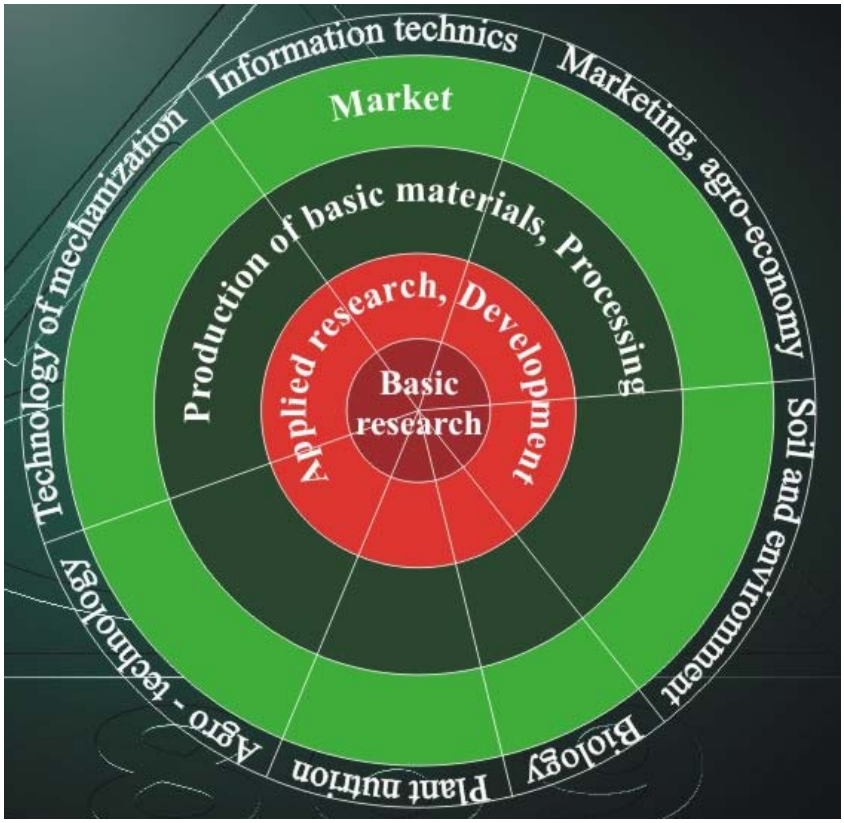
On Chart 1. it is emphasized that research (including basic research) is the foundation of agriculture, and this can also holds true for the processing and the commerce of food products. In the above-mentioned production aspects each professional field has its own "slice". The marked aspects serve as examples. Naturally, other angles of study are possible (law, logistic, etc.).

The role of information technology should be stressed (fig. 1.and 2.), because in a functioning system it is essential that each party have access to necessary information to make intelligent decisions. The mapping of beneficial, modifiable technologies with regard to market changes is possible on the basis of a Geographical Information System (GIS).

Furthermore, establishing a system is necessary for the implementation of tasks determined on the basis of previously set goals. As mentioned above, market-conscious technology is not done by an information system manager but by organizations working together.

Figure 1

The research links of the agricultural process

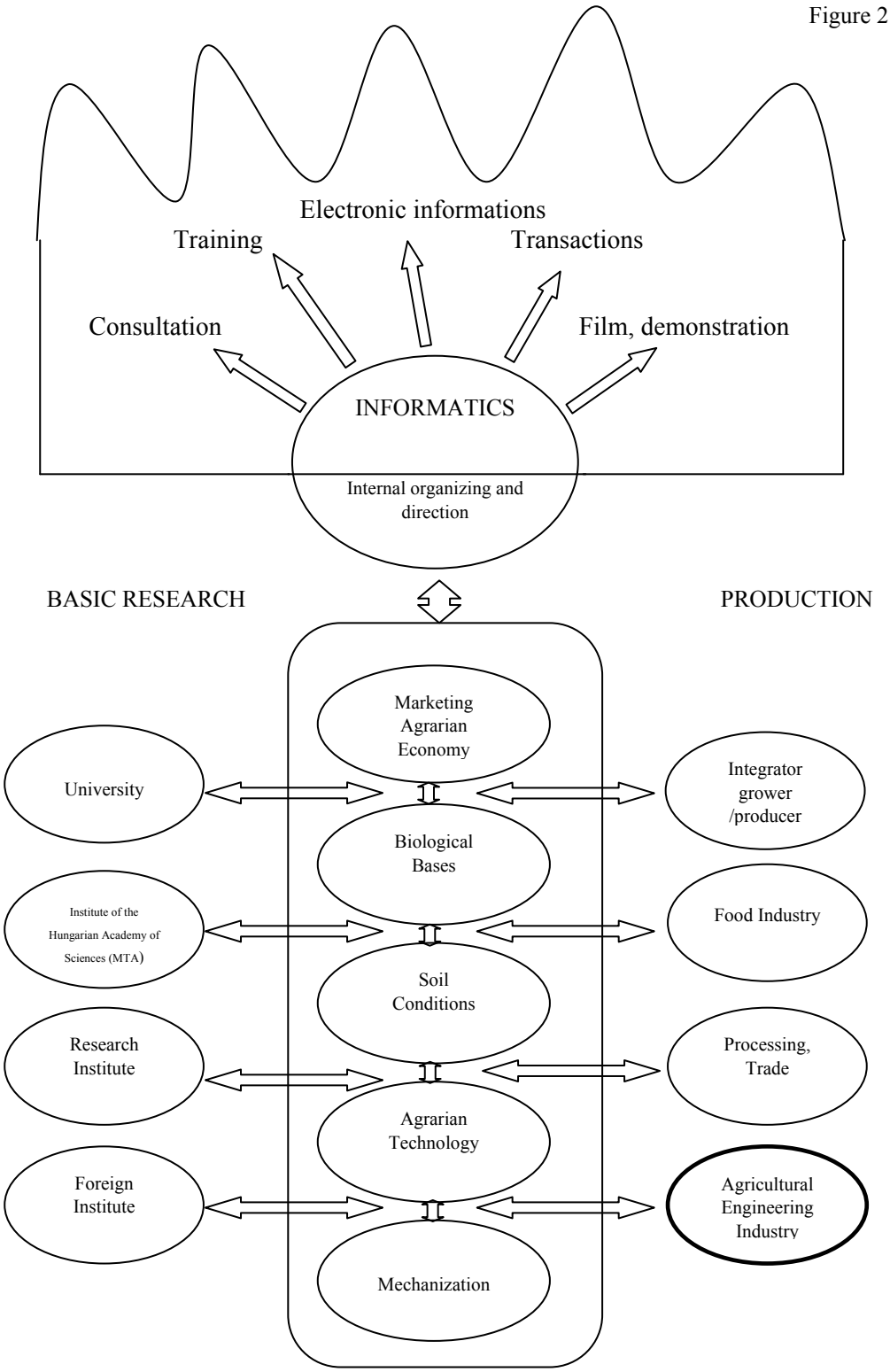


(Source: Fenyvesi et al., 2000)

Technological improvements within existing resources can be done by every Hungarian producer, which demonstrates the significance of the information system. Highly efficient or experimental farms can of course take on a demonstrational or a counselling role. In agricultural innovation one shouldn't underestimate the importance of basic and applied research (Husti, 1998). Progress in agricultural mechanics is designed to mesh biological, chemical, and technical criteria with agricultural production.

Goal-driven tasks can only be accomplished within a well-functioning system. The structure of the system is presented on fig. 2. The structure is similar to the position of spinal cord nerves. The tasks presented are accomplished by well-coordinated sectional research institutes. The relationship between these organizations shows a pronounced downward flowing structure, but at the same time there is an upward flow of information and cooperation governing the nature of the work. Institutions' structure ensures a close connection between basic research and development.

Figure 2


Electronic informations
Training
Transactions
Consultation
Film, demonstration
INFORMATICS
Internal organizing and direction
BASIC RESEARCH
PRODUCTION
Marketing Agrarian Economy
University
Integrator grower /producer
Biological Bases
Institute of the Hungarian Academy of Sciences (MTA)
Food Industry
Soil Conditions
Research Institute
Processing, Trade
Agrarian Technology
Foreign Institute
Agricultural Engineering Industry
Mechanization

The final results of research and development are accomplished for those involved in agro-business and they also join the system. Through such means the system offers practical applications for the completed working solutions. A key part of the organization is the "head", which on the one hand directs the whole system, while on the other hand communicates with the outside world.

The development of agricultural engineering technologies is not a self-contained task as it does not solely involve the introduction of technical improvements, but focuses on the increase in productivity effectiveness as well. In order to achieve this effectiveness, research in different fields is needed. Market-oriented technology accomplishes this coordination as seen on fig. 2., which demonstrates the system's structure.

Effectiveness of the Market-Conscious Model

There is a loose connection between each profession: economic demands: (available biological basis, agricultural technology, producing conditions – soil, climate) are to be met by optimizing technology regarding input, meaning appropriate establishment and utilization of chemicals, equipment, etc.

In all specialized fields effective research is being done concerning inappropriate requirements. And not only horizontal but vertical attributes are to be developed as well (e.g. productivity structure, land size, type of venture, means of production, equipment).

The given fields can aid or hinder each other, but are to be geared toward their main endeavour (productivity, rural development goals). Thus it is imperative to define a successful product from a marketing perspective.

In order to create a modernized, well-equipped agriculture, able to utilize modern technologies and produce marketable products, in this sector rational property concentration must take hold. Establishing producer organizations able to integrate production and aid marketing are essential, and so is production market cohesion. A market-conscious production structure is to be created. These trends will exert great influence on the long-run technological modernization of agriculture. Production methods that mesh in environmentally friendly ecological conditions, guarantee high quality, and ward off crop failure. At the same time such a structure will need to optimize expenditure by using precision techniques for production and equipment for seed cultivation. Horticultural plants play a significant role in the above-mentioned trends.

As part of the above-mentioned model, reference works include the farmland oreliculture program started in 2002 (Fenyvesi et al., 2004), the non-food production program started in 2003, and the market-conscious development of fructiculture, a program that started in 2004. The chief consideration regarding research tasks is that all hypotheses formulated during the basic research as well as tasks needed to be carried out during applied research should be linked to market-conscious technology, in other words they should directly serve agricultural production.

Mechanization-Terms of Market-Conscious Technological Development

As mentioned above, mechanization plays a significant role in the system. In order to start technological development for current machinery, full knowledge of the parameters and characteristics of domestic equipment is needed. The equipment's practical value greatly differs from the nominal value, and determining the value is only possible through industrial scrutiny. The Institute of Agricultural Mechanization of the Ministry of Agriculture (MGI) takes responsibility for this task and regards it as essential.

The amount of equipment is also important information. MGI endeavors to maintain the files through statistical processing of data for sold equipment and cataloguing all equipment available on the market.

The system is influenced by unchangeable peripheral conditions. It is essential to differentiate between peripheral conditions and the system itself. For example, basing a production system solely on different forms of support (including EU support) is unwise as change will cause the model to collapse, also eliminating a lot of invested resources. Naturally, the peripheral conditions dominate the entire model. Under certain circumstances these conditions can destroy the model (as the human body can only function at a set temperature).

Hungarian agriculture's technical progress and its technological standard lag behind the developed countries (Fenyvesi et al., 2003). It is thus vital to raise the technical standard and this can be done by using up-to-date technology to create effective quality-oriented production.

Compared to developed countries, Hungarian agriculture lacks an adequate supply of mechanic propulsion high-capacity equipment. 60% of the close to 10 million kW engine-capacity is provided by tractors, 22% by harvesting machines and 18 % by heavy goods vehicles. Presently in Hungary close to 120 000 tractors are used in agricultural production. One tractor covers 51 hectares of farmland, which is a four to five times higher than in the developed countries. (Hajdú, 2001).

The situation is similar for combine supply. The average size of farmland harvested by combines is 248 hectares, and that is almost three times higher than in Western Europe. Conditions are much the same in the case of other types of equipment where supply is equally inadequate. With a lower rate of equipment-density and equipment-utilization the workload of utilized equipment increases. This tendency creates further problems as discarding outdated equipment is delayed, increasing the number of working hours and servicing costs. In the case of tractors the average is almost 18 years, and for combines almost 15 years.

During our research the following goals were formulated:

- In order to increase production safety, establish competitive output, and raise the standard of product-quality, the agricultural sector will need to modernize its technical and technological foundation. In order to achieve acceptable output and quality what are needed are up-to-date, more productive and more economical equipment and mechanization methods. Also needed are environmentally friendly production technologies.

- Innovation is to be continual based on marketing those products deemed most essential.
- Mechanization with regard to environmental and agricultural land conditions, adjusted to production factors in a given region.
- Increasing production of Hungarian specialties and registered products as well as the technical-technological establishment of these products.
- Implementation of farm cattle technologies using equipment for efficient utilization of animal feed, and more comfortable, spacious, and humane living facilities for farm animals.
- Expansion and modernization of infrastructures for efficient agricultural production.
- Consolidation and availability of computer information services. Rational economic planning is imperative in agriculture mechanization. To reach this, equipment sharing partnerships and fiscally prudent attitudes are to be paid greater heed.

For the above-mentioned tasks and direction in technology development, national agricultural mechanical engineering and national agricultural equipment trade are to have a major role as both are able to impact on technological standards by increasing equipment supply.

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The Implementation of the Cohesion Fund in Greece 2000-2006

Eszter Réka Mogyorósy [18]

Abstract

Since EU accession (01.05.2004) Hungary can benefit from the Structural Funds and the Cohesion Fund. The Structural Funds' system is better known to Hungarians as its funds are available to the public too. The Cohesion Fund finances large transport and environmental infrastructure projects – the minimal cost of a project being 10 Mio EUR– (COUNCIL REGULATION (EC) No 1264/1999). The Fund is centralized and invesments backed by the Fund cover the whole country and the commitments for the period 2004 -2006 are 330 Mio EUR/year. At the same time the four former "Cohesion Fund countries" – Greece, Ireland, Portugal and Spain – receive 8.578 Mio EUR. It is not necessary to explain the opportunities provided by this huge amount, but, to make use of it effectively and fully, it is worth analysing the experience of the four above-mentioned countries.

Key words

allocation and management, Application Form, Cohesion Fund, controlling and financial regulation, environmental sector, final beneficiaries, Managing Authority, monitoring, Operative Program, Paying Authority, programming, project, strategies, transport sector

Introduction

Usually Greece is not mentioned as an example, because in the previous programming period (1994-1999) the country was able to use only a fraction of EU commitments. Nevertheless, it is highly important for Hungary to analyse what and why went wrong in Greece in order to avoid these mistakes in Hungary as a new cohesion country. The goal of the study is to help this systematisation and hence generate ideas and a positive approach, and analyse all the relevant bodies, actors and areas that take part in the implementation of the Cohesion Fund. In the first chapter the author introduces the institutional system and its legal background. It is followed by a more practical topic introducing the programming system, focusing especially on the aspects that differ from Hungarian practice. The process is analysed in both sectors – transport and environment –revealing possible mistakes and lapses as well as positive elements. The third chapter is about the monitoring and controlling system which follows the previous part's logic about programming. Finally the last chapter is a conclusion regarding Hungary, but does not entail repetition of the former statements, rather the collection and analysis of other important experiences of well-known Greek experts and the author's impressions.

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1. Overview of the Cohesion Fund

The Cohesion Fund was established by the Maastricht Treaty on European Union, which was signed in 1992. It is separate from the Structural Funds, and has its own set of principles governing expenditure eligibility. The Fund assists projects in transport and environmental infrastrcture. The legislation governing the Cohesion Fund is Council Regulation (EC) No. 1264/1999 and Council Regulation (EC) No. 1265/1999, both amending Council Regulation (EC) No. 1164/94 which established the Cohesion Fund. The detailed rules for management and control systems and the procedure for making financial corrections are laid down in Commission regulation (EC) No 1386/2002 of 29 July 2002.

In order to qualify for Cohesion Fund assistance, a country must have as Gross National Product of less than 90% of the European Union average. The Cohesion Fund differs from the Structural Funds in that it targets Member States rather than regions. Member States are eligible for Cohesion Funding, while eligibility for the Structural Funds is usually specific to certain regions (article 2 of Council Regulation 1164/94, as amended by Council Regulations 1264/1999 and 1265/1999).

Hungary at present qualifies for Cohesion Fund assistance, and is able tocommit funds of 994 Million Euro in the period 2004-2006. The distribution between Member States is made mainly on the basis of population, per capita GNP, land surface and deficiencies in transport infrastructure (article 5 of Council Regulation 1164/94, as amended by Council Regulations 1264/1999 and 1265/1999).

The Cohesion Fund finances projects in two main areas - transport and the environment (article 3 of Council Regulation 1164/94, as amended by Council Regulations 1264/1999 and 1265/1999). The aim of the Fund is to achieve a balance between these two areas of assistance. In Hungary Cohesion Fund projects in the area of transport will cover rail projects, road, and civil aviation, while environmental projects include water supply, waste water treatment, and solid waste projects and remediation projects. The Cohesion Fund focuses on large projects (i.e. those costing more than €10 million).

The rates of EU assistance for Cohesion Fund projects are also different from those under the Structural Funds. The EU provides an aid rate range for Cohesion Fund projects of 80-85%, whereas the maximum aid rate under the Structural Funds is 75%.

Different administrative procedures apply to management of the Cohesion Fund and to the Structural Funds. In this context, the main difference is that Cohesion Fund spending is allocated on a project-by-project basis, rather than on the Strctural's Funds' programme basis. It follows, therefore, that individual project applications have to be made to the European Commission (DG Regio) with respect to the Cohesion Fund.

The author had the opportunitity in November 2003 to spend one month in Greece and visit the key institutions dealing with the Cohesion Fund and participate in several site visits all over the country. The aim of the present study, which is based mostly on interviews and analysis of legal matters, is to shed light on the Greek system and draw conlusions which can be useful for the former, but especially for the new member states.

2. Institutional system

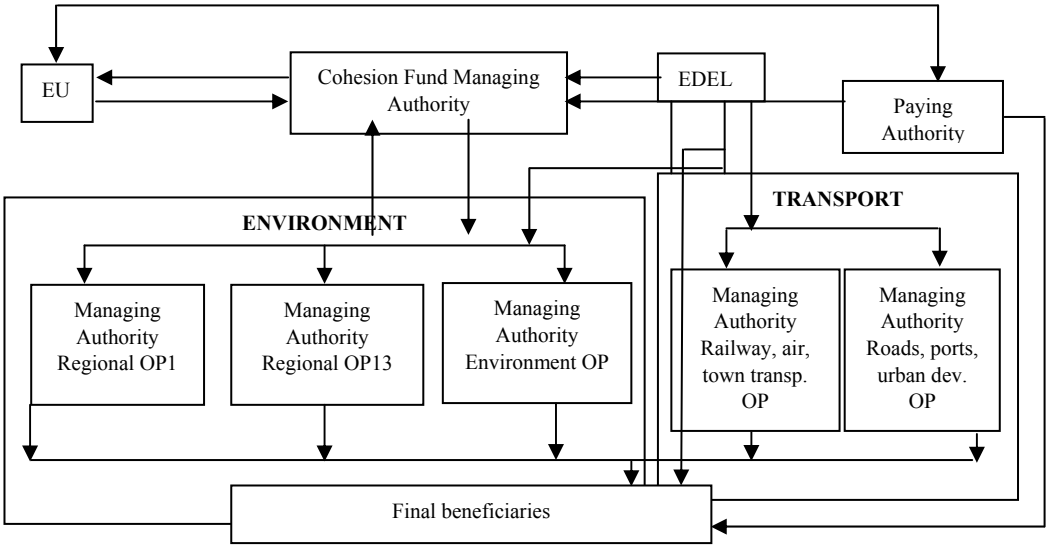
In the previous programming period from 1994 to 1999, project monitoring and project management were closely linked under the ex-ante approval of the Commission of the European Union. The Managing Authorities' system was not completed at this phase, so the Application Form for support was compiled by and sent to Brussels by the final beneficiaries, evaluated by the inter-ministerial committee created by and working under the coordination of the Ministry of the Interior, Ministry of Economy and Finance, Ministry of Environment. Unfortunately, looking back, it can be said that the committee did not have the appropriate experts, and forwarded every project proposal automatically without a detailed audit, and the majority of the project proposals were not properly prepared and thus cost overruns became a general problem during implementation.

Learning from the experience of previous years the Greek institutional system was established taking into consideration the following **laws in the 2000-2006 programming period:**

- EU Council Regulations 1164/99, 1264/99, 1265/99;
- EU Commission Regulations 1386/2002, 16/2003;
- EU Commission Decision 455/96;
- Act 2860/2000;
- Ministerial decisions
  - on setting up the Operative Program (OP) Managing Authorities (MAs)
  - on the responsibilities and tasks of the Cohesion Fund Managing Authorities;
  - on setting up the Paying Authority;
  - on setting up the "Central" Managing Authority, overseeing the Cohesion Fund Managing Authorities;
  - on the composition of the Monitoring Committee.

The institutional system created for the implementation of the Cohesion Fund is shown on the diagram below:

Diagram 1



Altogether 16 Managing Authorities operate in Greece, 13 of which are regional and the remaining 3 are horizontal Managing Authorities. Compared to the Hungarian system, we may assume that this level is the equivalent of the Intermediate Bodies waiting to be set up (government decree 1/2004).

The role of the Hungarian Cohesion Fund Managing Authority is taken over by the **Managing Authority** (MA) (Diagram 1). In Greece this body is located within the Ministry of Economic and Finance. Its tasks are the following:

- coordination and monitoring the other OP MAs;
- approving the project list and forwarding it to the EU Commission .
- cooperation with the European Union Commission;
- keeping track of implementation of the projects;
- auditing;
- modification of proposals;
- compilation of Progress Reports;
- setting up and operating the Central Information Monitoring system.

The aforementioned statutory regulations detail the internal structure of the **individual MAs** as well, so they consist of the same organisation units with precisely defined and standardised tasks and responsibilities. Only the "Central MA" is unique, having a different structure. There is no cooperation agreement between the MAs, though the form and manner of cooperation is stipulated by Act 2860/2000, and particularly ministerial decisions. The following diagrams show the internal structure of MAs in Greece (interview: LOGOTHETIS, LAW 2860/2000).

Diagram 2

"Central" MA organisation structure

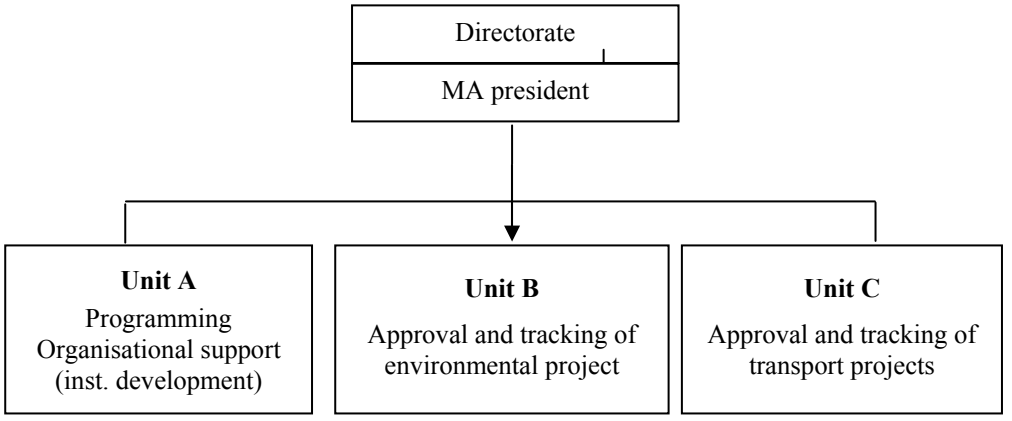
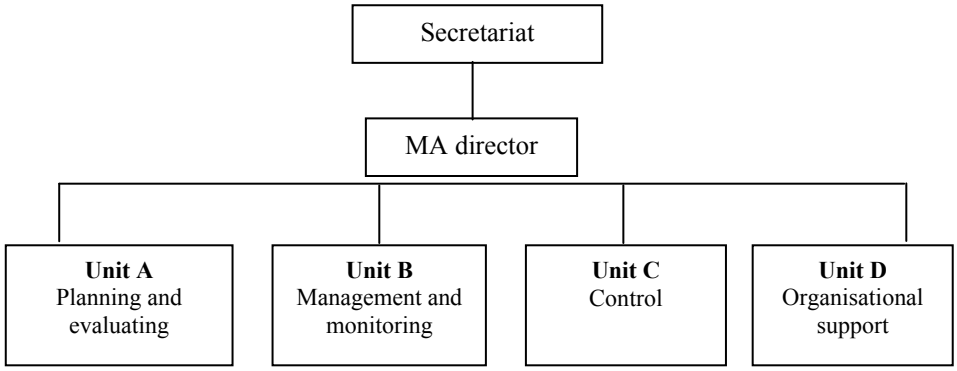


Diagram 3

Organisational structure of an MA



The tasks of the **Paying Authority** (COMMISSION REGULATION (EC) No 16/2003) are almost identical with Hungarian plans, thus:

- Providing for the correctness of cashflow in the Cohesion Fund;
- Submission of payment applications to the Commission of the European Union;
- Checking the transfer of funds to the final beneficiaries;
- Providing forecasts on expenses to the Commission of the European Union;
- Performing audits at the MAs and at final beneficiaries.

The **EDEL**, which is at the top of the three-level audit system, performs on-site auditors specified in EU legislation, covering minimum 15% of costs that can be acknowledged (COMMISSION REGULATION (EC) No 1386/2002).

In the Greek state administration system the so-called "**Regional Services**" and "**Special Services**" that can be considered as part of the final beneficiaries, and can also be associated with ministries – actually this is the OPMAs' level, but there may be several MAs within a single ministry. The Regional Services, as shown by its name, represent the relevant ministry at the regional level in every special field. The "Special Services" are also on-location ministry institutions that are not associated with the regions, but they were created for the management of large individual projects, so these are the ones having special importance with respect to Cohesion Fund projects. At present there are 13-14 special "Special Services" operating in Greece, 3-4 of them are located in Thessaloniki, which also has independence from the regional system of division. Of course cooperation between the two types of services is necessary and indispensable for the successful completion of the projects, but this does not have any officially regulated form.

Similar to the Hungarian municipal system, "county" and regional levels are also differentiated in Greece. Each municipality is entitled to establish an organisation that is independent from the ministry, operating as a joint-stock company for the management of local projects. These are the "**DEYAs**".
D = Municipal
E = Enterprise
Y = Water supply
A = Sewage

These are managed by a board of directors with 7 members who are appointed by the mayor. Typically the mayor takes the position of the chairman, and there are many functions

that overlap between a DEYA and the representative bodies. The DEYAs' headquarters is in Larissa, where the chairmen of the board of directors and the mayors with 181 members meet yearly at the **general meeting**. The work of the general meeting is assisted by **two consulting councils**. One of them consists of 16 members and provides technical assistance while the financial council having 15 members discusses budget issues.

Regarding future plans, the number of both the MAs and regions should be decreased and the state administration system set up in such a way that each region has its own ministry in order be more efficient in representing interests at central levels as well (interview: BELTSIOS, KANARIS, KARAVAKAS, SBILIRIS, MINISTERIAL DECISIONS).

3. Programming

In the new **programming period from 2000 to 2006** the total budget of the Cohesion Fund grew to EUR 18 billion, of which **Greece's share is EUR 3.112 billion** (17.3 %). In accordance with the rules Cohesion Fund support is divided at a rate of 50% each between the transport and environment sectors (EUR 1.556 billion/field). In the transport sector EUR 821 million is allocated on the development of roads and harbours (road building: EUR 790 million, harbour building: EUR 31 million), and EUR 723 million on railway and air traffic (railway: EUR 790 million, air traffic: EUR 8 million).

In Greece **there is no separate Cohesion Fund Framework Strategy, the sector strategies form a separate part of the OPs** (Environment OP, road, harbour and city development OP, railway, air traffic and city traffic OP, and the relevant Regional OPs). **However the concrete, long-term infrastructure developments are already known** and have been given a clear format (e.g. in respect to railway infrastructure developments 10-year plans have been composed!).

One of the reasons for the difference between Hungarian and Greek implementation may be that in the case of Greece, since 1994 the Cohesion Fund has had additional transport and environmental support payments from the Structural Funds which has been in operation for years. Most probably the other reason for the difference is that the European Commission puts much more emphasis on the separation of programming documents and the support categories toward the new member-states.

In general the conclusion can be drawn that in Greece the allocation and management of the Cohesion Fund and the Structural Funds (especially that of the European Regional Development Fund) is less separated than in Hungary. **Certain projects** (e.g. motorway building) **can be supported from both funds**. Except for the "Central" MA the same MAs deal with Structural Funds and Cohesion Fund projects, and the management is not necessarily divided even at project manager levels. (This is especially typical for Regional OP MAs.) One of the reasons for the latter is the insufficient number of employees to the quantity of work. As a consequence of the European Commission's regulations and practical experience – while maintaining some flexibility – the trend in Greece will likely tilt towards such separation in the future. This is also supported by an audit result performed by the Paying Authority at the Environment OP MA (interview: ISSAIA, GIOTTI, COUNCIL REGULATION (EC) No 1264/1999, COUNCIL REGULATION (EC) No 1265/1999).

The main player responsible for programming is the "Central" Cohesion Fund MA, while the OP MAs are responsible for the technical assessment of the project proposals, and the final beneficiaries for the submission of the project proposals.

3.1 Programming in the environmental sector

A different approach in the Hungarian system is that not only centrally designated projects are supported from the Cohesion Fund in the field of environment, but it is also possible to support smaller, locally initiated projects through tenders.

- Typically the **central projects** are larger investment projects of national significance with a pre-determined budget managed by the Environment OP MA. The preliminary list of the projects is included in the Environment OP.
- In respect to **tender projects initiated at a local level,** on the one hand they determine the categories to be supported and, on the other hand, criteria for their selection. After the approval of the framework by the European Union the individual projects are selected by the Greek authorities, and are approved by the European Commission one by one. These projects are managed by the Regional OP MAs.

In Hungary project preparation is carried out according to a system similar to tenders. However, this system should be studied further, because the mixed system of central and tender projects may cause operating problems in several places, and in the 2007-2013 programming period, particularly in its second half, mostly local environmental projects will occur in Hungary.

The **Commission of the European Union is not too receptive toward regional environmental** (wastewater management and solid waste management) **project group proposals, and this also holds true in Greece.** The reason for this is, for example, in solid waste management projects costing EUR 2-3 million are typically amalgamated, but there is a EUR 10 million minimum limit, so even in this case the project group is still considered a small "project", while the **Commission of the European Union favours the large ones** (interview: PANTELIAS, PSALIA, TOLERIS, MUNICIPAL ENTERPRISE FOR WATER SUPPLY AND SEWERAGE OF CHALKIS 2003, MINISTRY OF ENVIRONMENT, PHYSICAL PLANNING AND PUBLIC WORKS OF GREECE 2000, COUNCIL REGULATION (EC) No 1264/1999, COUNCIL REGULATION (EC) No 1265/1999).

3.2 Programming in the transport sector

In the transport sector **only the projects identified in the relevant OPs are supported** from the Cohesion Fund. The preliminary project list is based on the Strategic Plan prepared by the Greek State in the transport sector. As mentioned above, the long-term development plans are specified for each sub-sector. These development plans serve as the basis for planning-preparation tasks. Many times the development plans cover a 10-year period due to the country's geometry, geographical position and network density. The country's railway network density is insufficient, so the construction of new lines is under way (on east-west and north-south axis). The building of a motorway network is also a major task for Greece,and also part of long-term development plans (the length of the west-east direction motorway planned on the northern part of the country is 680 km) (Interview: GIBBONS, HINDLEY, MARAVAS, PAPSSIOPI, POLIZOU, SVIFKA, THOMAIDOU,

CENTRE FOR RESEARCH AND DEVELOPMENT HELLAS 2001, HELLENIC RAILWAYS ORGANIZATION 2003, MINISTRY OF TRANSPORT AND COMMUNICATION 2000, COUNCIL REGULATION (EC) No 1264/1999, COUNCIL REGULATION (EC) No 1265/1999).

3.3 Project-preparation

3.3.1 Application for support

In the environment sector the Application Forms are sent to the Regional Managing Authority where its quality control is carried out. Then the project proposal, including a completed checklist, is sent to the Environment OP MA, which evaluates the projects solely on the basis of the checklist in respect to level of preparation and compliance with strategic goals (using a scoring method). The Environment OP MA forwards the package to the "Central" Cohesion Fund MA with the evaluation form containing the scores, where the projects to be forwarded to Brussels are selected on the basis of the score and political/economic interests. According to statistics from several hundred project proposals Greece forwarded around 40 to Brussels, but till now only only 10-20 have been adopted by Commission decision (interview: PANTELIAS).

The situation is similar in the case of **transport projects**, but these are central and not tender-based projects. As described in the section dealing with the institutional system, there are two Managing Authorities in the transport sector (1.: railways, airports, city traffic, 2.: roads, harbours). The applications received are evaluated and forwarded by these Authorities to the "Central" Cohesion Fund MA. From there the process is analogous (interview: SARANTIDIS, TOYBANAKI, EGNATIA ODOS 2003, CENTRE FOR RESEARCH AND DEVELOPMENT HELLAS 2001).

3.4 Project selection process

1. Planning.
2. **In the case of central projects** the competent sectoral OP MA officially requests the final beneficiary to submit the application. **In the case of tender projects** an invitation to tender is called by the "Central" Cohesion Fund MA in cooperation with the Ministry of Environment, which is open to any final beneficiary.
3. The final beneficiaries submit their applications to the relevant OP MA, which is the sectoral OP MA in the case of central projects and the Regional OP MA in the case of tender projects.
4. The OP MA evaluates the bid, rejecting or accepting the request, in the latter case forwarding it to the "Central" Cohesion Fund MA including the evaluation checklist.
5. The "Central" Cohesion Fund MA continues with the proposal's evaluation, and after the necessary interaction and, in the case of a positive opinion, sends it to the Commission of the European Union including the official ministerial decision.
6. The Commission of the European Union evaluates the application with the involvement of the pertinent superior directorates, and in the case of a positive outcome makes an official decision on supporting the project. This decision also

contains the project's final budget. (interview: ADRAKTAS, KOKKINOS, MARGIDOS).

Development projects for transport infrastructure are selected under the procedure used for central projects. With respect to both railway and road projects, preparatory work-harmonised with the above development plans – are carried out on an on-going basis.

4. Monitoring, controlling and financial regulation

In accordance with Cohesion Fund rules, the Cohesion Fund Monitoring Committee also holds two meetings every year.

Both the nature of the monitoring committees' work and the scope of participants differed in the former (1994-1999) from the new (2000-2006) programming period. Previous to 2000 projects were discussed in detail, but in the present programming period a general presentation is made about the projects' progress, and the various professional meetings have become the forums for the detailed inspection of implementation. In the former programming period, monitoring committee meetings were held behind closed doors. Since the discussion of individual project data no longer takes place, it is not necessary to exclude social partners from the meetings, so **after 2000 the partnership principle was extended to the Cohesion Fund as well**. The Cohesion Fund Monitoring Committee has not operated as decision-making body in either period.

Although the **supreme monitoring body of the Cohesion Fund projects is the Cohesion Fund Monitoring Committee**, the OP Monitoring Committee, which is run by the Operative Program Managing Authority, also deals with Cohesion Fund projects as a consequence of institutional structure. These meetings are also held with the involvement of social partners (interview: LOGOTHETIS, MINISTRY OF ECONOMY AND FINANCE 2000, COMMISSION REGULATION (EC) No 1386/2002, COMMISSION REGULATION (EC) No 621/2004).

Developed in Greece in 1999-2000, the computer information system (**Monitoring Information System: MIS) is** suitable for the **electronic administration and monitoring of programs and projects** to be implemented with EU support. The system has been in operation since 2001 with respect to the Structural Funds, and work began at the end of 2002 for its applicability on Cohesion Fund projects. This work has just been completed, and experimental operation has started. Greece received support from the European Union for it. The MIS is an ACCESS-based user-friendly database. The bodies do not control access to the system, and data are manually entered by the OP Managing Authorities using reports supplied by the recipients.

Payment data is to be submitted monthly in the required format to the MA, while **concrete progress is to be reported every 3 months**. The format of both reports is identical to similar MIS aspects (identical table formats) (interview: PALLAS).

4.1 Audit

As already mentioned under the introduction to the institutional system, the **Paying Authority** is located in the Ministry of Economic and Finance. Two main tasks are **level 2**

control and **transaction of payment processes** (interview: LOGOTHETIS, COMMISSION REGULATION (EC) NO 16/2003).

The following should be mentioned regarding **levels of control**:

1. **The OP Managing Authority** managing the Cohesion Fund projects must audit every project at least once on the site during the project's lifecycle. This is the responsibility of Unit C.
2. The **Paying Authority** has the right to audit any aspect of the project, but audit activity is carried out exclusively with a sampling procedure based on risk analysis. In addition to this the Paying Authority inspects the compliance of the Managing Authority with the provisions of EU and national laws, and its performance in the progress of the projects every year.
3. At the top of the audit system the **EDEL** performs on-site audits specified in EU legislation, covering a minimum 15% of acknowledged costs.

4.2 Treatment of irregularities

The system audits specified at level 2 are carried out once every year with respect to each MA, but afterwards the implementation of the recommendations is also monitored. **"Non-performance"** may result in a variety of consequences:

- if the recommendation concerned only entails modifications, non-performance does not result in negative financial consequences;
- if the MA was ordered to perform a task during the audit, aimed at strengthening financial accountability, the failure to perform such a task may result in the temporary suspension of payments.

The Greeks proposed that the project audits should take place in the middle of the project's implementation period so it is much easier to recover misused funds from the recipients. In such an event, and without the repaid funds, the recipient has to complete the project with the original technical specifications from its own resources. The difficulties related to repayments can be eased, if, from the outset, responsibility is placed on specific individuals.

If the national authorities discover and expose the irregularity, the EU support sum is freed upon repayment (or non-payment) and may be used within the project, or a new project may be submitted for its sum, but it may not be used for any other project in operation.

4.3 Payments

The other key task of the Managing Authority is to direct the payments. No application was made for EU funds under new Regulation 1386/2002/EC.

The **payment of contractors' bills is done according to the post-rate principle**, which means that the EU funding part is also paid in advance by the central budget. The EU funds and the related inland support are located at the Ministry of Economy and Finance. The final beneficiary/implementing body submits confirmed contractors' bills to the OP MA, which proceeds with their payment. The Cohesion Fund Managing Authority also joins the

audit confirming the withdrawl of EU funds, then forwarding the package to the Paying Authority after authentication activities.

Interim payments take place 2-3-times each year, relying on the data of the MIS system to a great extent. The Paying Authority may block payments pertaining to a MA while the audit of a given MA is not completed.

According to the rules, **final payment,** accounting to 20%, is due at the end of the project and **may be drawn only 6-12 months after completion**; so when budget plans are made it is necessary toseriously take into account the advance payment to be made by the Eu central budget in terms of payment of contractors' bills.

5. Conclusions and consequences for Hungary

5.1 Experiences and challenges

Before taking into account the "obstacles" it is important to state that the EU evaluated the 1994-1999 period according to the new, current programming period and legislation based on that. This in itself leads to numerous misunderstandings, because as mentioned at the start of the report, the Greek institutional system had undergone a major transformation from the previous period and the faults of the past were taken into consideration in the establishment of the new system. What Hungary can learn is that we have to look ahead, and watch for and **analyse tendencies and always be one step ahead of the EU**.

Another problem is that if the European Union finds similar problems in several projects, it can become judgemental and classify it as a fault in the entire system, and then cut or withdraw support (interview: PANTELIAS).

The **most sensitive fields** are as follows:

- quality of work performed;
- transparency;
- flawless compliance with EU legislation;
- cost overrun;
- public procurement: open tenders, equal opportunities.

Unfortunately, this list is highly reminiscent of the summary of problems that came up during the implementation of the ISPA program, and this is why it should receive some serious thought!

5.2 Public procurement

This is probably the most delicate issue and the most problematical for Hungary (interview: GOURGIOTIS, LEMAS).

The public procurement process is very similar to the Hungarian practice. The final beneficiary prepares the tender document with a detailed description of tasks, schedule and budget. Of course the latter is made to indicate profits, design costs, VAT and inflation. The tender is then called and the bidders make their price offers. This was generally much lower

than in the call for tenders. At the end of the programming period the prices proposed were 70% of the price specified in the tender document! Since the one with the lower bid was favoured given the two principles in public procurement procedures - 1. most advantageous proposal as a whole, 2. lowest price - two problems were lpresent in the previous period:

1. the funding that was available could not be used up;
2. quality deteriorated, constant disputes and modifications led to unmet deadlines and delays.

According to the Greek experts it is impossible to find a perfect solution because of the clashing interests, but problems can be reduced by preparing highly detailed technical specifications and applying the principle of the "most advantageous proposal as a whole".

Other problems include the EU's endeavour to enhance competition, open up borders and make room for foreign entrepreneurs. This plan has been met with local opposition everywhere. Several misunderstandings were caused by the ignorance of foreign specialists about Greek system and legislation.

In the case of Hungary, the situation is further complicated, because it is obliged to use the new Public Procuremnet Act since 1st May 2004 in the tendering process in ISPA projects too.

Unfortunately it was impossible to publish the tender before 1st of May 2004 in most ISPA projects, which were directed to become Cohesion Fund projects automatically from the 1st of January, and therefore they have to be prepared again, but in accordance with the new Act, which causes several problems:

- as it is not forbidden to write the tender in English, it is not obligatory to translate them into Hungarian (the ISPA tenders were prepared in English), but the contract documents must be Hungarian. This matter will likely cause extra-work for the beneficiaries and the Intermediate Bodies; moreover, personnel have to familiarise themselves with the new Act and this process takes a lot time and may cause delays.
- A lot of extra money is needed to modify the documents.
- Delays due to clarifying the new standardised documents (Guidelines, Forms) and establishing the institutional system.
- Training the former ISPA management.

It is important to remember that the EU expects compliance with its legislation, even though national legislation may be stricter in a given area. Failure to comply with EU rules leads to the withdrawal of support and it may take years to alter a subsequent negative perception.

5.3 Quality control

Hungary could learn a lot from quality control in public investment projects. The framework for this approach was created in the previous programming period. Work is done by the ESPEL consortium, an independent outside body consisting of several companies selected for the programming cycle for an international tender, and financed jointly by the Greek State and the European Union. The ESPEL audits every project 2-3-times. Performance is judged on compliance with the Technical Specifications, and the acceptability of costs. Three performance categories are used:

1. problem-free,
2. the revealed problem can be fixed,
3. serious problem.

In cases 2 and 3 designated payments are not included in the next cost statement, which means that EU funds can be allocated only for expenses falling into category 1. Costs can be permitted by the Commission and consequently allocated, if the project is placed in category 1 during further audits by the ESPEL.

All documents attached (cost benefit analysis, environment impact assessment, etc) to the Application Form must be perfect. If something is missing, the EU Commission sends back the whole "package" but this was not the case with ISPA projects where it was possible to modify and complete the documents later because of lack of experience by both parties. There is still a lack of experience in quality control because a totally new approach and way of thinking is needed. It is clear that to set up a Hungarian quality control consortium of experts for documents from the projects' preparation and implementation would be recommended (Interview: ISSAIA).

5.4 Horizontal PR contracts

The above should also be considered in Hungary. In Greece publicity for several projects, and even for an entire sector or Cohesion Fund support payments are solved with so-called horizontal contracts.

The essence of this is that the horizontal PR budget is planned as part of the PR tender cost of the projects it covers, dividing it among the projects at a specific or equal rate. Although the administration of payments is quite complicated (the bills have to be broken down and paid from the budget of several projects), this solution would allow for EU co-financing of horizontal PR activities, in addition to project-level PR (interview: ISSAIA, Commission Decision (EC) No 96/455).

Not appreciating the value of PR is common, but PR is especially important in the case of EU support payments. On the one hand, Commission Regulation ((EC) No 621/2004) imposes strict rules regarding information and publicity, but on the other hand involving and informing people about the investments is a guarantee for successful project implementation. In Hungary we are only beginning to appreciate PR's importance. The presidency of the Cohesion Fund Managing Authority has created the Communication Working Group. It meets every 3 months, but financing remains a problem for the Working Group.

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List of abbreviations

EU	European Union
ISPA	Instrument for Structural Policies for Pre-accession
MA	Managing Authority
MIS	Monitoring Information System
OP	Operative Program
PR	Public Relations
VAT	Value Added Tax

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