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**Theoretical and practical questions of cooperation in
agricultural machine use in Hungary**

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1. INTRODUCTION

1.1. RELEVANCE OF THE SUBJECT

The agricultural sector has always had a key role in the national economies and it is true in our days, too. It should be noted, however, that the historical, economic and social development is permanently re-evaluating this role, thus exposing the sector and its actors to new challenges.

I considered a basic problem that, in historical perspectives, the structural development of agriculture in a lot of places of the world, including Europe, has not kept pace with the concentration processes in input and output relationships. As a result, *it has been driven into a corner by the monopolies.* It is an economic principle that monopolies – exploiting their market dominance in their relations – aim to obtain an increasing share of their partners' income. These efforts have become the source of serious problems in the sector. Recognizing this, the nations – especially the countries of the prevailing European Community – forced extensive state interventions as a solution, in the frames of which, besides the development of special protecting mechanisms, considerable financial grants, subsidies started to flow into the agriculture as a compensation of diminishing income.

By today, there is an increasing effort – that can be regarded a new challenge – *pointing in the direction of radical reduction of agricultural subsidies.* Although it may not be realised very quickly in the near future – due mainly to the complicated relationship of interests – it can draw the attention to the fact *that the agricultural producers should prepare for the reduction of state involvement and the strengthening of market regularities, including market competition.* Some of the countries that integrated into the European Union in 2004 and 2007 – including especially Hungary – should follow closely these processes because *the agricultural sector in these countries can be characterized with well-known structural and efficiency problems due partly to historical reasons, partly to the political transformation.*

The requirements set up for the agricultural sector have also changed by our days owing to other changes. Today it is not an exclusive demand that the sector provides foodstuff of appropriate quantity and quality for the population. Other functions, namely rural development; retaining rural population; stabilization of income conditions of those living on the sector; sustainable development; preservation of ecological balance; protection of biodiversity; development of competitive agriculture and utilization of comparative advantages, have also gradually been put into the foreground. All these expectations lead to the problems of sustainable agriculture.

In regards to the above problems, in my opinion, the role of farmers' cooperation is becoming more important. At the same time, a lot of empirical experiences prove that *the willingness, the readiness on behalf of the farmers to cooperate is extremely low today in Hungary.* It gives new tasks to researchers. It will be necessary to explore those factors which may influence the cooperation willingness of farmers. It is advisable to map those inner motives of farmers which make them cooperate or reject cooperation. *The main priority of the present paper is to understand why the farmers do not intend to live with the possibilities given by the cooperation, why they do not want to recognize that it is much easier to „build upon each other” than working alone?*

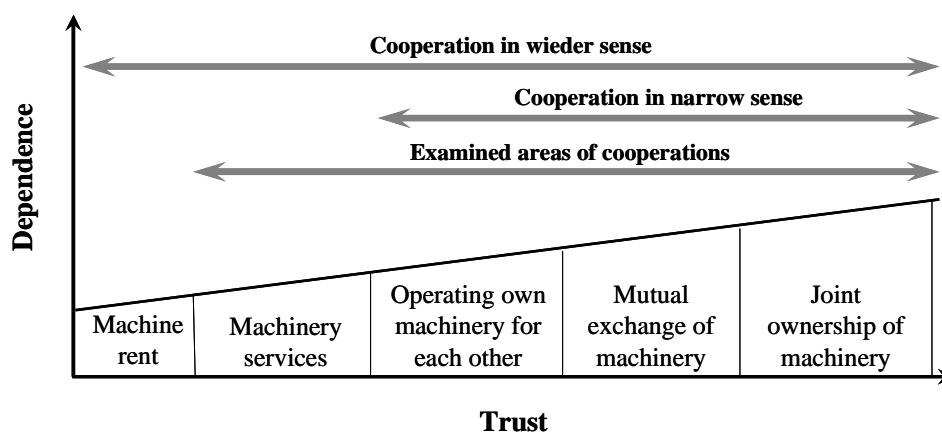
1.2. DEFINING THE SUBJECT

I draft three main areas as the definition of the subject of my research work:

- *In regards to sustainability it is especially important to deal with the profitability conditions of agriculture,* it is important to explore the obvious tendencies and relations both in the European and the Hungarian agriculture.
- *The performance of agriculture is significantly determined by technical development, including the situation of mechanization.* It is especially true for crop production which justifies the

involvement of this area in the examinations. The technical facilities in connection with profitability should be examined in two aspects: on the one hand, the equipment supply is to be analyzed, on the other hand, the efficiency of utilizing the resources should be considered.

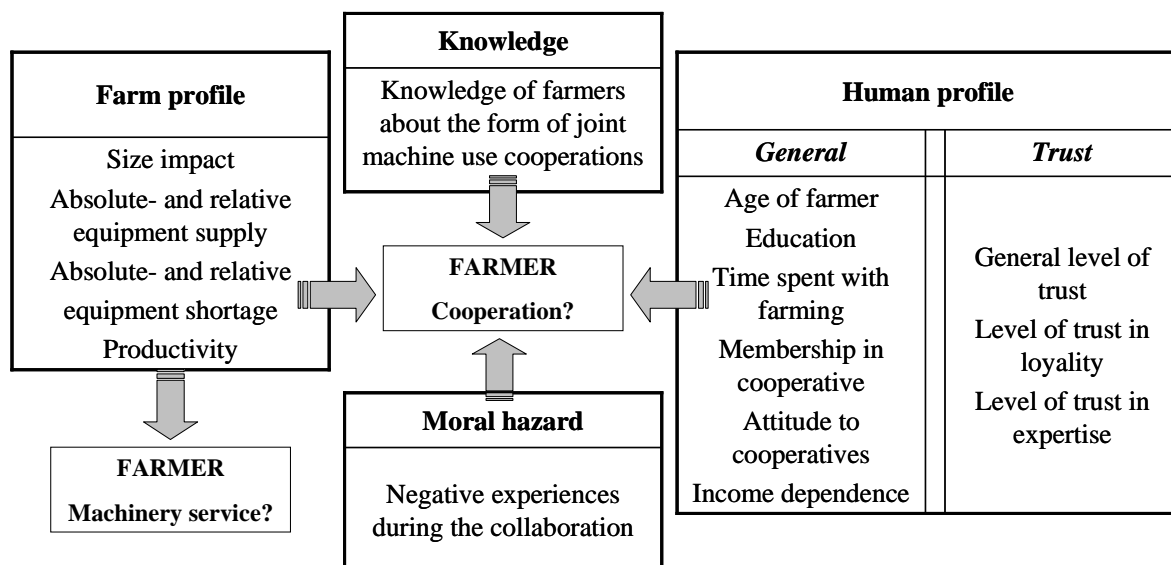
- *In regards to the above, the cooperation among farmers is the main focus of my research. The cooperation can emerge in many forms and in many phases of the agricultural production process, as an adequate farming solution for improving profitability within a segmented farm structure. Out of these forms, my research activities have concentrated on the cooperation on the input side, especially in the area of joint utilization of technical resources, machinery and equipment:*
 - Cooperation, as a concept, can be considered in a broad sense – even in connection only with machine use – and it can have a lot of forms. In my research *I have developed a typology, where the individual forms of cooperation create a structure according to the degree of trust and dependence of farmers.* (Figure 1).



Source: own construction

Figure 1: The discussed forms of cooperation in relation to the levels of trust and dependence

- The examinations concerned the four indicated stages of cooperation. *I was looking for those factors which can explain the cooperation behaviour of farms.* By forming four groups of presumed affective agents, I examined the relationships with explanatory models. (Figure 2)



Source: own construction

Figure 2: Logical classification of factors that presumably affect cooperation willingness

1.3. OBJECTIVES, TASKS TO SOLVE

According to the definition of the subject, I set up the following objectives and tasks to solve in my dissertation:

I. Objectives and tasks connected with processing the literature

1. *Review of the main features of Hungarian farm structure, supporting the reasonability of farmers' cooperation, focusing basically on joint machine use.* Tasks: a) clear the historical background and aspects of Hungarian farm structure; b) based on secondary (Hungarian Statistical Office – KSH) data give a picture about the current farm structure and define the group of those farmers who can potentially be concerned in cooperations for machine use; c) explore the relationships within the context of farm size – efficiency – profitability.
2. *Proving the importance of technical development – including mechanization – in the performance of agriculture.* Tasks: a) definition of concepts; b) review of the situation and exploring of the main economic relations.
3. *Introduction of the concept of virtual (large-scale) farm.* Tasks: a) definition; b) introduction of institutionalized forms of joint machine use, report on the home experiences of their implementation; c) review of advantages and disadvantages of cooperations for machine use; d) proving the competitiveness of virtual (large-scale) farms.
4. *Exploring the economic and sociological aspects of cooperation.* Tasks: a) review of results of new institutional economics in order to clear the nature of cooperations, as „quasi organizations”, the utilization of main conclusions in the evaluation of my research results; b) summary of the results of trust-research related to the machine use cooperations.

II. Objectives and tasks connected with own research:

1. *Examination of profitability and machine supply issues and relations in Hungarian agriculture.* Tasks: a) setting up and testing empirical models
2. *Exploring the factors that explain the activity of farmers in joint machine use cooperation.* Tasks: a) definition and evaluation of explanatory factors; b) evaluation of the intensity of joint machine use activity in our days; c) construction of explanatory models in order to define the scope of factors that influence the cooperation activity.
3. *Identification of those forms of cooperation that are supposed to be implemented in the future in the fulfillment of capacity needs of agricultural ventures.* Tasks: a) evaluation of results of primary data collection, drawing of conclusions.

In addition to the above outlined objectives, I set my presumptions that basically determined the range of special reference sources. My presumptions were as follows:

- *In Hungary, owing to the social transition, a rather heterogenous farm structure has been developed. The Hungarian farms are at (competitive) disadvantage in many aspects with the agriculture of most of the former European Union member states. There is a (competitive) disadvantage – among others – in the field of profitability, machine supply and capital efficiency. The concentration of forces, the cooperation among farmers can be an adequate solution for coping with these disadvantages.*
- *The Hungarian farmers have given basically wrong answers to the problems that arouse following the political transformation, the independence has been preferred instead of cooperation. In spite of this, I think that there are a lot of forms of cooperation in the interactions between farmers, they do not perform their activities totally independent or separated from each other.*
- *The subsidies have key role in agricultural economies of the European Union – including Hungarian agriculture, too. In my opinion, the subsidies – that are going with considerable*

social sacrifices – also *weaken the economic rationality, give wrong market impulses, one of the negative consequence of which is the low cooperation willingness of farmers.*

- *The role of trust in the – business and non-business - relations among people is decisive. It is especially true in case of joint machine use cooperations.*
- *There are a lot of alternatives for the joint utilization of technical resources. The particular solutions are differentiated according to the degree of dependence if one participates in them, and the degree of trust needed on behalf of farmers. In my opinion, most of the farmers are willing to undertake only those solutions that need lower trust and lower degree of dependence.*

I selected the literature for processing – from a rather wide range of subjects - in order to reach the above outlined objectives and provide comprehensive and well-based analysis of presumptions. Most of the reference sources deal with the structural issues of Hungarian agriculture, the relations between farm size – efficiency – profitability - competitiveness, and the significance of technical development – including mechanization. Based on the revealed relations and the obvious tendencies I discuss the concept of virtual (large-scale) farm, the explanatory models of new institutional economics and the issues of trust in order to understand the nature of cooperation.

Following the processing of literature references and utilizing its results, the research hypotheses are detailed in chapter „Material and method”.

2. MATERIAL AND METHOD

2.1. RESEARCH HYPOTHESES

Based on the processing of special literature, and maintaining my presumptions, I drafted and analyzed the following research hypotheses in my work:

Hypothesis 1 (H1)

The Hungarian agricultural enterprises are - in many aspects (e.g. profitability, machinery supply, capital efficiency) – at (competitive) disadvantage with the agricultural plants of most of the former European Union member countries. The joint machine use cooperation can be an adequate alternative in coping with the existing problems.

Hypothesis 2 (H2)

A lot of forms of cooperation can be found in the relations among Hungarian farmers, they do not perform their activities totally independent or separated from each other. The intensity of these relations, however, is typically low.

Hypothesis 3 (H3)

The agricultural subsidies weaken the economic rationality, give wrong market impulses, thus adversely influence the willingness of farmers to cooperate.

Hypothesis 4 (H4)

Hypothesis 4.1. (H4.1)

The role of trust in fellow farmers is decisive in machine use cooperation. The relation between cooperation activity and the level of trust can be proved.

Hypothesis 4.2. (H4.2)

The trust both in loyalty and expertise has great significance in joint machine use cooperations, irrespective of the form of cooperation.

Hypothesis 5 (H5)

Out of the possible joint machine use alternatives, those will receive priority in the future that require greater independence and lower level of trust

2.2. DEFINING THE DATA SOURCES, METHODOLOGICAL QUESTIONS

Secondary and primary data sources were used in my dissertation.

2.2.1. Secondary databases

I used secondary data from two sources for my research. These sources were as follows:

I used the („macro-level”) *databases of KSH* (Hungarian Central Statistical Office) in order to illustrate the changes in the machine resource supply of Hungarian agriculture (1972-2005).

In modelling the profitability and asset supply, I worked with „meso-level” data. The information was collected from the public *FADN database* of the European Union.

2.2.2. Primary data sources

The „micro-level” data from *primary research* had key role in my paper. The utilized information came from two sources. The first data collection was made in the Summer of 2008. The survey based on questionnaires and deep interviews concerned the private farmers of two settlements in Békés county ($N= 17$). The farmers were specialized in field crops production. I made a *network of relations* among the observed farms on the basis of the information gathered.

The most important primary data source of my research work was the second, more extended data collection. The questionnaire survey and deep interviews were also made in Békés county. The

research concerned the private farmers of three statistical microregions – namely the microregions of Orosháza, Békéscsaba and Mezőkovácsháza. The selection of the examined sample was made with random sampling and the so-called snowball sampling. The survey concerning the economic year of 2007-2008 was carried out between November 2008 and October 2009. I obtained information about 132 private farms with questionnaires, and also made deep interviews with 23 farms out of them. The questions of the questionnaires covered – among others – the following areas: *general information about the head of the farm* (gender, age, school qualifications, income dependence on agricultural activity, etc.); *general information about the farm* (scope of activities, size of leased and own land, size of animal stock, etc.); *natural indices of farming* (production structure, output, asset supply, etc.); *main questions of cooperation with fellow farmers* (forms and frequency of cooperation, knowledge about the institutionalized forms of cooperation and the opinion of the farmer about these solutions, etc.); and the *question of trust*. I called on the farmers personally for the deep interviews. The subject of the interviews focused basically on cooperation, but also concerned the existing farming situation, the prospects of farming and many other fields.

Evaluating the representativeness of the sample I stated that the *results cannot be regarded representative either at national or regional level* due to the geographical concentration and the low number of elements.

2.3. APPLIED MODELS

Considerable amount of quantitative and qualitative information from secondary and primary data sources supported the objectives of my dissertation. *Modeling* has an important role in processing of the information, as well as generating and presenting the result. I constructed 24 mathematical models altogether.

2.4. STATISTICAL METHODOLOGY

In addition to the descriptive statistics I also used *multivariate methods* for processing the collected information. I underline the role of so-called *explanatory models* (Figure 3) and *data reduction techniques* (principal component analysis and cluster analysis).

		Measurement level of independent variable	
		Low (Non-metric scale)	High (Metric scale)
Measurement level of dependent variable	Low (Non-metric scale)	Cross-table analysis	Discriminancy analysis
	Binominal logistic regression analysis		
High (Metric scale)	Analysis of Variance (one-way ANOVA) (hierarchic ANOVA) (Post-hoc tests)	Correlation calculation Partial correlation Linear regression analysis (Enter-, Forward-method)	

Source: own calculation

Figure 3: Classification of applied explanatory models

Another methodology to mention is the group of *test statistics*. I used – among others – the different versions of t-test (one-sample t-test, independent two-sample t-statistics, paired t-test), Kolmogorov-Smirnov and Shapiro-Wilk tests for the normality of datasets, as well as Levene-test for checking homoscedasticity.

3. RESULTS

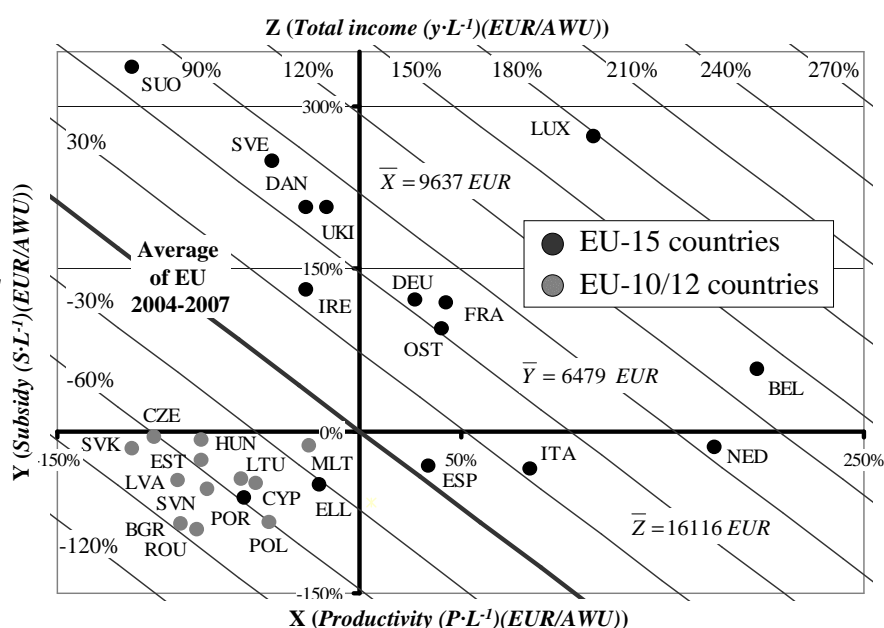
The results of my research are described in two main logical units:

3.1. RESULTS OF SECONDARY RESEARCH

On the basis of the FADN database, I examined the profitability and asset supply questions and relations of European – including Hungarian – agriculture.

3.1.1. Experiences of profitability examinations

The model analysing the profitability conditions of European agriculture defined the total income in the farms per annual labour use as the sum of (own) output of agricultural activity (productivity) and the subsidies (subsidization). The main results of examinations are summarized in Figure 4 for the EU-27 countries, from 2004 to 2007.



Source: own construction

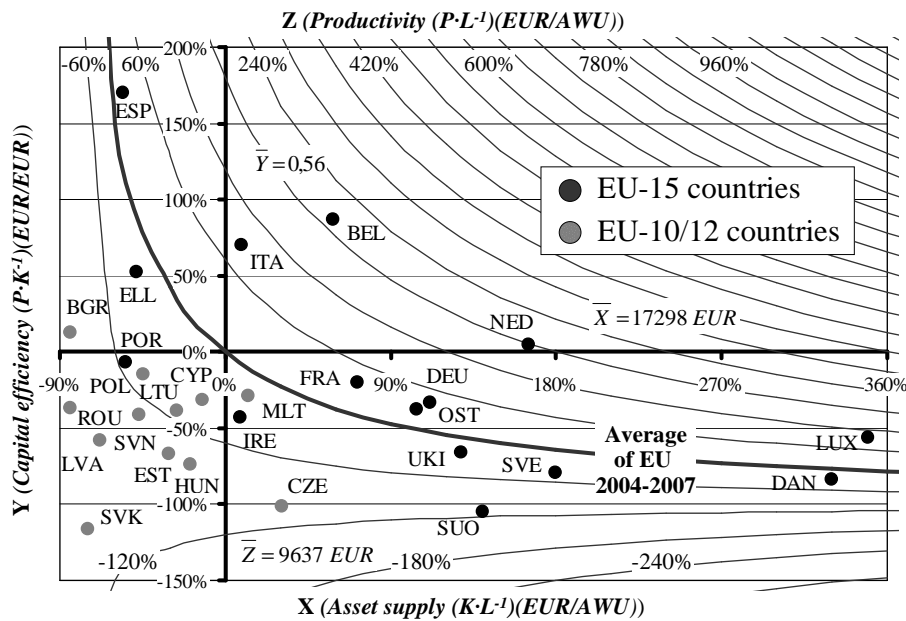
Figure 4: Profitability in the agriculture of EU-27 countries (2004-2007)

In regards to the evaluation of the position of Hungary, I could state that the *total income per one unit of annual labour use in agriculture falls short of the EU average by about 50%*. Another negative finding is that *the own income production is behind the centre by more than 78%, which is partly compensated by the around-the-average subsidization level*. The outlined phenomenon refers to high dependence on subsidies: *78% of the total income on average comes from external sources*.

3.1.2. Relations between profitability and asset supply

The starting point of the model used for the examination of own income producing ability of agricultural ventures was given by the partial efficiency calculation that measured the efficiency of technical development. The efficiency index *leads the live labour productivity to the casual relations between capital productivity and capital supply*, that is to their product of multiplication.

Reviewing the situation of the Hungarian agriculture, it was explored that behind the own profitability value – which is below the EU average by 80%, as it was described above – there is an asset supply level lower than the EU average by 20% and, moreover, a capital efficiency lower by 74% (Figure 5). All these underlined that *the low own productivity is not necessarily due to the level of asset supply but rather to the low utilization efficiency of capital locked in equipment*.



Source: own construction

Figure 5: The own income producing ability and the influencing factors in agriculture of EU-27 countries

The profitability, equipment supply and capital efficiency issues in European agriculture are also examined in my paper at farm level, extending the examinations towards the farm structure. The results of principal component analysis – partly proving the above – revealed that *the agriculture of Hungary – in European terms – has segmented farm structure, the profitability in the farms is typically low, the level of equipment supply is low-medium, and the capital used in the production is utilized at low efficiency.*

3.1.3. Trends in asset supply of Hungarian agriculture

In order to explain the paradox phenomenon – why the relatively low equipment supply is paired with weak capital efficiency – I used the databases of the Central Statistical Office for the historic analysis of the changes in the mechanization of the Hungarian agricultural economy between 1972 and 2005. The examinations revealed that there have been many tendencies in the machine and equipment supply of Hungarian agriculture as well as in the utilization efficiency of the equipment during the last decades. It can be proved that *the specific machine capacities have almost doubled by our days (2005) compared to the era before the post-communist transition (1981), thus the capacity utilization and the efficiency of utilizing the technical resources (equipment effectiveness) has declined in the whole sector and it has had significant impact on the efficiency of the capital locked in them, too.* I also underlined, that the tendency of declining equipment effectiveness (together with capital efficiency) have already started in the years before the political transition and accelerated after 1989.

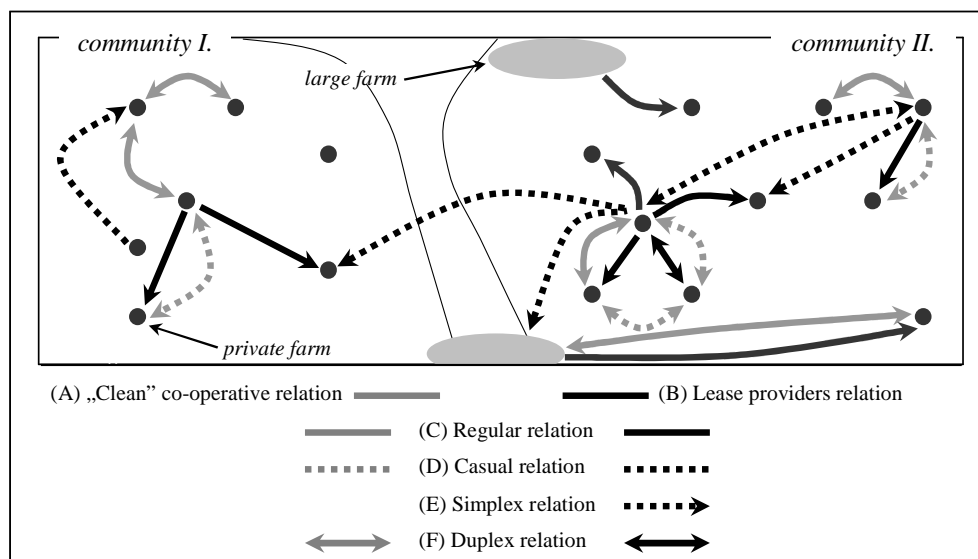
Reviewing the asset supply data of agriculture for 2005, I *have found considerable resource allocation problems.* It is typical in the smaller size categories that there is one power machine per 20-25 farms, while significant part of capacities is probably unexploited in most of the larger farms. The result is that *the considerable capacity surplus and capacity shortage at farm level parallelly exist in the Hungarian agriculture.* It is obvious that under these conditions the operation of machinery or the organization of machine work is very complicated and, owing to this, probably very expensive. The equipment use of small farms can be regarded especially wasting.

I suggest the joint machine use partnerships as adequate solutions for the identified problems of asset supply. Further on in my paper I examined the related questions and possibilities.

3.2. RESULTS OF PRIMARY RESEARCH

3.2.1. Network of relations in partnerships for machine use

On the basis of the survey about the farms of two villages I proved that *the farmers perform the agricultural activities not isolated, independent from each other, there are a lot of forms of interaction among them in regards to joint machine use* (Figure 6).



Source: own construction

Figure 6: The network of relations among the surveyed farms

According to the experiences, the *most frequent – „quasi” – form of cooperation is the lease machine service, but there are „pure” cooperation mechanisms, too, based on mutuality (in narrow sense)*. The survey has identified three types of cooperative machine use in narrow sense: *machine work based on mutuality* (in many cases it was also made as lease service, on mutual basis), *the mutual lending of agricultural machinery to each other*, as well as *the joint ownership and use of machinery and equipment*. In regards to the frequency of relations among farmers, I have found that these are basically „occasional” relations, that is *the frequency of interactions is low*. Although in case of machine lease services the tendency goes toward the increasing regularity of relations, the proportion of occasionality is still determinant. *Among the participants of „pure” cooperation mechanisms, there were always close social ties, which means that the cooperative partners belonged to the same family or group of friends*. The looser social relations (simple acquaintance) seemed to be enough for entering into lease services, even on regular basis.

I have made some model examinations concerning the network of relations. In the frames of these I have found that *in lease service relations basically the larger farms with higher equipment supply provide services to smaller ones, and the development of tighter partnerships is typical for farms with almost the same equipment supply*.

The research experiences had an important role in the preparation and realization of subsequent, more extensive survey. I described the results of this survey in the next part of my paper.

3.2.2. Evaluation of questionnaires

3.2.2.1. General features of examined farms

The impact of external environmental conditions on agricultural production is obvious. Evaluating the attributes of the farms involved in the survey, it can generally be said that – in national comparison – *one of the most favourable environmental condition system serves the successful*

agricultural production in Hungary. I stressed the advantageous soil properties, the average quality of arable land used by the farms in the sample ranged from 31 to 45 gold crowns.

According to the EU typological system, one of the key dimensions of examination in my dissertation was the economic size of farms. The economic sizes of observation units in the research sample ranged within wide limits. The smallest farm in the survey was 0,6, while the largest one was 141,1 in terms of European Size Unit (ESU). The average farm size regarding the whole sample was 22,7 ESU, with significant dispersion ($s= 28,6$ ESU). *In regards to the line of production, the farms were specialized in field crops production.*

I intended to explain the activity of farmers in joint machine use partnerships by statistical methodology, with three presumed factor groups. Out of them, first I reviewed the factors observed in the condition system of farming, the so-called *farm profile* elements and reported about the tendencies. In addition to the farm profile, I defined two larger logical units, detailed the aspects of land use and sowing structure, as well as analyzed the areas of technical resource supply within the enterprises.

3.2.2.2. Some key elements of „farm profile”

(i) Features of land use and sowing structure

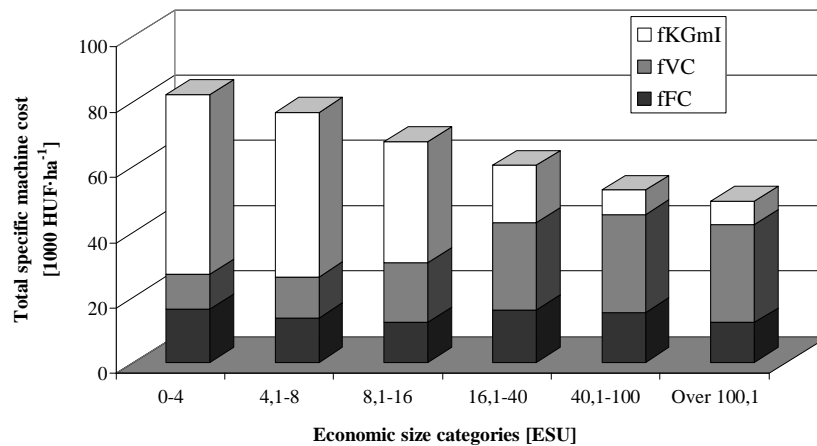
One of the main resources of field crop production is the arable land. In regards to the land use and sowing structure of farms I made the following – main – statements:

- The size of surveyed farms in hectares ranged within wide limits, the smallest farm had 1,8, while the largest had 405 hectares of – mainly – arable land.
- *Land leasing has major role* in the farms, on average one-fourth of their total area comes from this source. The weight and significance of lease is increasing by the farm size.
- In regards to the structural questions of farms, the *segmentation is a great problem*. E.g. there are 18 separate plots in a farm that cultivates 95 hectares.
- According to the experiences, the farmers would like to increase the area of their farm, but *farm expansion through both the land purchase and land leasing can hardly be realized due to the weak supply and financial reasons*.
- The *proportion of cereals is the highest, more than 70%, in the sowing structure*. The evaluation of the questionnaires pointed out that the *farms do not intend to leave this conventional cereal producing role in the near future*.
- Another important feature of sowing structure is the *diversification*, in connection with this I could state that 3,9 crops are produced on average in the examined farms. *The number of produced crop cultures is increasing by the growing of farm sizes*.
- The standardized yield level index I developed for the examination of *natural efficiency* questions *reveals a significantly expanding relation by the growth of farm size*. At the same time, in regards to the size of gross production value per area unit, that also measures the efficiency, the relation cannot be proved statistically, but the tendency is obvious.
- Analyzing the global potential of crop producing activity of farms by models, *I found close connection between farm size and farm-level gross production value variables*. The market value of crops produced by one farm was more than 11 million HUF (min: 0,3, max 90 million HUF) on average which means about 5 million HUF contribution margin.
- On average of the sample, *significant amount, about 2,4 million HUF subvention goes to one farming unit. This amount, of course, is in close correlation with economic size* ($r= 0,97$). Specifically, for one hectare of agricultural land, about 44 thousand HUF was provided for the farms.

(ii) Questions of technical equipment supply in the examined farms

The technical equipment is still an extremely important resource for the agricultural activities on the arable land. In this regard, I made the following statements:

- *The „robust” indices of equipment supply quantity (number of engines (ESZ, pcs), total nominal performance (ÖNT, kW), value of locked machine equipment capital (LGET, HUF)) show significantly positive correlation with economic size. At farm level more than 10 million HUF asset capital on average was available for production (min. 200 thousand HUF, max: 100 million HUF).*
- *The specific natural indices applied for describing the quantity asset supply, the engine density (ES, pcs·100 ha⁻¹) and the specific nominal performance (FNT, kW ha⁻¹) have strong hyperbolic correlation with farm size. It is very interesting, that the similar tendency in asset supply expressed in value (specifically locked machine asset capital index (fLGET, HUF·ha⁻¹) was only weak and deformed. The revealed phenomenon can be due basically to the quality dimension of asset supply.*
- *The examination of quality indices of asset supply (average nominal performance (ÁNT, kW), average age of engines (EÁK, year) and the modernity index (KI, -)) led me to the conclusion that the use of more and more advanced, high technology machinery (of bigger specific value) could be observed in the farms as the farm size is growing.*
- *Evaluating the asset supply with equipment shortage indices (need for external machine work (KGMI, thou HUF) and need for specific external machine work (fKGMI, thou HUF·ha⁻¹) I have found that typically the group of medium-large farms with 16-40 ESU sizes can be regarded independent farms in terms of mechanization. I referred to the fact, that the farms with capacity shortage obtain the necessary resources mostly in the form of lease services.*
- *The examinations of capital efficiency (defined as the quotient of farm-level gross production value and machine asset capital locked in the farm) revealed that there is no statistically provable relation between farm size and capital efficiency. I also pointed out the following relation: by increasing the farm size, the volume of equipment stock is more and more suitable for creating the conditions of independent farming in regards to mechanization, that is the almost fully mechanized larger farms are able to produce the given capital efficiency level while the value of capital efficiency in the smaller farms exists parallel with considerable capacity shortage. In this approach, the more favourable and higher level of capital utilization ability can be proved.*
- *According to my estimations for the analysis of questions of machine capacity utilization, the average exploitation of heavy-duty machines – calculated for duties within the farm – is low, around 20%. Similarly to the capital efficiency, the growth of farm size does not necessarily results higher exploitation. The experiences prove that the pace of expansion of capacities goes together, in many cases even surpasses the increase of farm size, thus there is no actual change in the level of capacity utilization.*
- *In regards to the costs connected with machine use in the enterprises, the statistical examinations prove that there is close, negative relation between farm size and machine use costs. Dividing the costs into components (Figure 7) it can be stated that the specific fix costs (fFC, thou HUF·ha⁻¹) are independent from the farm size. This statement means serious consequences primarily for the smaller farms because, on the one hand, they have to bear almost the same permanent costs than larger farms, and, on the other hand, they have to calculate with a significant external resource cost (fKGMI, thou HUF·ha⁻¹) due to the significant asset shortage. The specific variable costs (fVC, thou HUF·ha⁻¹) are becoming determinant cost components within the total costs as the farm size is increasing.*



Source: own construction

Figure 7: Costs connected with machine use by economic size categories

- From 2004 to 2008 about 730 million HUF was totally spent on mechanization investments in the examined farms. It means 5,5 million HUF investment volume on average, per one farm. *Own sources (46,3%) and loans (39,6%) have major role in financing the investments, while the share of development subsidies is small (14,1%).* It is important to stress, however, that the subsidies transferred under different titles (SAPS, top-up, AKG – Agricultural Environmental Management) are often used for financing the investments in the farms. *In this approach, I underline that subsidy is one of the main reasons why the farmers are not interested in the joint machine investment and operation partnerships.* In those farms, where the subsidies are not realized in capacities, the „free” sources help the financing of lease machine rates and do not encourage the purchase of capacities through narrower cooperation mechanisms.

3.2.2.3. Human profile of farms

Another logical unit of the questionnaire dealt with the issues of human resources at the farms. Most of the questions focused on the actual leading person of the farm. My paper examines the human profile in two approaches, first I reviewed the general features than I discussed the issues of trust.

(i) General human profile

In regards to general human profile I made the following statements:

- The actual leading and decision-making role belongs to men in most of the 132 farms involved in the survey (91,6%).
- The average age in the whole sample is 48,5 years (s=11,2 years; min = 27 years; max = 72 years).
- Rendering a numeric scale from 1 to 11 to the school qualifications classified in hierarchic order it can be stated that the average level of the highest school qualification is 4,28. This value corresponds to the specialized vocational level qualification. *There is negative, medium correlation ($r = -0,519$) between the age and school qualification of farmers.*
- The heads of farms have been performing agricultural activities for 14,8 years on average. The majority of them (65%) started farming in the years following the post-communist transition, between 1990 and 1993.
- 35% of the respondents belonged to a cooperative before the post-communist transition.
- Using a scale from 1 to 7 the respondents evaluated their attitudes to the collectivisation that had been before the political transformation. The results reveal that *the farmers heavily tend to give*

extreme judgement: 41% expressed categoric rejection to this formation of the past (1), while 21% had maximally positive opinion (7). (Average value: 3,45).

- I tried to collect data about the labour use of farms, but the analysis of this issue is set aside in my paper due to data recording problems.
- The results of examinations concerning the dependence of farmers on income from agricultural activity, it has been proved that *the agricultural activity basically has only an income-complementing function in the smallest size categories. It has become the sole income source for farm leaders typically in the farms above 16 ESU.*

(ii) „Trust profile” of farmers

In addition to general human features, I also discussed the issues of trust. The main statements I made were as follows:

- The level of general trust in fellow farmers was evaluated on a scale from 1 to 7. The trust determined this way was a bit higher than medium, 3,77 on average (s=2,13).
- I made further statistical examinations in order to see the effects of the above outlined general human profile elements (age, qualification, time spent with farming, membership in and approach to cooperatives, income dependence) on the level of trust in farmers. The results of statistical examinations prove that out of the set of indices only the age has measurable impact on the level of general trust. The tendency in connection with this is that *the younger farmers typically have more trust in their fellow farmers than the older generation.*
- I examined the trust of farmers on the basis of Sholtes model, too. According to the basic model, the trust is developed when the faith in loyalty and abilities is high. *Under loyalty I mean that approach to trust which focuses on honesty and keeping the promises. The trust in abilities means that the partner, on the one hand, possesses the appropriate tools for fulfilling the commitments and, on the other hand, possesses the personal qualities to realize the undertaken transactions without any negative consequences.* It can be proved statistically in the examined sample that *the level of trust in the abilities of fellow farmers is higher than the faith in loyalty.*
- I examined which general human profile factors can be related with the above mentioned types of trust. *In regards to loyalty trust, the impact of age and income dependence variables can be proved.* The impact of age is a bit stronger, regarding their direction both of them are opposite, that is *the older the farmer the lower is his trust in the loyalty of fellow farmers and becomes more and more sceptic concerning the fair behaviour of fellows.* The same negative tendency can be seen in case of income dependence. *The stronger is the income dependence of farmers on agricultural activity, the more reserved is the farmer, the more inclined to avoid „vulnerability” (risk), which can threaten his existency through trust.* Using similar methodology and relation system for the examination of trust of farmers in the abilities of their fellow farmers, *only the effect of age could be proved. The higher is the age, the lower is the trust in competency of others.*

3.2.2.4. Moral risks in the examined farms

The last presumed factor to examine was the issue of moral risk. My results were as follows:

- It can be stated that *the moral risk exists in the relations among farmers but it is insignificant.* The average value of aggregated index developed for measuring the moral risk was 5,28, with the range definition from 0 to 21.
- By using a regression model for the examination of the relations between trust in expertise and moral risk, the relation between the two variables can be proved statistically. *The direction of the relation is negative, that is the sustained injuries result the decrease of trust.* The

explanatory force of the model is low which projects that the former experiences may influence the trust in abilities, but other subjective factors also affect it. I analyzed the relations between the observed moral threats and loyalty trust. The relations can be proved but the explanatory force is much more modest. Comparing the standardized B coefficients, *the effect of moral risks is almost half in case of trust in loyalty than the value observed in case of trust in professional competencies.*

3.2.2.5. Evaluation of cooperation activity among farmers

One of the focal points of my research was the identification and evaluation of different forms of cooperation that can be observed in the use of technical resources. The questionnaire used in the survey distinguished three types of cooperation in narrow sense, namely: *machine work in mutual basis, lending machines and equipment to each other and, joint ownership and use of machines.*

I gave the following evaluation about the alternatives:

- According to the responses given to the questionnaires, *almost 50% of farms participate in machine work on mutual basis.* 65 farmers declared that they do machine work on mutual basis with one or more fellow farmers (sometimes in the form of lease service), which can even be considered informal machine ring activity. The average activity value of cooperation (*COOP_1, -*) is low. The activity of 1,47 can be interpreted by the consideration of the following: the model that defines activity value resulted 1 as a value when the responding farm declared about a work phase that mutual machine work is made in it only once or twice per economic year; value 2 was resulted by two alternatives: the respondent cooperates either 3-4 times per one work phase, or 1-2 times per two work phases. The cooperation typically involves a small number of farmers, the most frequent is the group of 2-3 persons, sometimes there are communities of 4-5 persons, too.
- The cooperation in lending the machines was indicated by less respondents. *Out of the inquired sample 49 farmers said that at least once a year lends a tool or equipment to a fellow farmer.* The average value of activity (*COOP_2, -*) is 2,25, which can be explained according to the same directions as in case of *COOP_1* variable. Similarly to the previous cooperation alternative, the group of farmers in this case, too, typically consists of 2-3 persons, bigger partnership groups can be observed here in the rarest case.
- In regards to the use of technical resources, the „top” form of cooperation is the joint ownership of machines and equipment (*COOP_3, -*). This form of cooperation is practiced by a small minority of farms, *only 12 farmers replied that they had a machine in their farm which was owned or used in common with at least one fellow farmer.*
- *According to the experiences of the interviews the potential group of cooperating partners is differentiated in the different forms of cooperation.* In case of machine work made on mutual basis, the mere acquaintance between farmers is often enough, but most often relatives or friends are involved in this type of cooperation, too. The machine lending, which is a higher level of cooperation, requires clearly closer ties between farmers. Apart from some exceptions, it is a cooperation mechanism only among relatives and friends, similarly to joint ownership.

In order to express the cooperation activity in wider sense, I made an aggregate index (*EH-rate*), *of the above three variables* (*COOP_1, COOP_2, COOP_3*) which fulfill the role of dependant variable in further statistical analyses. The average value of *EH rate* was 1,27 (*s=1,08*) in the whole sample.

3.2.3. Results of explanatory models

In the further part of the paper I examined the relations between cooperation activity and the above outlined factors.

3.2.3.1. The relations between „farm profile” and cooperation activity

I made three main groups of factors of the discussed farm profile elements, about which I presumed that they can be connected and can influence several dimensions of farmers' partnerships. *I used explanatory models for analysing the effect of farm size, the so-called size-effect relations, the explanatory force of equipment supply in different aspects and the questions of productivity.* Table 1 gives a review about the results of analyses.

Table 1: Summary of relations between farm profile and cooperation activity

Farm profile elements	EH-rate	COOP_1	COOP_2	COOP_3	Machine lease service provider
	Status				
Size impact	✓ proved	✓ proved	✓ proved	X not proved	X not proved
Absolute equipment supply	X not proved	X not proved	X not proved	X not proved	✓ partly proved
Relative equipment supply	X not proved	X not proved	X not proved	X not proved	✓ partly proved
Absolute equipment shortage	✓ proved	✓ proved	✓ proved	X not proved	not examined
Relative equipment shortage	X not proved	X not proved	✓ proved	X not proved	not examined
Productivity	X not proved	X not proved	X not proved	X not proved	not examined

Source: own construction

Some additional notes to the above outlined results:

- I have found as a general tendency that *there is negative correlation between the size of the farm and cooperation activity: the smaller is the farm size, the higher is the cooperation willingness.* I have also proved that:
 - The average value of EH rate is lower in the smallest size categories (0-4 ESU), there is a significant growth in the next size level, then the average values of group averages show a monotonous decreasing tendency.
 - The machine work on mutual basis (*COOP_1*) is the most frequent in the medium-size farms, this form of cooperation has significantly lower frequency in smaller and higher categories.
 - The peak of frequency curve of *COOP_2* type of cooperation that shapes through the group averages shifts toward the smaller size unit categories.
 - The joint machine ownership (*COOP_3*) is typical also in case of smaller farms, but this relation cannot be proved statistically.
- The examination of equipment supply on the cooperation activity was divided into four further research segments on the basis of multi-variable statistical methodology (factor analysis) and some special considerations. I have found the following results:
 - *The absolute (potential) and relative (specific, reflected on area unit) asset supply of agricultural farms did not indicate statistically supportable relation with the dimensions of cooperation activity. It can partly explain only the „quasi” cooperation mechanism, when somebody is becoming machine lease service provider,.*
 - *The absolute asset shortage of farms (the value of external machine capacity need at farm level expressed in money) was also identified as cooperation motivating factor. It was interesting and very valuable result that I could statistically prove in case of COOP_2 variable that the significant asset shortage at smaller farm sizes can more strongly facilitate cooperation. This stimulating effect does not exist in case of medium and larger farm sizes.*
 - The equipment shortage of farms was evaluated from other aspects by the index of specific external machine labour need which expresses the quantified degree reflected on area unit

(that is the relative asset shortage). According to the models, *the variable determines – positively - only the values of cooperation activity manifested in the lending of machines.*

- *The relation between natural production efficiency and cooperation activity could not be proved at all in the examinations.*

3.2.3.2. Cooperation activity explained by „human profile”

The effect of human profile on cooperation activity was analyzed through the questions of general human profile and trust. The results are summarized in the following (Table 2).

Table 2: Summary of the relations between human profile and cooperation activity

Human profile elements	EH-rate	COOP_1	COOP_2	COOP_3
	Status			
Age of farmer	✓ proved	✓ proved	✓ proved	X not proved
Highest school qualification	X not proved	X not proved	X not proved	X not proved
Time spent with farming	X not proved	X not proved	X not proved	X not proved
Membership in cooperative	X not proved	X not proved	X not proved	X not proved
Attitude to cooperatives	✓ proved	✓ proved	X not proved	X not proved
Income dependence	X not proved	✓ proved	X not proved	X not proved
General level of trust	✓ proved	X not proved	✓ proved	✓ proved
Level of trust in loyalty	✓ proved	X not proved	✓ proved	X not proved
Level of trust in expertise	✓ proved	✓ proved	✓ proved	✓ proved

Source: own construction

Short explanation and some notes to the above results:

- I studied the determination of *general human profile* on cooperation activity in the frames of multivariable explanatory models. My statements were as follows:
 - Out of the six presumed factors, *the age of farmers and their attitude to the cooperative movement before the political transition has some real influence on EH rate variable.* The value of activity is the strongest determined by the age, while the partial impact of attitude is much more modest. The older the farmer, the lower is the cooperation activity, while the more positive judgement of cooperative movement is typically paired with higher cooperation willingness. The effect of time spent with farming, which separately indicated a relation, as a variable has been eliminated due to the interference.
 - The effect of three variables proved to be significant on machine work on mutual basis (*COOP_1*), *namely the indices of age, attitude and income dependence.* The determination of feelings toward the collectivisation before the political transition is a bit stronger than that of the age. The income dependence also has a real impact on dependant variable, the direction of relation is positive, that is the increase of income dependence motivates cooperation, at least this form of cooperation.
 - *COOP_2* form of cooperation separately has relations with more human profile elements. Building the explanatory variables into one model, *only the age effect remains significant.*
 - The joint machine ownership (*COOP_3*) could not be explained by any of the above discussed elements of profile.
- The impact of trust on cooperation was examined from two approaches:
 - *The level of trust in general was identified as an important factor in partnerships for machine use.* The relation could not be proved only in case of machine work on mutual basis, which means that this form of cooperation can exist at lower level of trust, too.

- The trust in loyalty and expertise has received priority in other approach to trust. The multivariable explanatory models gave the following experiences:
 - *The value of EH-rate is significantly determined by the trust both in loyalty and expertise*, in regards to the power of explanatory variables, the trust in expertise has much stronger impact. The direction of correlation is positive.
 - *According to the statistics, the value of activity exerted in machine work on mutual basis is „moved” positively only by the trust in the abilities of the fellow farmer*. The trust in loyalty shows a great degree of independence from this.
 - *Both explanatory variables became significant model elements in the multivariable model that analyzes the questions of cooperation based on machine lending*. The loyalty trust, however, has greater effect, it explains the machine lending activity more than the trust in expertise.
 - *In binominal logistic regression model, the value of COOP_3 variable received really positive determination only by the trust in abilities*. The impact of loyalty trust could not be proved even separately.

In connection with trust, I also tested the Sholtes model on the basis of the following presumptions: the starting premiss was that the cooperation among farmers is more probable if they trust each other. According to SHOLTES the trust is developing when the level of trust both in loyalty and expertise is appropriately high. On the basis of this, it should be realized that cooperation is the most clear at high level of loyalty and competency trust. I determined the average values of cooperation activity (EH-rate) in the space of trust dimensions (Table 3).

Table 3: The average values of cooperation activity rates in each dimension of trust

Dimensions of trust		Degree of trust in expertise			
		Low	Medium	High	Total
Degree of trust in loyalty	Low	0,42 (<i>s=0,51</i>) (1)	1,17 (<i>s=0,90</i>) (2)	1,32 (<i>s=1,20</i>) (3)	0,99 (<i>s=0,91</i>)
	Medium	0,33 (<i>s=0,51</i>) (4)	1,28 (<i>s=0,96</i>) (5)	1,66 (<i>s=1,41</i>) (6)	1,24 (<i>s=1,06</i>)
	High	- -	1,56 (<i>s=1,16</i>) (7)	1,99 (<i>s=1,33</i>) (8)	1,71 (<i>s=1,22</i>)
	Total	0,39 (<i>s=0,50</i>)	1,31 (<i>s=0,99</i>)	1,72 (<i>s=1,31</i>)	1,27 (<i>s=1,08</i>)

Source: own construction

On the basis of the analysing and evaluating examinations I can declare the following:

- *The methods of descriptive statistics prove that the assumption based on Sholtes model was correct because the average activity values are lower at the low levels of trust and higher at high levels of trust*. The values were calculated basically between the two extreme values in case of the other trust level combinations.
- The one-way variance analysis and the related post-hoc tests proved, among others, that the cooperation activity of groups (1) with total distrust and (8) unconditional trust – using the titles of the original model - is significantly different from each other. It was interesting to see, however, that in group 3, which represents the respect for fellow farmers, the expected value of activity rate actually did not differ from the average of any other group. None of the farmers belonged to the category of pure sympathy, such a combination could not be identified in the examined sample. In regards to groups of conditional, that is medium level of trust, the experiences have revealed that the approaches to trust even based on Sholtes model could not

give perfect explanation to the cooperation activity of farms but the validation of the model could be regarded successful.

3.2.3.3. Effect of moral risk on cooperation activity

Above I discussed that the moral risk exists in the surveyed farms, although its level is relatively low. I identified as a methodology problem that a significant proportion of farmers had not presumably lived with some solutions of cooperation, had not participated in them and thus had no opportunity to be disappointed in them. I performed the examinations in two aspects in order to eliminate the problem that was revealed: first I examined the moral risk and the questions of cooperation willingness in the whole sample, then I made screening in the sample, narrowing the examinations to the farms that actually cooperate. The results of examinations are summarized according to the following:

- I could state for the whole sample *that the moral risk in partnerships cannot be connected with cooperation activity, it is not able to explain the low level of activity.*
- In regards to the cooperating farms I can *reveal the negative correlation between the values of cooperation activity and moral risk, proving those expectations according to which the negative experiences of the past can set back the inclination to cooperate.*
- With further examinations I revealed that *the moral risk influences cooperation willingness in different farm size categories but to a different degree.* The smaller size categories are basically more inflexible to risk and they undertake cooperation even at higher risk levels. Aversion, the rejection of risk is more typical in case of larger farm sizes, which also results lower cooperation willingness.

3.2.4. Knowledge about and suitability of institutionalized forms of cooperation

Within my research I examined the knowledge of farmers about several institutionalized arrangements of joint machine use cooperations. I could state that *the farmers have insufficient information about this field.*

I also measured the motivation of farmers to set up an independent machine pool, thus an independent farm concerning mechanization. This value was higher than medium, but it was strongly differentiated by economic size groups. In case of smaller sizes, the leaders of farms were less characterized by this ambition while in case of larger farms, this kind of effort was stronger.

It should also be noted that *the joint ownership was strongly rejected by the surveyed farmers.* The results convince us that those forms of cooperation where the technical resources are based on joint ownership, will not be relevant among the farmers of the region.

I also examined the willingness of farmers for longer terms of engagement concerning the purchase of technical resources from external sources. I have stated that *there is a very strong, dominant effort to keep independence and avoid engagement.*

3.3. NEW SCIENTIFIC FINDINGS

On the basis of my examinations, I can draft the following new and original scientific findings:

1. *I prove with scientific methods on secondary databases that the Hungarian agricultural producers are in many aspects at (competitive) disadvantage to the producers of many countries of the European Union.* In the frames of this, I point out that the volume of total income realized by the farmers in the Hungarian agriculture is (relatively) low, the subsidies in these incomes have major share, thus resulting significant dependence on subsidies. I also underline that the reason for low (internal) income production is not in farm structure and level of equipment supply, but much rather in the low utilization efficiency of capital locked up in assets. There are resource allocation asymmetries in the background of efficiency problems, indicating the relevance of machine use partnerships.
2. *I prove on the basis of empirical experiences that the so-called „size impact” in the examined sample can be statistically proven related to the cooperation activity of farmers in narrow sense.* I regarded the size of farms, the potential performance (gross production value and, from this, the size of usable income amount), the level of technical asset supply and the volume of subsidies transferred under different titles as size impact factors. In regards to the direction of relation, I prove that the cooperation willingness of farmers shows an increasing tendency as the farm size is decreasing – especially due to the pressure of economic factors. The farms of the smallest size category, however, show significant deviance from this trend. I explain this phenomenon with the low economic interest connected with the special features of small-scale farms (e.g. part-time). I also point out that the lease service providing activities, as quasi cooperation mechanism, are not determined by „size impact”, but much rather by the high specific asset supply of farms which have stimulated these activities through economic mechanisms.
3. *I prove in the sample with statistical tools that the personal features of agricultural producers explain cooperation willingness in many aspects.* In the frames of this, on the one hand, I reveal higher cooperation willingness on behalf of younger farmer generations, on the other hand, I prove that the attitude of farmers to the collectivisation process back in the communist era still has serious impact on the issues of cooperation. The negative judgement is paired with aversion to cooperation. The role of trust is identified as another personal factor that determines cooperation activity. I can declare that trust in loyalty and expertise have key role in joint machine use. It is also cleared that the importance of each type of trust is different in the different fields of cooperation.
4. *I prove that the low cooperation activity that is revealed among the responding farmers cannot be explained with the existence of moral risk.* I also prove that there is some moral risk among cooperating farmers, but its negative impact on cooperation willingness is small. I can declare that the risk-flexibility of farmers by farm size is different. The revealed tendency can be basically led back to economic motives.
5. *I point out that no solutions belonging to the concept of virtual (large-scale) farm will have any role in the group of responding farms in the near future where the dependence of farmers is strong (e.g. based on joint ownership).* I prove that the only institutional solution, really considered by all farmers, is the machine lease service, as quasi form of cooperation for fulfilling the external capacity needs of farms. I indicate machine ring as another possible alternative, but only a small number of farms would give more considerable role to it.

3.4. FULFILLMENT OF RESEARCH HYPOTHESES

According to the examinations I performed I give the following evaluation in regards to the research hypotheses outlined above.

Hypothesis 1 (H1)

The Hungarian agricultural enterprises are - in many aspects (e.g. profitability, machinery supply, capital efficiency) – at (competitive) disadvantage to the agricultural plants of most of the former European Union member countries. The joint machine use cooperation can be an adequate alternative in coping with the existing problems.

Status: Proved hypothesis. (Note: In regards to the asset supply questions of the Hungarian agriculture it should be underlined that its degree is really below the EU average but the low utilization efficiency of capital locked up in assets is a greater problem. This fact can be considered the major source of (competitive) disadvantage.)

Hypothesis 2 (H2)

A lot of forms of cooperation can be found in the relations among Hungarian farmers, they do not perform their activities totally independent or separated from each other. The intensity of these relations, however, is typically low.

Status: Proved hypothesis.

Hypothesis 3 (H3)

The agricultural subsidies weaken the economic rationality, give wrong market impulses, thus adversely influence the willingness of farmers to cooperate.

Status: Proved hypothesis.

Hypothesis 4 (H4)

Hypothesis 4.1. (H4.1)

The role of trust in fellow farmers is decisive in machine use cooperation. The relation between cooperation activity and the level of trust can be proved.

Status: Proved hypothesis.

Hypothesis 4.2. (H4.2)

The trust both in loyalty and expertise has great significance in joint machine use cooperations, irrespective of the form of cooperation.

Status: Partly proved hypothesis. (Note: the empirical experiences proved the role of both types of trust in cooperation, but also point out that their weight is different by the areas of cooperation.)

Hypothesis 5 (H5)

Out of the possible joint machine use alternatives, those will be highlighted in the future that require greater independence and lower level of trust.

Status: Proved hypothesis. (Note: the results of the survey revealed that the machine and farm assistance rings, as form of virtual (large-scale) farming can have relevance in the future in some segments of the examined group of farms.)

4. CONCLUSIONS AND SUGGESTIONS

The topics discussed in my paper lead to extensive and comprehensive conclusions. Putting in logical order, I make the following statements:

Profitability and asset supply of agricultural production

According to the examinations made on the basis of FADN data I come to the conclusion that *the agricultural sector of the European Union – the constant objective of which is the unification – shows the signs of strong polarization in many aspects*. The results of the examination highlight that the agricultural plants of EU-27 countries operate under rather heterogenous national condition systems, which include the degree of farm concentration, the volume of available income (amount of coverage and subsidy), the level of equipment supply and the efficiency questions of capital locked up in assets.

As the result of polarization, the groups of former (EU-15) and the newly integrated countries (EU-12) can be very sharply defined. My examinations definitely prove the significant lag and the subsequent competitive disadvantage of this latter group of countries. *The results clearly draw the attention to the fact that the prolongation of the revealed negative situation would further increase the already considerable differences in development level and the growth of competitive disadvantage between the two segments of European agriculture*. In order to cope with this competitive disadvantage not only the help of more developed countries, the clear and concise policy of national governments is required but also the active participation of farmers from the countries to be closed up, their identification with the need for becoming competitive and – subsequently - their appropriate actions.

Focusing on the situation of Hungarian agriculture out of the countries of the European Union, I can draft the following statements:

- *In the Hungarian agriculture which has very segmented structure, the volume of total income realized by the producers is (relatively) low, far behind the average of the European Union and is paired with the clearly provable subsidy dependence*. The significant share of subsidies within total income becomes really serious problem in regards to those processes which show towards the direction of reducing the role of subsidies. *These tendencies highlight the role of own (internal) income production*.
- *In EU comparison, the own income production of Hungarian farms is typically low*. In the frames of partial efficiency calculation *it can be pointed out that this phenomenon cannot necessarily be led back to the degree of asset supply, but rather to the low capital efficiency*.

Evaluating the tendencies observable in the asset supply of the Hungarian agricultural economy based on the data of the Hungarian Central Statistical Office, it can be stated that:

- *Following the political transition, an extensive development process was carried out in the sector*. *The prevailing government had significant role in the process (through the investment supporting programs)*. As the result of this, *the available equipment capacities have considerably increased in the sector, but – as a negative aspect besides the positive impact – the asset efficiency, and the efficiency of capital locked in assets has deteriorated very much*.
- *The development policies were not adequate with the farm structure that developed following the political transition which led to significant asymmetries in the distribution of technical resources*. *Some farms had huge unexploited capacities while others had permanent shortages*.

On the basis of the above – summarizing – statements I can declare the following final conclusion: *the Hungarian agriculture will not be sustainable in longer run under the current circumstances and conditions*. Considering the imminent changes of agricultural policy, the

agricultural producers should prepare for stronger prevailing of market regularities and the reduction of state intervention that is realized in financial subvention. *The appropriate response to the above explored problems is the cooperation among farmers*, considering the social demand for sustainable Hungarian agriculture. The partnership of farmers – especially in the field of joint utilization of technical resources – can have positive economic and social consequences from many aspects. First of all, focusing on the problems identified in research, the higher level exploitation of resources in the virtual (large-scale) farms would improve the efficiency of asset capital used in the sector and, the inequalities in the distribution of capacities could be solved at significantly lower transaction costs. All these positive impacts would ultimately result increasing income for the farmers.

In regards to the questions I also want to stress that *in longer term, the cooperation in machine use itself will not be able to treat all the problems in the Hungarian agriculture*. In my opinion, it will be necessary to make the cooperative relations among farmers even more intensive, in the frames of which the cooperation should be expanded on the whole range of resources utilized in production and the whole phases of production processes. I also underline that the *ownership rights, the interests of the owner cannot be damaged in the meantime*.

Cooperation among farmers

The results of – non representative – empirical research that was carried out among agricultural enterprises in Békés county indicate that the farmers in the new situation following the political transformation gave wrong answers to the occurring problems. *The new situation would have required strongly adaptable, cooperating behaviour from the farmers, but according to the experiences it has not happened during the last twenty years*. The outcomes led us to the recognition that the changes of political-economic environment give – often controversial – impulses to the farmers, in which the encouragement of cooperation was less obvious.

The production structure of the examined farms shifted towards the production of fully mechanized crops which has low live labour needs, the value added is low, and, moreover, a buyers' market has been developed for these crops during the recent years which has kept the producer prices low thus resulting profitability problems. Animal husbandry is permanently decreasing within the production structure. Instead of diversification, the tendency goes toward specialization, which – under given conditions – increases production risks and hamper the adaptation to market demand very much due to the inflexibility. The low activity in the field of *product innovation* can be due, in my opinion, to many subjective and objective reasons. On the one hand, *the lack of competency, which explains the insistence on the well-known crop species that have been grown for years*. Another aspect is the great aversion to risk, *fear of the new*, which is enforced by the own negative experiences or the news about them. The existing subsidy system is also a determining factor. *The current subsidy system which prefers some areas according to its philosophy also causes distortions to the production structure*.

The farms in total are very active in *technological innovation*, although the degree of activity is considerably different according to economic sizes. The differences are basically due not to the skills, but much rather to the innovation ability, which appears through the capital force.

The experiences lead us to the conclusion that the *classical – input and output side – marketing channels are typically preferred in the market relation system of the surveyed farms*. The purchase of inputs used in production (e.g. fertilizer, crop protection chemicals) is not made through directly from the manufacturer, and similarly, the marketing of the products is not made directly to the processing plant, but these transactions are carried out with the other participants (wholesalers, middlemen) involved in marketing channels. *It results significant income losses for the producers, because the income needs of actors playing merely middlemen roles are realized mostly at the expense of the producers*. In many cases the production inputs and agricultural products get to the actual and final place of use through a lot of middlemen, which significantly reduces the producers'

income. The farmers refer to the low trade volume and do not deal with exploring new purchasing and selling methods or solutions, they accept their subordinate role. Although the concentration of demand and supply through partnerships – which also leads to the issues of innovation – can offer a real solution alternative to the problem thus creating the possibility for shortening the marketing channels and increasing the size of realizable income. In my opinion, the impact of subsidies has a key role here, because it results the distortion of judgement and economic rationality of farmers by compensating the income which is drained away in transactions.

In my research, the examinations focused on the question of *organizational innovation ability* in the field of mechanization and machine use. On the basis of the explanatory models of the new institutional economics I detailed that the purchase of the required machine capacities for the agricultural enterprises is made in the frames of three institutional arrangements, which are as follows: the possibility of ensuring capacities on market basis is offered by the short-term (1) (occasional) *machine lease service agreement*, while the so-called hybrid form is the (2) *virtual (large-scale) farm*, as an alternative, where the capacities are provided in the frames of long-term agreements. The organized institutional arrangement in this case is the (3) *machine investment in own property*. The experiences of the survey prove that *the farms implement mostly the market and organizational arrangements, the so-called neoclassical agreements are rare and at low intensity*. The phenomenon is explained by the following factors: *value distorting effect of subsidies, self-interest following behaviour and low level of trust*.

It is a general statement among the technologically innovative farms which make machine investment that *the machine capacities realized at farm level on their own significantly surpass the actual needs, the exploitation of assets is low, which also result the low exploitation – thus slow return – of capital locked up in them*. There is a question then: why do the farms realize these capacities within their organizational framework? The perfect reply is given by the explanatory models of the new institutional economics.

It is a basic principle that *in case of all those investments where the optimal exploitation of resources cannot be ensured with organizational arrangement (own property), it is economically justified to obtain the required capacities through another institutional arrangement*. At the same time the subsidies soften the market judgement. *As the consequence of subsidies with investment (and not investment) purposes, the assets have double value. One of the values is the actual investment value, paid for the given asset, the other value is what the farmer should produce and pay from own sources. Due to the separation of the asset value in this form, the investing farmer calculates only with the asset value decreased by the value of subsidies. This value is considered a returning investment even in case of significantly lower exploitation levels, therefore it will be realized. In this approach, the difference between the two values should be paid by the society*. The economic theory explains the preference of own property with the degree of uncertainty (especially behaviour uncertainty). This question also leads to the issue of trust. *So the low level of trust among farmers also explain the independently performed investments*.

The purchase of missing machine capacities required for production in the examined agricultural enterprises is made mostly on market basis, in the frames of short-term machine lease service agreements. These transactions result significantly higher transaction costs for the farms, as against to the costs of capacity fulfillment carried out in the frames of some other form of more intensive joint machine use. At the same time *the subsidies eliminate a significant part of market transaction costs, in fact transfer them into social costs*. Thus the subsidy system does not stimulate the farms with capacity shortage to follow economic rationality and reduce the transaction costs by choosing certain cooperation mechanisms.

As a further explanation, the clash of interests should also be seen in this context. As the result of significant resource allocation asymmetry, the mixed asset supply is also an obstacle to the development of tighter forms of cooperation. *It is a more preferred alternative for farms with significant accumulated asset capital – mostly from subsidies, at the cost of the society – to provide*

their surplus capacities on the basis of machine lease service, and not in the frames of non-profit agreements. Due to the self-interest-following behaviour, the only alternative for the farms with capacity shortage is the machine lease service to ensure the required resources. It should be noted, however, that the behaviour of farms providing machine lease services can also be characterized by the concept of limited rationality instead of self-interest-following behaviour because mostly the short-term profit maximization is the primary target in their activities.

Another question, why these agreements are short-term? The explanation for short-term market agreements can be that *there are relatively large number of actors in the machine lease service market in all the settlements, thus the partner exchange can be solved without difficulties for the farms with capacity shortage and the long-term commitments are not encouraged in the purchase of capacities.* It was seen during the surveys that in those settlements where the capacities were less accessible in the form of machine lease services, the irrational own machine investment was more typical, as well as the longer-term, often written contractual agreements concluded with the lease providers of the surrounding settlements. *All the above clearly confirm the concept of the institutional economics, according to which the existence of mutual dependence and interest results the deepening of cooperation between economic actors.*

The value distorting effect and the self-interest following behaviour of farmers does not fully explain the selection of institutional arrangement. It is enough to consider the Western-European experiences. The role of subsidies is significant (or even more significant) in the agriculture there, in spite of this there are well-functioning cooperations among the farmers. *The issues of trust can give further explanation.*

Following the political transformation in Hungary – due mainly to the difficult economic and social circumstances – the breaking of social relations and the consequent loss of trust has become general. The distrust has appeared in the relations among farmers and induced the worst possible responses to the occurring problems. *It motivated the farmers to be independent instead of joining foci* which further worsened the already difficult situation. This phenomenon is still existing, the level of trust is still very low. It is, however, a *positive sign that there is a younger farmer generation – free of the presumed or real insults of the era before the political transition - which is more open to the principles and (economic) advantages of cooperation and concentration.*

It is a very difficult and complicated task, but cannot be avoided by the author of the present paper to draft *some suggestions* on the basis of the research, *which can enhance the partnerships in machine use and the strengthening of trust among farmers in each other.* Hereinafter the items drafted are basically referred to the competency of the government:

It was often – intentionally – mentioned in the paper from many aspects that *the subsidies paid from public grants, at the expense of considerable social sacrifices, cause great distortions in the market judgement of farmers, give wrong impulses and result inadequate market behaviour.* This statement, however, can be regarded true only with great subtlety. On the one hand, it is true that at macro-level and on the long run this approach does not follow economic rationality, but, on the other hand, in the short run, this way of thinking is absolutely rational from the aspect of the farmer, at micro-level. *The producers utilize the possibilities offered by the regulations, even if it is not advantageous at the level of the society.* In the long run, however, this approach is not good even for the farmers. Since they get into an artificial economic environment, react on not-real economic real processes, they lose their „immunity” which may result serious consequences if the condition systems happen to change. Due to this, *it is absolutely necessary and urgent to carry out the reform of the subsidy system.* It will be necessary – considering the vision of sustainable agriculture – *to separate the subsidy questions of producing and social agriculture. The group of farms, which is able to operate on market basis in the near future, should be defined.* In this relation, it should also be seen, that this task cannot be solved in the currently applied system of subsidies, the basic principles of distributing public funds should be revised.

In regards to the revision of subsidy system, I do not draft any concrete proposals in the frames of the present paper, but I stress that *the efforts to enhance and strengthen the mutual dependence of farmers should be a key element in the proposals*. It can be realized, in my opinion, by the gradual and calculable reduction as well as more even distribution of production-related subsidies among farmers.

The above outlined suggestion for the restructuring of the subsidy system *can also function as the tool of developing trust by contributing to the creation of mutual dependence of farmers*. In the interest of survival, the interdependence, as a pressure can contribute to the development of more „extensive” forms of cooperation among farmers, the positive – economic and also social – experiences can result the further improvement of cooperation, parallel with the increasing trust.

The outcomes of the survey clearly proved that *most of the farmers do not know, has not even heard about those institutionalized solutions of cooperation which can actually contribute to the improvement of effectiveness of farming by providing organizational framework to the joint machine use of farms*. It would not be correct to say that it is a direct obstacle to the expansion of cooperation, but its indirect impact is sure. Therefore *specialized promotion campaigns should draw the attention of farmers all over the country to the economic – and also social – advantages of the institutionalized constructions of joint machine use*.

Finally, there is a question: *whether the government should assist in the future the establishment and operation of the so-called virtual (large-scale) farming enterprises, the institutions providing organizational framework for joint machine use*. The Western European experiences clearly prove that the quick expansion and real development of these organizational arrangements is not likely without state support. The – generalizable - experiences of the Hungarian machine ring movement also prove that *the state involvement should be consistent and predictable*. The hectic, campaign-like treatment of the question would lead to the dying of the early „sprouts”, the breaking of the farmers’ enthusiasm and the ab ovo distrustful reception of new initiatives. The stimulating subsidy policy would successfully contribute to the establishment of many new organizations within short time but the operational grants are inevitable in the early phase of setting up and strengthening the organizations.

Naturally, the above outlined proposals are not much use if the farmers do not recognize that their acts should serve the long-term social (and consequently individual) profit maximization instead of the short-term individual profit maximization. They have to realize that they can be competitive only through joining their forces, the condition of their survival is the cooperation.

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