

## **DELIVERABLE 6.4**

### **"Analysis of farmers' cooperation in Poland"**

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## Executive Summary

The farm structure in Poland is characterised by a large number of small-scale farms, which in the majority are subsistence or semi-subsistence farms. It is often argued that cooperation considered as a strategy allowing farms to remain in agriculture and to achieve sufficient incomes can influence structural changes in rural areas. Available studies on cooperation among farmers in Poland have been mostly concentrated on propensity to cooperate in formal institutions. There is a lack of in-depth studies on different aspects of social capital and their role in facilitating informal cooperation, especially among small-scale farmers (see more detailed discussion in Wotek and Milczarek-Andrzejewska 2008).

Therefore, the main objective of this research is to deliver in-depth analysis of the role of social capital in promoting informal cooperation and further the role of informal cooperation in commercialisation of the farms. The results of the research could be also useful for policymakers reforming the CAP.

The following research questions were formulated: a) what is the role of individual social capital and the availability of own production factors for the informal cooperation between farmers? and b) what is the role of informal cooperation for farm households commercialisation?

In order to answer the first research question aggregated indicators of individual social capital were constructed with a use of IRT models and factor analysis. Then a cluster analysis was conducted to verify the role of social capital and the availability of own production factors for informal cooperation among farmers. The last step included logistic regression model to verify if the level of individual social capital and availability of production factors are statistically significant determinants of informal cooperation.

To answer the second research question, i.e. to verify if different kinds of informal cooperation are statistically significant factors affecting the level of commercialisation, multiple regression models were used.

Due to a lack of available micro data including information on social capital and cooperation in rural areas in Poland the specific survey has been designed and implemented within the SCARLED project. The SCARLED survey in Poland was conducted in 9 villages (3 were chosen from lagging behind regions, 3 from average regions and 3 from prosperous regions).

Descriptive analysis of data from the SCARLED survey showed that most of the households, that are engaged in informal cooperation, help each other in field works. Other popular forms of cooperation are common use of machinery and common use of transportation means. Households engaged in informal cooperation are those of the smallest size. Informal cooperation among farmers seems to be a substitute of economic resources and it may serve as "capital of the poor". It is the most common among worse off farmers from different regions, but most often from lagging behind regions.

To analyse the role of individual social capital four aggregated indicators of individual-level social capital (readiness to cooperate, trust towards people and local institutions, relations with neighbours and attendance in the elections) were created on the basis of data collected from the SCARLED survey. According to the results of cluster analysis, readiness to cooperate and civil engagement (measured by attendance in the elections) are of key importance in explaining the level of informal cooperation. Results of logistic

regression model showed that farms cultivating larger acreage are better equipped and they do not engage in informal cooperation so often as smaller farmers. Both an agricultural education and a higher level of general education increase likelihood of being self-sufficient in agricultural activity. Therefore, it can be concluded that social capital facilitates informal cooperation among small-scale farmers. However, scarcity of production factors decides about their engagement in cooperative action.

Research concerning the role of informal cooperation in commercialisation process showed that farm households which cooperate informally in form of common use of machinery and transportation means, common purchase of production inputs and help in field work represent higher level of commercialisation (controlling the level of production factors owned by the farm households). Thus, informal cooperation can be considered as strategy allowing farmers overcoming deficiencies of production factors or lowering the costs of operating.

Therefore, informal cooperation should be rather perceived as a substitute for lacking production factors. The most important policy measures aiming at an increase in the level of commercialisation should be those focused on modernisation of farms.

However, for several farms informal cooperation seems to be only a strategy allowing to conduct agricultural production as an additional source of income. It can be argued that other policy measures - also going beyond agricultural and rural policy - are required for such households.

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## **LIST OF ABBREVIATIONS**

AKI	Research Institute for Agricultural Economics
CSO	Central Statistical Office
CUB	Corvinus University Budapest, Dept. of Agricultural Economics and Rural Development
EU	European Union
GDP	Gross domestic product
IAMO	Leibniz Institute of Agricultural Development in Central and Eastern Europe
IERiGŻ	Instytut Ekonomiki Rolnictwa i Gospodarki Żywnościowej (Institute of Agricultural and Food Economics)
K.U. Leuven	Catholic University Leuven, Centre for Transition Economics
NEC	National Electoral Commission
NGO	Non-governmental Organisation
NMS	New Member States
NUTS (NTS)	Nomenclature des Unités Territoriales Statistiques, i.e. Nomenclature of Territorial Units for Statistics
SCARLED	Structural change in agriculture and rural livelihoods
UL	University of Ljubljana
UNEW	University of Newcastle upon Tyne, Centre for Rural Economy
UNIKENT	The University of Kent, Kent Business School
UNWE	University of National and World Economy
USAMVB	Banat's University of Agricultural Sciences and Veterinary Medicine Timisoara
WP	Workpackage
WUDES	Warsaw University, Dept. of Economic Sciences

## 1 INTRODUCTION

Cooperation among farmers is often advised as a remedy for small-scale farmers facing the barriers to the market integration. Common action problems and the importance of effective activity of producers' organizations have been recognized as important factors influencing the process of restructuring of the agricultural sector. However, in case of small-scale farms different kinds of informal cooperation may be the only strategy for accessing the lacking resources necessary for agricultural production and further, for their market integration (see more detailed discussion in Wotek and Milczarek-Andrzejewska 2008). This form of cooperation is based on social capital which reduces the transaction costs associated with the formal coordination mechanisms like contracts or bureaucratic rules (Fukuyama, 2000).

The major weakness of social capital in Poland is the relative lack of engagement of rural people in such forms of activities as NGOs but also a very low propensity to cooperate in conducting economic activity. It seems that rural Poland still relies on its traditional social capacities but does not formalize and institutionalise these ties for joint working and formal cooperation. Moreover, rural communities present an attitude of distrust in general, and to national institutions which is inherited from the communist period (Rural Poland, 2006).

The in-depth analysis of the role of social capital in promoting informal cooperation and further the role of informal cooperation in commercialisation of the smallest farms can deliver an important information for policymakers reforming the CAP. This is of key importance for Poland where structural changes towards consolidation of farming structures are necessary. The predominant opinion indicates diversification of income sources as the main solution for farmers to increase their well-being and further encourage them to exit agriculture. However, diversification possibilities are limited due to the low local labour markets capacities and the low level of human capital among farmers. In this context, the efforts could be also focused on supporting small-scale farms in order to commercialise their production.

The results of Polish case study conducted within the SCARLED project can explain if social capital and informal cooperation are important for persistence or market-orientation of small-farms facing the scarcity of production factors and impediments from the market.

In the second chapter general methodology and description of specific statistical methods applied at subsequent levels of the analysis are presented. The following chapter focuses on selection procedure and description of surveyed regions in Poland. The fourth chapter includes a descriptive analysis of collected data with regard to social capital and cooperation at the farm level. In the fifth and the sixth chapter the results of the analysis concerning determinants and economic effects of informal cooperation are presented. The concluding remarks follow.

## 2 METHODOLOGY

The objective of this study is to verify a hypothesis that higher level of social capital facilitates informal cooperation among farmers. However, in case of small-scale farms the scarcity of own production factors is also an important factor that decides about their engagement in cooperative action. Moreover, different kinds of informal cooperation can be considered as the strategy to access lacking resources essential for agricultural production and furthermore help farms to overcome impediments to market participation.

It is often argued that subsistence farming can constitute an impediment to rural economic growth. Thus, higher level of market integration of subsistence agriculture can positively influence structural changes in rural areas. However, the question is what are the drivers for and barriers to commercialisation of subsistence farms?

The term “subsistence” is frequently related to different concepts mostly describing “the defects” of agricultural holding such as traditional, small-scale, peasant, low income, resource poor, low-input or low technology farming (Kostov and Lingard, 2004). All these associations are directly linked to the farm’s production potential or are its derivatives. Farms with little resources do not have possibilities to succeed, thus they face the choice between non-farm employment, expanding agricultural activity or remaining subsistence.

One of the problems this research tries to solve is how small-scale farms can overcome the barriers of scarcity of resources in the situation when they want to farm and sell on the market. Cooperation is often advised as remedy for small-scale farmers confronting growing power of processing and retail sectors. Cooperation between farmers can increase the possibilities to access the market since it increases the total pay-off to a potential group over what they could do individually (Schmid, 2004). However, this kind of cooperation is understood as the formal membership in producers organisations, which requires to involve bigger-scale production potential than mostly subsistence farms have. One of the possible solutions is engagement of resource poor farms in the informal cooperation (in form of common use or exchange of different production factors) with the other farmers from the area of home or adjacent village. Such form of cooperation is determined by the farmers’ need for accessing lacking resources necessary for conducting agricultural activity. As the result of engagement in informal cooperation, small-farmers are more likely to achieve marketable surplus, therefore acting together can be conducive to commercialisation.

When the scarcity of resources is recognized as the tangible determinant of cooperation it is crucial to analyse farmers’ cooperation under the wider framework of social capital since this concept refers to intangible aspects of collective behaviours<sup>2</sup>. In line with Woolcock and Narayan (2000), social capital is defined as norms and networks that enable people to act collectively. Moreover, important role of trust is emphasized since it is considered as collective asset which promotes the relations and networks, and enhance the utility of embedded resources, or vice versa (Dufhues *et al.*, 2006).

The above problem can be analysed at two stages by answering the following research questions:

- a) what is the role of individual social capital and the availability of own production factors for the informal cooperation between farmers?
- b) what is the role of informal cooperation for farm household commercialisation?

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<sup>2</sup> See more detailed discussion in Wotek and Milczarek-Andrzejewska 2008.

In general the conception of this study can be presented in two equations describing interdependences of relevant variables:

$$(1) \quad \begin{matrix} (+) & & (-) \\ \text{SOCIAL CAPITAL} & + & \text{FACTORS OF PRODUCTION} = \text{INFORMAL COOPERATION} \end{matrix}$$

$$(2) \quad \begin{matrix} & & (+) \\ \text{FACTORS OF PRODUCTION (NON-OWNED) ACCESSED THROUGH INFORMAL COOPERATION} & + & \\ & & (+) \\ & + & \text{OWNED FACTORS OF PRODUCTION} = \text{COMMERCIALISATION} \end{matrix}$$

In order to achieve the above objectives different statistical methods necessary at the following stages of analysis were employed:

- Construction of aggregated indicators of individual social capital - IRT models and factor analysis,
- Preliminary verification of the role of social capital and the availability of own production factors for informal cooperation among farmers - k-means cluster analysis,
- Verification if the level of individual social capital and availability of production factors are statistically significant determinants of informal cooperation - logistic regression model,
- Verification if different kinds of informal cooperation are statistically significant factors affecting the level of commercialisation measured by the share of output sold - multiple regression models.

The more detailed explanation of these stages is presented below.

## 2.1 Indicators of individual social capital

On the basis of data collected from the SCARLED survey, four aggregated indicators of individual-level social capital were created: readiness to cooperate, trust towards people and local institutions, relations with neighbours and attendance in the elections. The data on social capital collected and the social capital indicators constructed are presented in part 4.

The aggregated indicators of individual-level social capital were built with use of two alternative methods: IRT models and factor analysis performed on tetrachoric (for dichotomous variables) and polychoric (for ordinal variables) correlations' matrices. Those methods are appropriate for the kinds of data collected on social capital: either binary (eg. questions regarding readiness to cooperate in different situations and participation in different types of elections) or ordinal (eg. questions regarding trust for different groups of people and organizations and relations with four direct neighbours).

IRT (item response theory) models provide the most elaborate and complete methodology for investigating latent traits for variables measured on dichotomous and ordinal level and are used for revealing scales in those kinds of data. They assume, that respondents'

answers are determined by the latent (hidden) traits that are modelled, and that can only be observed with some errors through responses for the survey's questions (called items). In the study there was used a nonparametric IRT - Mokken Model (Mokken, 1997) and its extension for polytomous item scores (Molenaar, 1997). These models are cumulative scale models, used to investigate unidirectional latent traits (especially appropriate for measuring different kinds of resources, including social capital, see Van Der Gaag, Snijders, 2005). They are stochastic generalizations of the Guttman scale (Sijtsma and Molenaar, 2002), which assumes that all items reflect the same latent trait but some are easier (more popular) and some are more difficult (less popular). Mokken scaling method (possible to be performed in STATA software) helps to verify, if data structure is in accordance with this theoretical scale and if the existing differences can be explained only as random errors. This procedure starts by taking the mostly associated pair of items, and continuing by gradually adding of well-fitting items until obtaining a scale that does not improve further when other items are added. The scale is judged based on Loevinger's *H*-coefficient.

The nonparametric IRT models were used in the study in the first place to verify, which questions measure one latent trait, and which should be excluded when constructing an aggregated indicator of this trait. Secondly, using measurement properties implied by those models, it was possible to construct very simple aggregate indicators of social capital. The models are powerful enough to justify the ordering of persons using the total score (Sijtsma and Molenaar, 2002), which means that as long as the questions constitute one scale, the ordinal indicator of the hidden latent trait can be counted as a sum of answers for those questions, both for binary and ordinal data.

For constructing each of aggregated indicators, there was also an alternative, parametric method applied, also appropriate for the binary and ordinal data. This method is called "underlying variable approach" (Barthomolew, Steele, Moustaki, Galbraith, 2002). In this approach the observed binary or ordinal variables (answers to the survey's questions) are perceived as realizations of continuous underlying variables. These underlying variables are continuous but incompletely observed - answers for questions indicate whether or not those variables exceed some thresholds. These incompletely observed continuous variables are treated as they had been generalized by the classical factor analysis model. It is possible to fit such a model if a proper correlations' matrix is used - tetrachoric<sup>3</sup> for binary data and polychoric<sup>4</sup> for ordinal data. This method needs several assumptions (see for reference Barthomolew, Steele, Moustaki, Galbraith, 2002), but it gives similar results to parametric IRT models (like Rasch Model for binary data and Rating Scale Model for ordinal data) and can be performed in broadly accessible software like STATA. More advanced issues about possible use of factor analysis for binary and ordinal data may be found in Barthomolew, Knott (1999); a general introduction to tetrachoric and polychoric correlations is made in Uebersax (2006).

The aggregated indicators constructed on the bases of this method may be treated as interval variables, they have much more levels than the simple sum of scores' indicators counted after nonparametric IRT model. At the same time nonparametric IRT scaling gave an useful indication which questions should be considered for the constructing each of the

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<sup>3</sup> In general, tetrachoric correlation estimates the Pearson correlation that would be obtained if the two, incompletely observed, variables measured on dichotomous scale, were measured continuously.

<sup>4</sup> Polychoric correlation is especially appropriate for ordinal data that are realisations of underlying continuous variables, tetrachoric correlation is a special case of polychoric correlation.

indicators and in this way the both methods used mutually supplement each another. In addition, both types of indicators built in the study turned out to be very highly correlated, which improves their reliability.

## 2.2 Factors determining informal cooperation among Polish farmers

Analysis of the role of social capital as conducive factor to informal cooperation<sup>5</sup> was based on the previously created indicators of individual social capital. K-means cluster analysis was carried out to define groups of farm households with the maximum homogeneity within the groups and maximum heterogeneity between the groups. Four variables were used to profile the clusters: readiness to cooperate, trust towards people and local institutions, relations with neighbours and attendance in the elections. As this taxonomic method requires to indicate the number of clusters the grouping procedure was limited to division into two subsets only. This decision was based on the *a priori* assumption that household head can represent bigger or smaller level of individual social capital. The share of farms cooperating informally was used as a cluster validation variable.

As it was hypothesised in this study, the lack of essential production factors necessary to conduct agricultural activity constitute incentive to informal cooperation with other farmers. As the initial method of statistical verification, k-means cluster analysis with the Gower's dissimilarity coefficient for a mix of binary and continuous variables was used. Several variables describing production potential were chosen to profile the clusters: characteristics of the farm (machinery equipment: tractor, plough, sowing machinery, chemical spraying, harvesting machinery, milk device, lorry/truck; livestock, total cultivated area, total number of plots, distance to the most distant plot, farming with household's labour only, credit for production and marketing); characteristics of the household head (percentage of time on-farm, age, level of education, agricultural education, agricultural experience) and engagement of household's members in non-farm activities (household's member in wage employment or self-employment). The share of farms cooperating informally was used as cluster validation variable.

Concerning previously applied cluster analysis as a preliminary method of data mining, the next step included logistic regression model as the main method allowing for identification of variables statistically significant in explaining informal cooperation among farmers. Several variables were tested for their predictive power in order to verify the hypothesis that individual level of social capital positively influence informal cooperation while the better equipment with different production factors limits incentives to informal cooperation. Dummy variable for engagement in informal cooperation with other farmers was chosen to be explained by the model. The set of independent variables included: indicators of individual social capital, machinery equipment, agricultural land, farm labour, engagement in non-agricultural activities and village dummies.

**Indicators of individual social capital** (for detailed information see paragraph 2.1): Four variables were chosen: readiness to cooperate, trust towards people and local institutions, relations with neighbours and attendance in elections.

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<sup>5</sup> The questionnaire implemented within the SCARLED project contained the set of questions concerning informal cooperation in form of common use of different production factors (such definition of informal cooperation applies throughout this study) (see paragraph 4.2).

**Machinery equipment:** The following dummy variables were used as proxies for machinery equipment: tractor, plough, sowing machinery, chemical spraying, harvesting machinery and lorry/truck.

**Agricultural land:** Total cultivated area (ha) reflects the production potential of the farm; number of plots and distance to the most distant plot are proxies for internal transaction costs.

**Farm labour:** The following variables were chosen: age of HH, agricultural education (dummy: 1 - agricultural education, 0 - otherwise) and the level of education of HH (dummy variable was defined as follows: 1 - secondary or post-secondary education, 0 - incomplete primary, primary or middle school, basic vocational), percentage of time on-farm (HH) and farming with household's labour only (dummy variable defined as follows: 1 - only household's labour, 0 - otherwise).

**Farm household members' engagement in non-farm activities:** Two dummy variables were chosen: engagement in wage employment and engagement in self-employment. These variables were included in the model as a potential measures of external (to farming) sources of financial funds. This approach was based on the assumption that wage or self-employment incomes can be transferred (if necessary) to agricultural part of household's activity.

**Village dummies variables:** These dummy variables were chosen as characterizing the "locality" of villages in reference to specific economic, social and cultural conditions (the set of indicators revealing differences between villages is presented in annex 1).

### 2.3 The role of informal cooperation for farm households commercialisation

This part of the study is focused on the verification if different kinds of informal cooperation - among other factors - positively influence the level of farms' market participation measured as the share of agricultural output sold. Specification of multiple regression model was hold on the basis of the following general equation describing potential factors that can explain the level of commercialisation:

$$(3) \quad SAOS = \frac{S}{P} = \frac{P - C}{P} = 1 - \frac{C}{P}$$

SAOS - share of agricultural output sold (proxy for the level of farm's commercialisation)

S - sales of agricultural products

P - total production of agricultural products

C - consumption of self-produced food

According to the forgoing equation the level of commercialisation depends negatively on the level of household's own consumption and positively on the level of total production. Thus, all factors of production used in agricultural activity should positively affect the level of total production and in consequence the level of commercialisation. Moreover, following the reasoning that scarcity of own production factors leads to informal cooperation, it can be presumed that informal cooperation is a proxy for non-owned but used lacking factors of production. Summarizing, the total collection of production factors used in farming consists of owned and accessible ones.

In order to test our hypothesis multiple regression model was calculated in which share of agricultural output sold was explained by the set of independent variables: machinery equipment, agricultural land and livestock, farm labour, distance to the nearest urban centre, share of food consumption from own production, different kinds of informal cooperation and the current aims for agricultural production.

**Machinery equipment:** Unlike in the Logit model, a machinery equipment variable (an aggregated indicator) was created by using factor analysis<sup>6</sup> (principal components analysis method for the initial extraction of common factors with varimax rotation) based on the input data in form of a matrix of tetrachoric correlation coefficients<sup>7</sup> (see paragraph 2.1 for the methodological introduction). Moreover, dummy variable describing the use of own machinery for providing services to others was included.

**Agricultural land and livestock:** Total cultivated area (ha) as a proxy for production potential and number of plots, and distance to the most distant plot as proxies for internal transaction costs were used. Livestock was included in form of dummy variable - on the one hand animal husbandry can positively influence the level of commercialisation if considered as a contribution to production potential; on the other hand livestock can be slaughtered and used for own consumption and in this way negatively influencing commercialisation.

**Farm labour:** The following variables were chosen: age of HH, agricultural education (dummy: 1 - agricultural education, 0 - otherwise) and the level of education of HH (dummy variable was defined as follows: 1 - secondary or post-secondary education, 0 - incomplete primary, primary or middle school, basic vocational), percentage of time on-farm (HH) and farming with household's labour only (dummy variable defined as follows: 1 - only household's labour, 0 - otherwise).

**Distance to the nearest urban centre (km):** This variable was included as a proxy for external transaction costs.

**Share of food consumption from own production:** This variable was used as a proxy for the level of consumption of self-produced food (see equation 3).

**Informal cooperation:** Four kinds of informal cooperation were used as dummy variables: common use of machinery, common use of transportation means, common purchase of production inputs and help in field work.

**Aims for agricultural production:** A list of ordinal variables measuring attitudinal statements on 5 - point Likert scales (from 1 - 'Totally disagree' to 5 - 'Totally agree') were obtained from the SCARLED questionnaire, which were treated as proxies of underlying continuous latent traits (different groups of aims for agricultural production). In order to get estimations of those traits, factor analysis (principal components analysis method for the initial extraction of common factors with varimax rotation) was applied. As input data a matrix of polychoric correlation<sup>8</sup> coefficients was used (see paragraph 2.1 for

<sup>6</sup> In the Logit model it was important to identify which machinery is significant in explaining informal cooperation. In regression model only general information on the agricultural equipment is considered as important for commercialisation.

<sup>7</sup> Tetrachoric correlation matrix was calculated using the following binary variables: tractor, plough, sowing machinery, chemical spraying, harvesting machinery, lorry/truck and milk device.

<sup>8</sup> Polychoric correlation matrix was calculated using the following ordinal variables measured on Likert scale - attitudinal statements: to provide food for the household, to provide work for household members, to enjoy farming, to generate cash income, we only produce for the provision of safe food for the household, we do not produce for pecuniary reasons.

introduction). On the basis of the obtained parameters' estimations, two aggregated indicators of aims for agricultural production were calculated, which, for the purpose of further analysis (multiple regression), could be treated as interval variables.

### 3 SELECTION PROCEDURE AND DESCRIPTION OF SURVEYED REGIONS IN POLAND

In Poland, the selection of regions and villages was made taking into account a previous survey done within the IDARA project (Strategy for Integrated Development of Agriculture and Rural Areas in CEE Countries, financed under the Sixth Framework Programme for Research). This approach allows for using historical data gathered within the IDARA project and for comparing the results of both surveys.

For the SCARLED survey sample regions at NUTS-3 level were selected according to their degree of economic development. The criteria was based on the level of GDP *per capita* for the total number of 45 NUTS-3 regions<sup>9</sup> with reference to average national level (GDP *per capita* in Poland = 100). However, big urban centres were finally excluded (Table 1).

**Table 1. Regions excluded from the selection procedure (data: year 2004)**

NTS-3 regions	GDP <i>per capita</i> (Poland=100)
Łódź City	120.4
Wrocław City	142.1
Gdańsk-Gdynia-Sopot Cities	143.6
Kraków City	155.0
Poznań City	203.2
Warszawa City	281.8

Source: Central Statistical Office.

All remaining 39 NUTS-3 regions in Poland were ranked in ascending order to facilitate selection. Finally, selected regions were divided into 3 groups (each group counts 13 NTS-3 regions) according to the value of GDP *per capita*: lagging behind, average and prosperous ones (Table 2).

**Table 2. Selection procedure - basic statistics (data: year 2004)**

Group of NTS 3 regions*	GDP <i>per capita</i> (average rate within the group)**	Standard deviation**	Minimum value of GDP/capita**	Maximum value of GDP/capita**
Lagging behind	81.25	7.96	70.22	92.99
Average	97.64	3.61	93.29	103.62
Prosperous	121.10	14.81	105.84	152.96

\* Each group counts 13 NTS-3 regions

\*\* Country average = 100 after exclusion of 6 big urban NTS-3 regions

Source: Own calculation based on data from Central Statistical Office.

Further, among all villages placed in 39 selected regions, these which are systematically surveyed by Polish subcontractor IERiGŻ (Institute of Agricultural and Food Economics - National Research Institute) were chosen (76 villages). Moreover, 5 villages (out of 76) have been surveyed within the IDARA project. As the main goal of the SCARLED project is to capture structural change in rural areas, decision for matching the data from both surveys has been made. Therefore, from the number of 76 villages geographically placed

<sup>9</sup> Sampling procedure was carried out in 2007 on the basis of the previous country division into (classification of) 45 NTS-3 regions. Currently, Poland is divided into 66 regions. More information can be found in the next paragraph.

in 39 NUTS-3 regions ranked in ascending order, the following selection was made (Table 3):

- From the group of lagging behind regions: selection of 2 villages surveyed in IDARA plus 1 random selection,
- From the group of average regions: selection of 3 villages surveyed in IDARA project,
- From the group of prosperous regions: all 3 villages are selected randomly.

**Table 3. Survey regions in Poland (data: year 2004)**

Group of regions	NTS 3 region	GDP per capita		Village
		Country average=100	Poland=100	
Lagging behind	Krośnieńsko-Przemyski	72.39	60.0	Wróblowa*
	Łomżyński	77.72	64.5	Święck Wielki*
	Ostrołęcko-Siedlecki	84.40	70.0	Ulasek
Average	Rzeszowsko-Tarnobrzeski	93.78	77.8	Bzianka*
	Białostocko-Suwalski	94.30	78.2	Andryjanki*
	Jeleniogórsko-Watbrzyski	97.34	80.7	Witoszów Dolny*
Prosperous	Warszawski	114.41	94.9	Chrzczany
	Bydgoski	114.83	95.3	Sławsk Wielki
	Ciechanowsko-Płocki	133.67	110.9	Białyszewo

\* Surveyed under IDARA

Source: Own calculation based on data from Central Statistical Office.

In consequence, amongst 9 villages selected to the SCARLED survey 5 villages were surveyed in the IDARA project in 2000. In every village 30 households were randomly chosen by interviewer (irrespectively of the household being a farming household or not). Finally, 270 observations were obtained in Poland.

Sample selection procedure applied in Poland varies slightly from other countries participating in the SCARLED project. The difference is related to the geographic criteria which signifies that group of 3 villages should be located in the same NTS-3 region. Sample selected in Poland does not meet this condition due to the necessity of matching the data obtained from the SCARLED with the IDARA projects. Selection procedure in the IDARA was based on the regions at NTS-2 level instead of NTS-3 level (as in the SCARLED). As a result, it was impossible to chose villages situated in the same region.

### 3.1 Description of selected regions

Sampling procedure was carried out in 2007 on the basis of the previous country division into (classification of) NTS-3 regions<sup>10</sup>. Currently, Poland is divided into 66 regions what results in the situation that some of the selected villages are presently assigned to different regions than before (Table 4).

<sup>10</sup> Until 2007 Poland was divided into 45 regions at NTS-3 level.

Table 4. New division into NTS-3 regions

Group of regions	Village	Previous classification		Present classification		
		NTS 3 region	GDP per capita* (2004)	NTS 3 region	GDP per capita*	
					2004	2006
Lagging behind	Wróblowa	Krośnieńsko-Przemyski	72.39	Krośnieński	75.61	75.78
	Święć Wielki	Łomżyński	77.72	Łomżyński	76.75	76.78
	Ulasek	Ostrołęcko-Siedlecki	84.40	Ostrołęcko-Siedlecki	84.05	89.32
Average	Bzianka	Rzeszowsko-Tarnobrzeski	93.78	Rzeszowski	90.95	91.06
	Andryjanki	Białostocko-Suwalski	94.30	Łomżyński	76.75	76.78
	Witoszów Dolny	Jeleniogórsko-Wałbrzyski	97.34	Wałbrzyski	96.26	95.73
Prosperous	Chrzczany	Warszawski	114.41	Warszawski Zachodni	130.96	140.61
	Sławsk Wielki	Bydgoski	114.83	Włocławski	94.07	90.93
	Białyszewo	Ciechanowsko-Płocki	133.67	Ciechanowsko-Płocki	133.35	127.81

\* Country average = 100

Source: Own calculation based on data from Central Statistical Office.

Introduction of the “new” classification of NTS-3 regions resulted in a necessity of adjusting statistical data. Therefore, the current data for “old” country division is not available anymore, which has to be taken into consideration in the description of selected regions. Moreover, within the “new” classification the largest NTS-3 regions were divided into smaller geographical units. In consequence, the available statistical data appropriate for the present classification, changed significantly in comparison with the previous one (Table 4). To solve the problem of inconsistency of the data, a decision about changing the level of aggregation has been made. Selected villages were located in the same NTS-4 regions independently of the NTS-3 classification (Table 5), therefore description of regions chosen to the SCARLED survey is based on the characteristics of regions at NTS-4 level<sup>11</sup>.

Table 5. Classification at NTS-4 level

Group of regions	Village	NTS 4 region (Poviat)	Previous classification NTS 3 region	Present classification NTS 3 region
Lagging behind	Wróblowa	Jasielski	Krośnieńsko-Przemyski	Krośnieński
	Święć Wielki	Wysokomazowiecki	Łomżyński	Łomżyński
	Ulasek	Wyszowski	Ostrołęcko-Siedlecki	Ostrołęcko-Siedlecki
Average	Bzianka	Rzeszowski	Rzeszowsko-Tarnobrzeski	Rzeszowski
	Andryjanki	Bielski	Białostocko-Suwalski	Łomżyński
	Witoszów Dolny	Świdnicki	Jeleniogórsko-Wałbrzyski	Wałbrzyski
Prosperous	Chrzczany	Sochaczewski	Warszawski	Warszawski Zachodni
	Sławsk Wielki	Inowrocławski	Bydgoski	Włocławski
	Białyszewo	Sierpecki	Ciechanowsko-Płocki	Ciechanowsko-Płocki

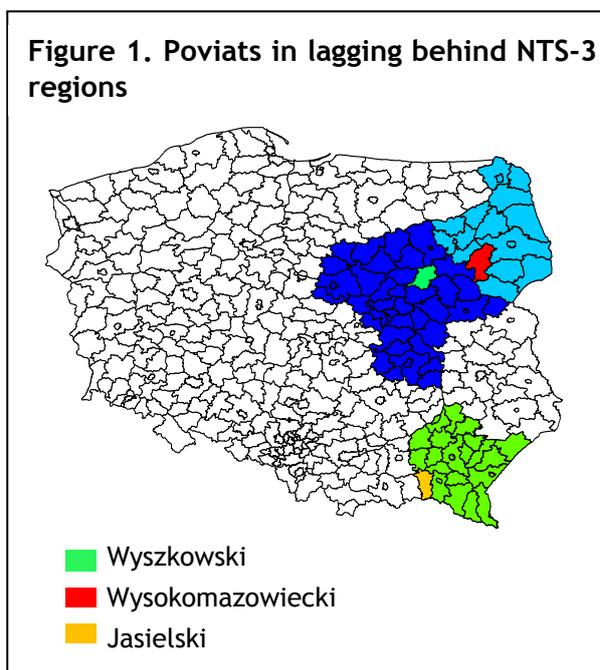
Source: Central Statistical Office.

<sup>11</sup> Poviat (Polish Administrative Unit at NTS-4 level) constitutes a group of communes (NTS-5 level).

**NTS-4 regions situated in the respective lagging behind NTS-3 regions**

**Wyszkowski region** is located about 55 km northeast of Warsaw. In terms of natural geography, this region is marked by lowlands, primeval forests (Puszcza Biała, Puszcza Kamieniecka) and rivers (Bug, Narew, Liwiec). The density of population is much below the country average (86 against 122 persons per km<sup>2</sup>). About 62% of total population is represented by population in working age, while 14.5% in post-working age. Among all employed persons, 45.8% work in agriculture, 20.3% in industry sector and 33.9% in services. Unemployment rate (15.4%) is a bit higher than the domestic average (11.2%). Average monthly gross wage and salary in relation to the country average is quite low - 78.6% (2 251.45 zł).

**Figure 1. Poviats in lagging behind NTS-3 regions**



**Wysokomazowiecki region** is located in the south-west part of Podlaskie Voivodeship. In the group of “lagging behind NTS-4 regions” it is the least densely populated (46 persons per km<sup>2</sup>), having 2.7 times lower population than the country average. As regards the economic development, agriculture is the most important sector, employing more than 65% of working population. Unemployment rate is relatively low (7.6%) and the average monthly gross wage and salary amounts to 2 389.5 zł (83.4 % of the country average).

**Table 6. Characteristics of NTS-4 regions (lagging behind regions at NTS-3 level)**

Year 2007	Poland	NTS 4 region (Poviat)		
		Wyszkowski	Wysokomazowiecki	Jasielski
Density of population (per km <sup>2</sup> )	122	82	46	138
Population (% of total)				
in pre-working age	19.6	23.2	22.1	21.8
in working age	64.4	62.3	59.4	62.4
in post-working age	16.0	14.5	18.5	15.8
Employed persons (% of total)				
in agricultural sector	16.0	45.8	65.2	33.0
in industry sector	29.0	20.3	14.9	30.6
in services sector	55.0	33.9	20.0	36.4
Unemployment rate	11.2	15.4	7.6	16.8
Average monthly gross wages and salary (Poland=100)	100	78.6	83.4	80.3

Source: Central Statistical Office.

**Jasielski region** is situated in the south-west part of Podkarpackie Voivodeship. In terms of natural conditions, this region is divided into two different parts: north is marked by highland and south by mountains. Compared to the others, Jasielski region is the most densely populated (138 persons per km<sup>2</sup>). Agricultural sector employs 33% of working population. Unemployment rate is relatively high (16.8%) and the average monthly gross wage and salary amounts to 2 302.79 zł (80.3 % of the country average).

#### NTS-4 regions situated in the respective average NTS-3 regions

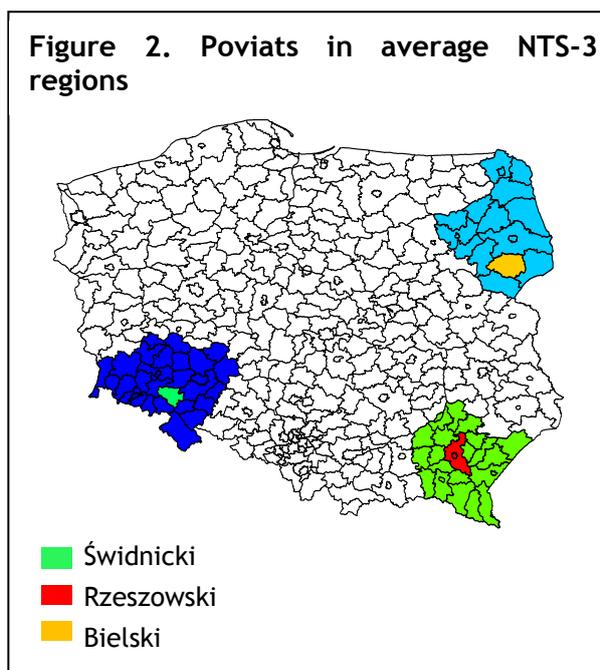
**Świdnicki region** is situated in the south part of Dolnośląskie Voivodeship. About 15% of its area is covered by the high value natural environment: scenic parks, nature reserves, etc. Among the group of "average NTS-4 regions" it is the most densely populated one (216 persons per km<sup>2</sup>). Relatively high proportion of population is currently in working age (65.7%). Predominantly, working population is employed in industry sector (47.3%) and services (41.7%), and only 11% in agricultural sector. Unemployment rate is close to the country average (12.1%) but wages and salaries are below (87.5% of domestic average).

**Rzeszowski region** is situated in central

part of Podkarpackie Voivodeship, near its capital - Rzeszów City. The economy of this region is primarily based on agriculture but services sector is also very important. The advantage of this region is good traffic connection to Ukraine and Slovakia. The density of population is above country average, unemployment rate is quite high (15.1%), and wages and salaries notably lower than country average (74.2%).

**Bielski region** is located in the area of so-called "Green Lungs of Poland", in the south part of Podlaskie Voivodeship. About 19% of its area is covered by forests and primeval forest. For this reason, tourism is very popular in Bielski region. International traffic connections in north-south and west-east directions are also very significant for its economic development. It is the least densely populated region in the group of "average NTS-4 regions" (only 43 persons per km<sup>2</sup>). Agriculture is predominant sector employing 56.7% of working population. Unemployment rate is relatively low (7.5%) and wages and salaries lower than country average (87.1%).

Figure 2. Poviats in average NTS-3 regions



**Table 7. Characteristics of NTS-4 regions (average regions at NTS-3 level)**

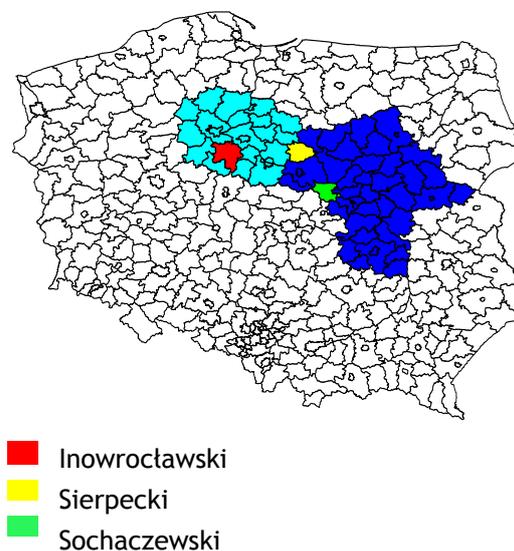
Year 2007	Poland	NTS 4 region (Poviat)		
		Świdnicki	Rzeszowski	Bielski
Density of population (per km <sup>2</sup> )	122	216	141	43
Population (% of total)				
in pre-working age	19.6	18.6	23.0	18.9
in working age	64.4	65.7	61.5	58.4
in post-working age	16.0	15.7	15.5	22.6
Employed persons (% of total)				
in agricultural sector	16.0	11.0	46.2	56.7
in industry sector	29.0	47.3	23.4	18.4
in services sector	55.0	41.7	30.4	24.9
Unemployment rate	11.2	12.1	15.1	7.5
Average monthly gross wages and salary (Poland=100)	100	87.5	74.2	87.1

Source: Central Statistical Office.

**NTS-4 regions situated in the respective prosperous NTS-3 regions**

**Inowrocławski region** is situated in the south part of Kujawsko-Pomorskie Voivodeship. In terms of natural geography, this region is marked by lowlands with a big number of lakes. As regards the area Gopło Lake is the 11<sup>th</sup> in Poland. This region`s density of population is a bit higher than country average. Among the group of “prosperous NTS-4 regions” the rate of working population employed in agricultural sector is the lowest (21.8%). Predominant sectors employing people in this region are services (42.4%) and industry sector (35.8%). Unemployment rate is relatively very high (22.3%), and wages and salaries much lower than domestic average (78.5%).

**Figure 3. Poviats in prosperous NTS-3 regions**



**Sierpecki region** is located in the north-west part of Mazowieckie Voivodeship. Within its area a very important traffic connections are situated, linking Warsaw with cities in the north. It is a typical agricultural area with the high rate of employment in this sector (50.3%). Services and industry sector employ respectively 30.4% and 19.3% of working population. The essential advantage of the region are its favourable natural conditions to farming: good quality of soil, climate and low pollution. Unemployment rate is relatively high (19.7%), and wages and salaries much lower than domestic average (77.1%).

**Sochaczewski region** is located in the west part of Mazowieckie Voivodeship. This region's relief is mostly plain and about 15% of its area is covered by forests and primeval forest. It has a good connection with Warsaw (about 50 km distance). Agricultural sector employs 28.8% of working population, industry 26.7% and the most important in this region, services 44.5%. Unemployment rate is relatively low (9.8%), and wages and salaries similar to domestic average (99.3%).

**Table 8. Characteristics of NTS-4 regions (prosperous regions at NTS-3 level)**

Year 2007	Poland	NTS 4 region (Poviat)		
		Inowrocławski	Sierpecki	Sochaczewski
Density of population (per km <sup>2</sup> )	122	134	63	114
Population (% of total)				
in pre-working age	19.6	19.9	23.1	20.7
in working age	64.4	65.4	60.7	63.6
in post-working age	16.0	14.8	16.2	15.7
Employed persons (% of total)				
in agricultural sector	16.0	21.8	50.3	28.8
in industry sector	29.0	35.8	19.3	26.7
in services sector	55.0	42.4	30.4	44.5
Unemployment rate	11.2	22.3	19.7	9.8
Average monthly gross wages and salary (Poland=100)	100	78.5	77.1	99.3

Source: Central Statistical Office.

#### 4 SOCIAL CAPITAL AND COOPERATION AT THE FARM LEVEL - DESCRIPTIVE ANALYSIS OF THE SCARLED SURVEY DATA

Analysis of social capital and cooperation between farmers is based on data from the SCARLED survey. Analysis is carried only among those 245 households, which conducted agricultural activity in 2006, as data collected on social capital and cooperation refer to this year.

##### 4.1 Characteristics of households

Within this group of households, 127 respondents pointed out the income band for their total annual net income for 2006. Table 9 presents the share of households in the group analysed by income band. Income bands 5 and higher represent income higher than the average income in rural areas for the year 2006 (Social Diagnosis 2007), which constitutes together the share of 52% households (79 households).

**Table 9. Share [%] of households by income bands [PLN] (total annual net income for 2006) - only households which conducted agricultural activity in 2006**

1	2	3	4	5	6	7	8	9	10
0-6338	6339-12676	12677-19014	19015-25353	25354-31691	31692-38029	38030-44367	44368-50705	50706-57043	>57043
0.79%	6.30%	14.17%	16.54%	19.69%	10.24%	7.87%	6.30%	3.94%	14.17%

Source: Own calculations: data from the SCARLED survey.

As only around half of the respondents decided to indicate their income band<sup>12</sup>, another question that may be considered as a source of information about farms' well being is the one about economic perspectives: "How do you evaluate the economic prospects of your farm within a timeframe of 5 years? Please rate on a scale from (1) not competitive/low profitability to (5) very competitive/high profitability."

**Table 10. Economic prospects of the farm within 5 years - number of households within lagging behind, average and prosperous regions**

Prospects:	not competitive	◀◀	◀◀▶▶	▶▶	very competitive	total
	(1)	(2)	(3)	(4)	(5)	
lagging behind regions	42	14	20	7	0	83
average regions	21	13	29	19	1	83
prosperous regions	22	10	36	9	1	78
<b>Total</b>	<b>85</b>	<b>36</b>	<b>85</b>	<b>35</b>	<b>2</b>	<b>244</b>

Source: Own calculations: data from the SCARLED survey.

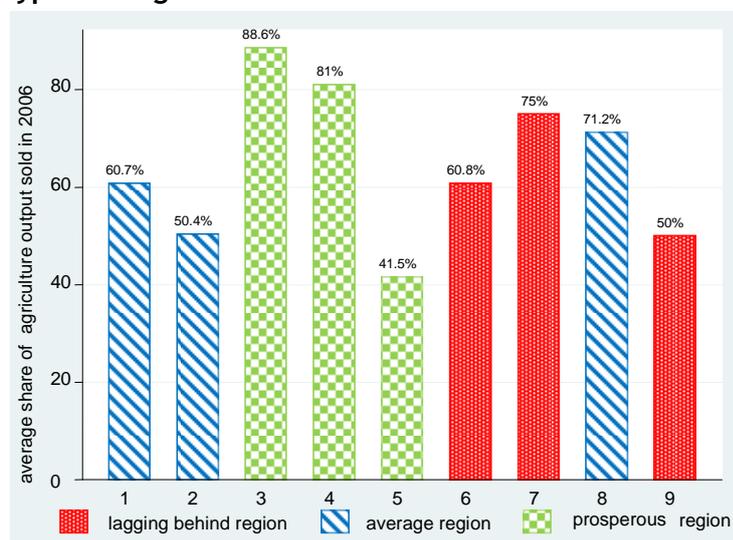
As it can be seen in the Table 10, only 2 respondents see their farms in the 5-year time as "very competitive". It can be also noted, that perceived economic prospects are lower in lagging behind regions than in average and prosperous regions, as it should be expected.

<sup>12</sup> In one of the lagging behind villages (Wróblowa) and one of the prosperous villages (Chrzczany) none of the interviewees indicated their income band. In other lagging behind regions, 23 (Święck Wielki) and 24 (Ulasek) of respondents indicated their income band. In average regions those numbers were: 15 (Andryjanki), 27 (Bzianka) and 8 (Witoszów). In the two remaining prosperous regions, 12 (Białyszewo) and 18 (Stawsk Wielki) interviewees indicated their income band.

The other important factor of farms' welfare is the area of land owned. Individual area of land owned by households under the study varied from 0 to 37 hectares. The village's average area of land owned by a farm varies from 2.6 to 15.4 ha and it is the highest in two villages: one from prosperous and one from average region, and the lowest in two villages: one from lagging behind and one from average region.

From the point of view of the model proposed in the study, one of the most crucial economic households' characteristics is their level of commercialisation, which can be measured by the share of agriculture output sold. Figure 4 presents an average share of agricultural output sold in 2006 indicated by respondents from different villages. As it can be seen, the highest average share of agricultural output sold is indicated in two prosperous villages, but also the lowest share of agricultural output sold is in a village from a prosperous region (Sławsk Wielki).

**Figure 4. Average share of agricultural output sold in 2006 by village from different types of regions**



Source: Own calculations: data from the SCARLED survey.

To summarize, the most important characteristics of households further used in the descriptive analyses of data on social capital and cooperation are:

- type of region in which the household is located (lagging behind, average and prosperous);
- household's income band (indicated only by around 50% of respondents);
- household's economic prospects perceived;
- area of land owned;
- share of agricultural output sold (indicator of commercialisation).

## 4.2 Informal cooperation

The following question about informal cooperation between farmers was asked: "Do you cooperate with other farmers informally (e.g. using machinery, buildings, etc.)? Among 245 households, which conducted agricultural activity in 2006, 145 said "no" and 96 said

“yes” (together 241 households answered this question). In Table 11 there are listed kinds of informal cooperation that farmers cooperating informally are involved in.

**Table 11. Kinds of informal cooperation - number of respondents cooperating and their percentage share among farmers cooperating**

Informal co-operation regarding:	No. of households among those 96 co-operating informally
common use of machinery	23 (24%)
common use of buildings	3 (3%)
common transportation means	23 (24%)
common sales of agricultural products	5 (5%)
common purchase of production inputs	13 (14%)
help in field works	74 (77%)
exchange of information	4 (4%)

Source: Own calculations: data from the SCARLED survey.

Most of the households that are engaged in informal cooperation, cooperate in form of helping each other in field works (77% of the households cooperating). Other popular forms of cooperation are common use of machinery and common use of transportation means (24% of informally cooperating households are engaged in each of those forms of help). The rarest forms of cooperation are: common use of buildings, common sales of agricultural products and exchange of information.

It may also be interesting to investigate, what are the characteristics of households that engage in informal cooperation. Generally, those informally cooperating households possess smaller area of land, have smaller income, worse economic prospects and bigger share of production in household consumption. They also concentrate in some villages, mainly: Chrzczany (from prosperous region), Wróblowa (from lagging behind region), Bzianka (from average region) and Ulasek (from lagging behind region).

To illustrate some of the foregoing statements regarding the characteristics of farmers cooperating informally: Table 12 shows informal cooperation by income bands, Figure 5 illustrates informal cooperation by area of land owned, Figure 6 informal cooperation by economic perspectives and Figure 7 gives average level of informal cooperation by type of region.

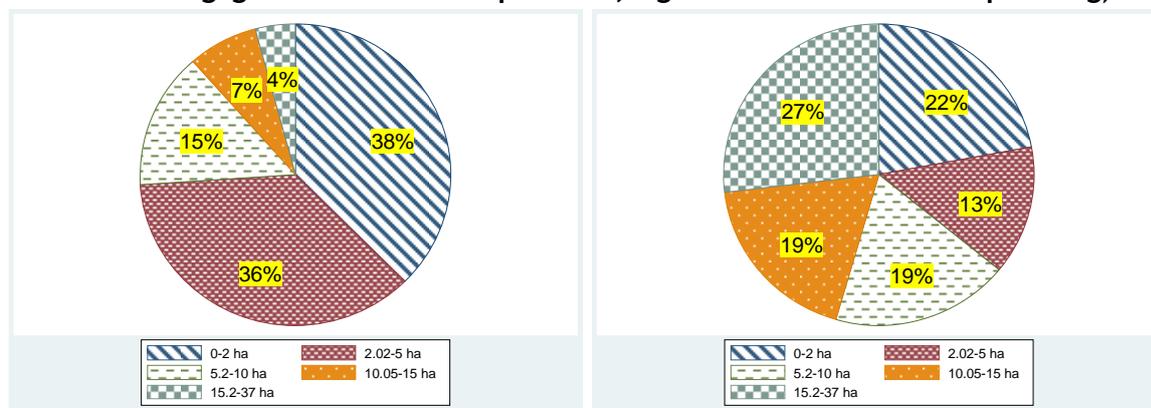
**Table 12. Informal cooperation by income band (no. of households)**

	Income bands									
	0-6338	6339-12676	12677-19014	19015-25353	25354-31691	31692-38029	38030-44367	44368-50705	50706-57043	>57043
informal cooperation	1	6	10	11	10	2	3	1	1	2
no informal cooperation	0	2	8	10	15	10	7	7	4	16

Source: Own calculations: data from the SCARLED survey.

As it can be observed in the Table 12, in the first four lowest income bands there are more households which are engaged in informal cooperation than these not engaged. In all higher income bands there are more households which do not cooperate informally than these cooperating.

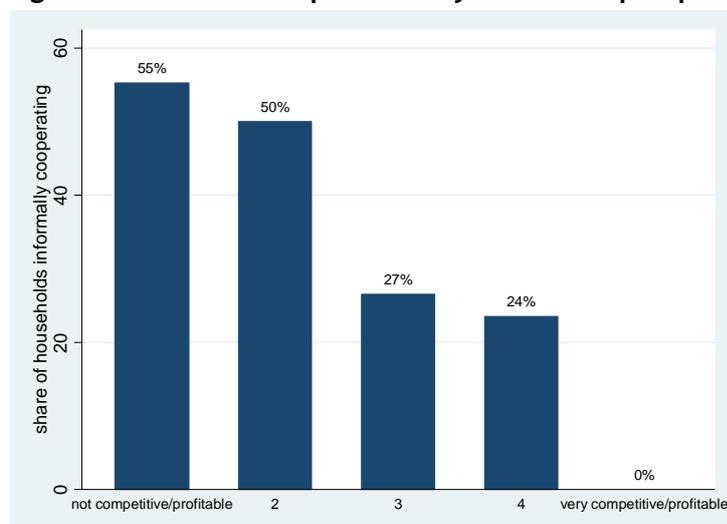
**Figure 5. Agricultural land owned by a household versus informal cooperation (left: households engaged in informal cooperation, right: households not cooperating)**



Source: Own calculations: data from the SCARLED survey.

More than 70% households informally cooperating possess up to 5 ha of area. At the same time, among households not cooperating, only around 35% are of that size. Therefore households which are engaged in informal cooperation are those of the smallest size (Figure 5).

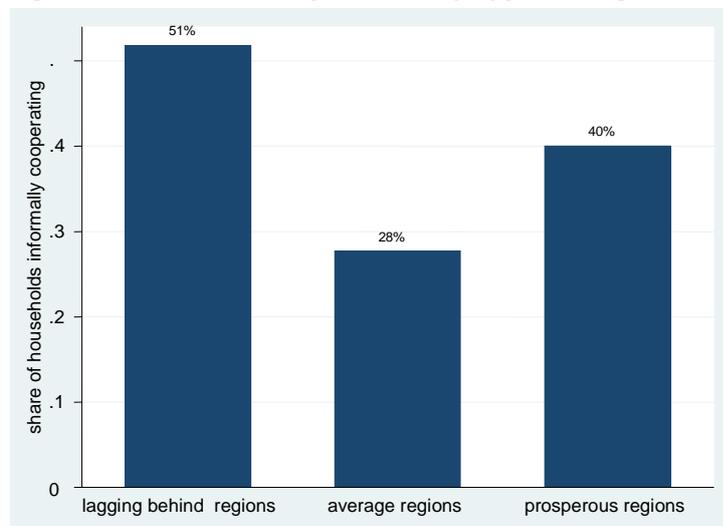
**Figure 6. Informal cooperation by economic prospects**



Source: Own calculations: data from the SCARLED survey.

The biggest share of households cooperating informally is between the group evaluating their households in the perspective of 5 years as not competitive and not profitable. This share decreases with better economic perspectives' perceived by the respondent.

Figure 7. Informal cooperation by type of region



Source: Own calculations: data from the SCARLED survey.

As in can be seen in the Figure 7, generally informal cooperation is the highest in lagging behind regions but it is still quite high in prosperous regions.

Respondents were also asked to evaluate benefits from informal cooperation with other farmers (see Table 13), as well as what were the barriers for such a cooperation (see Table 14). Those questions were asked only among those farmers who were engaged in informal cooperation.

Table 13. Evaluation of benefits from informal cooperation with other farmers - percent of respondents who indicated the given answer, among 96 respondents informally cooperating

	Not important at all	Of little importance	Of moderate importance	Very important	The most important	Lack of answer
	(1)	(2)	(3)	(4)	(5)	(0)
No need for additional investment in machinery	1.04	5.21	20.83	60.42	7.29	5.21
Increase in scale of production	39.58	28.13	16.67	9.38	0	6.25
Increase in sales revenue	38.54	34.38	16.67	5.21	0	5.21
Decrease in production costs	5.21	4.17	14.58	56.25	13.54	6.25
Higher prices for products	45.83	36.46	10.42	2.08	0	5.21
Possibility of signing contracts with purchasers	45.83	38.54	10.42	0	0	5.21
Possibility of signing contracts with production input providers	45.83	38.54	10.42	0	0	5.21
Gaining technological knowledge	39.58	36.46	13.54	5.21	0	5.21
Gaining knowledge of marketing	37.50	36.46	16.67	4.17	0	5.21

Source: Own calculations: data from the SCARLED survey.

The most important benefits from informal cooperation are “no need for additional investment in machinery” and “decrease in production cost”. This type of cooperation

looks very basic and traditional. It seems that these households lack long term strategy for developing agricultural activity.

As for the barriers for informal cooperation, Table 14 lists the share of respondents (among 96 households informally cooperating) who gave each of the possible answers, regarding different barriers for informal cooperation among farmers.

Farmers engaged in informal cooperation perceive barriers mainly as those of economic nature. They evaluate that the most significant barriers are: "production is not profitable" (it is very important or the most important barrier for around 79% of respondents), "there are no possibilities to receive higher price through common sales" (it is very important or the most important barrier for around 74% of respondents) and "there are no possibilities to receive lower price for production inputs" (it is very important or the most important barrier for around 76% of respondents). It is also an explanation, why farmers are involved mostly in help in field work, common use of machinery and common transport means.

**Table 14. Evaluation of barriers for informal cooperation with other farmers - percent of respondents who indicated the given answer, among 96 respondents informally cooperating**

	Not important at all	Of little importance	Of moderate importance	Very important	The most important	Lack of answer
	(1)	(2)	(3)	(4)	(5)	(0)
Other farmers do not wish to cooperate	15.63	34.38	36.46	13.54	0	0
It is not profitable	17.71	31.25	27.08	22.92	1.04	0
In general I do not trust in business cooperation with other people	9.38	50	36.46	3.13	0	1.04
I do not trust other farmers in my village	11.46	58.33	27.08	1.04	0	2.08
There are no possibilities to receive higher price through common sales	1.04	6.25	18.75	48.96	25	0
There are no possibilities to receive lower price for production inputs	1.04	4.17	18.75	62.5	13.54	0
Production is not profitable	1.04	8.33	12.50	44.79	32.29	1.04

Source: Own calculations: data from the SCARLED survey.

Respondents were also asked if they knew any example of informal cooperation in the closest surroundings. 61% (150 interviewees) of all respondents stated that they were aware of informal cooperation in the closest area. Those respondents were asked what kind of informal cooperation it was. The kinds of cooperation among farmers observed the most often by the respondents in the closet surrounding are: help in field work (79% of respondents who answered this question), common use of machinery (41%) and common use of transport means (30%), which is in accordance with the information about the informal cooperation performed by the respondents themselves.

Further all respondents were asked: "Will, in your opinion, intensity and frequency of cooperation among farmers change in the future? Please rate from 1 to 5. "1" means "will increase a lot", "5" means "will increase a lot". Around 62% of respondents chose the middle answer (3) indicating that they do not foresee any changes in cooperation in the

future. Other answers did not indicate any trend: answer 2 and 4 were chosen accordingly by 18% and 16% of respondents, answers 1 and 5 were chosen by 2% and 1%, 1% of respondents did not answer these questions.

Respondents were also asked to evaluate factors that can increase intensity and frequency of cooperation among farmers in agricultural activity.

In the opinion of the respondents, the most important factors that can increase intensity and frequency of cooperation among farmers are: necessity of help in field work (very important or the most important factor for around 53% of respondents), lack of necessary machinery (very important or the most important factor for around 53% of respondents) and possibility of common marketing and receiving higher prices for agricultural products (very important or the most important factor for around 49% of respondents).

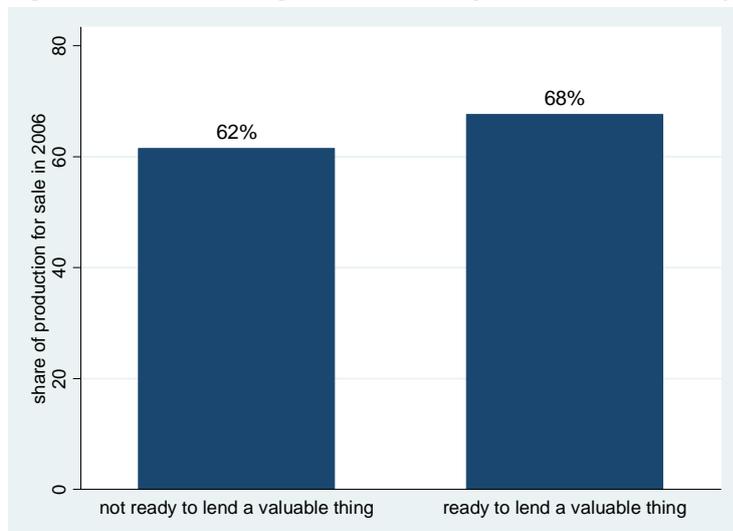
The following conclusions concerning informal cooperation can be drawn:

- the most popular form of informal cooperation is help in field works, other popular forms of informal cooperation are common use of machinery and common use of transportation means;
- informal cooperation is the most common among worse off farmers from different regions, but most often from lagging behind regions;
- the most important benefits from informal cooperation are: “no need for additional investment in machinery” and “decrease in production costs”;
- informal cooperation among farmers seems to be a substitute of economic resources and it may serve as “capital of the poor”.

### **4.3 Readiness to cooperate**

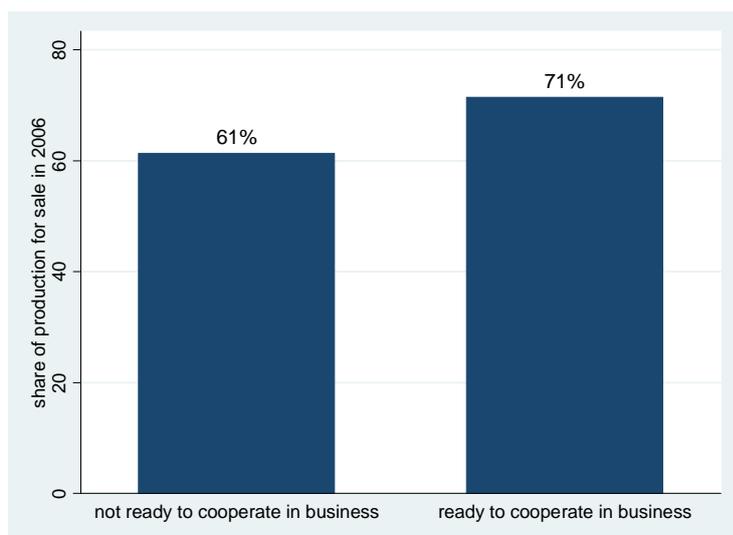
Within the survey, respondents were asked the following question: “Are you ready to cooperate with people (not from your family) in the following situations: a) lending valuable thing?, b) in business activity?, c) working in favour of your society? Among all the 245 interviewees, 47% of respondents are ready to cooperate by lending valuable thing, 30% are ready to cooperate in business activity and as much as 87% are ready to cooperate in working in favour of their society. Figures 8 - 10 illustrate readiness to cooperate in different situations specified by share of agricultural output sold in 2006 (as a proxy of farm's commercialisation). As it can be noticed, in all three situations readiness to cooperate is on average connected with higher share of agricultural output sold.

**Figure 8. Share of agricultural output sold in 2006 by readiness to lend a valuable thing**



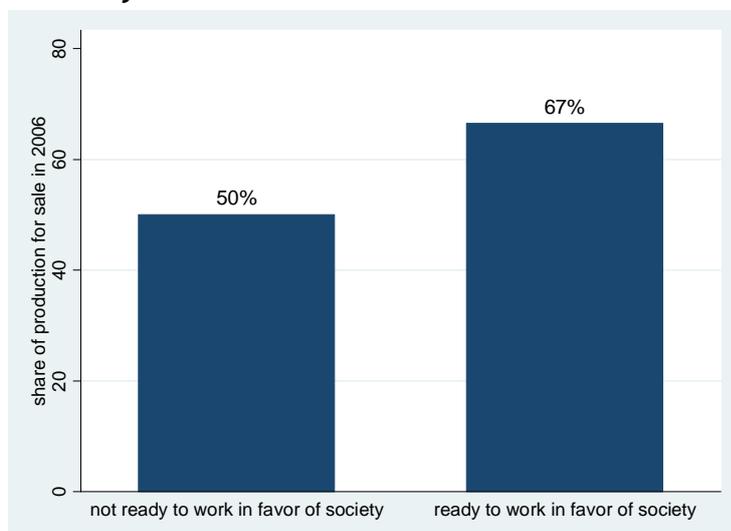
Source: Own calculations: data from the SCARLED survey.

**Figure 9. Share of agricultural output sold in 2006 by readiness to cooperate in business**



Source: Own calculations: data from the SCARLED survey.

**Figure 10. Share of agricultural output sold in 2006 by readiness to cooperate in favour of society**

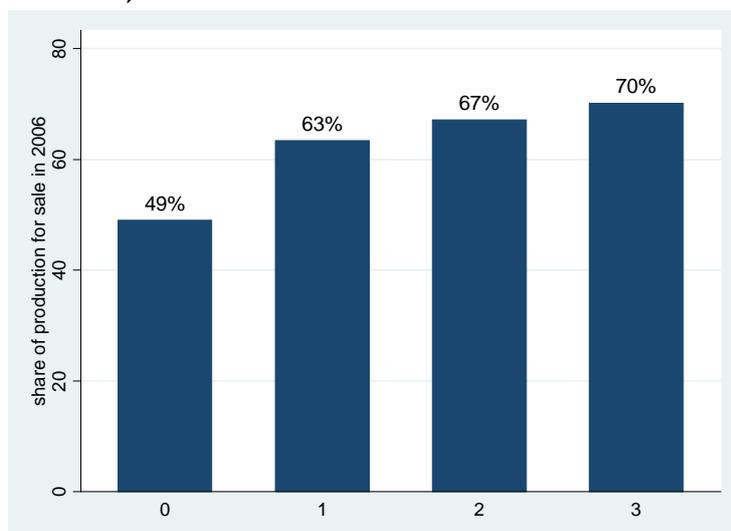


Source: Own calculations: data from the SCARLED survey.

In addition, it can be stated that readiness to cooperate in different situations specified is bigger in higher income bands and it can be especially seen in case of cooperation in work in favour of the society.

Nonparametric IRT model (Mokken model, see paragraph 2.1 for the introduction) helped to verify, that all 3 items (readiness to cooperate in three situation specified) constitute one scale, which means that the answers collected measure one, latent (hidden, immeasurable directly) trait (readiness to cooperate with people outside the family). “Working in favour of your society?” was found to be the easiest item, which means that respondents may agree to this item but at the same not agree to other, more difficult items. ‘Cooperation in business activity’ is the most difficult item, which means, that respondents agreeing to it are characterized by high level of the latent trait (readiness to cooperate with people outside family). To estimate the Mokken model, MSP procedure in STATA was used and it helped to state, that all 3 items constitute one strong scale. Nonparametric item response theory enables ordering of persons (according to the latent trait) using as an approximation simple total score - sum of scores for all the items constituting the scale. Therefore an indicator of readiness to cooperate was constructed as a sum of scores of three items: readiness to lend valuable thing, readiness to cooperate in business activity and readiness to cooperate in working in favour of society.

**Figure 11. Share of agricultural output sold by indicator of readiness to cooperate (sum of scores)**



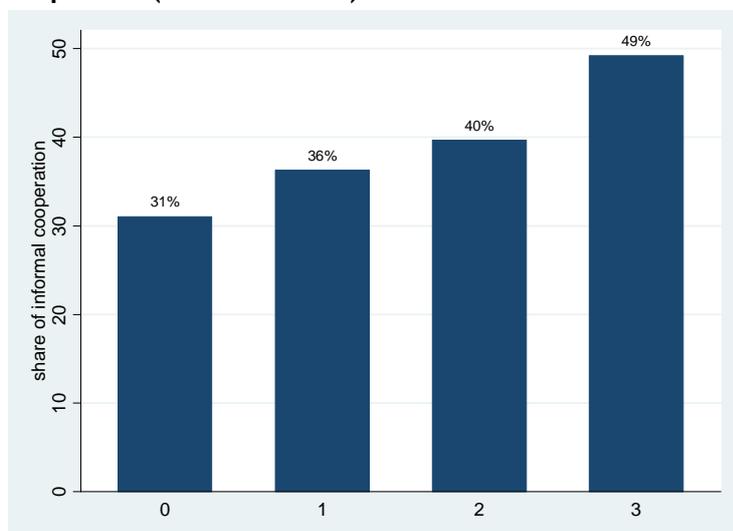
Source: Own calculations: data from the SCARLED survey.

In Figure 11 this indicator is used to evaluate the relation between the level of commercialisation (measured by a share of agricultural output sold) and readiness to cooperate. The indicator of readiness to cooperate (total score of three items) is presented on the horizontal axe. “0” is a level of this indicator for a respondent, who is not ready to cooperate in any of the three situations listed, “3” is the maximum score, achieved by respondents ready to cooperate in all three situations specified. As is can be seen in the figure, the higher is the level of readiness to cooperate, the higher is the share of agricultural output sold in 2006.

In Figure 12 the same indicator is used to see, what is the relation between the readiness to cooperate and informal cooperation. For each level of the indicator of readiness to cooperate, the percent of farmers cooperating informally is counted. As it can be seen, the higher is the level of readiness to cooperate, the higher percent of farmers is cooperating informally.

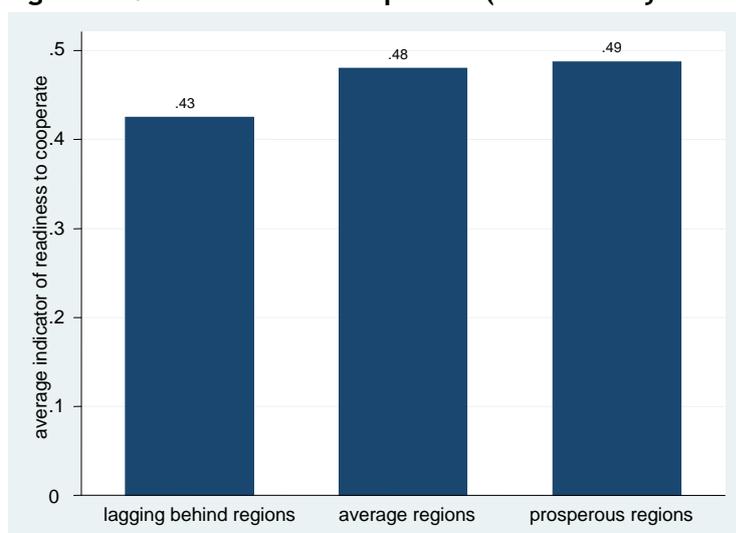
In addition, an alternative aggregated indicator of readiness to cooperate was constructed with use of factor analysis performed on tetrachoric matrix (see paragraph 2.1 for the introduction). As it turned out, both indicators, achieved by different methods, gave highly correlated results (correlation of 0.98), although “sum of scores” indicator has 4 levels and “factor analysis” indicator has 7 levels. The indicator based on factor analysis is used in Figure 13, which illustrates different levels of readiness to cooperate in different types of regions, showing that farmers from lagging behind regions are the least ready to cooperate.

**Figure 12. Percent of farmers cooperating informally by indicator of readiness to cooperate (sum of scores)**



Source: Own calculations: data from the SCARLED survey.

**Figure 13. Readiness to cooperate (factor analysis' indicator) by type of regions**



Source: Own calculations: data from the SCARLED survey.

To summarize:

- on the basis of the questions about readiness to cooperate in three different situations: lending valuable thing, business activity and work in favour of the society, it was possible to built an aggregated indicator of readiness to cooperate;
- higher readiness to cooperate is on average connected with higher share of agriculture output sold, higher informal cooperation and being better off.

#### 4.4 General trust and general relations in the village

As a part of the SCARLED questionnaire, respondents were presented with 4 statements regarding general trust and general relations in the village and were asked, if they, in general agree or disagree with those statements, and were requested to rate their answers from 1 (totally disagree) to 5 (totally agree). The statements and answers acquired from the respondents are listed in the Table 15.

**Table 15. General trust and general relations in the village - percent share of respondents who chosen the given option among all 245 respondents analysed**

	Totally disagree	Somewhat disagree	Neither agree or disagree	Somewhat agree	Totally agree	Lack of answer
	(1)	(2)	(3)	(4)	(5)	(0)
Most people can be trusted	0.82	10.61	43.27	40.82	4.08	0.41
Most of the people in the village know each other	0	0	0.82	51.43	47.35	0.41
You should be very careful in your relation to others	0	5.71	49.80	39.59	4.49	0.41
In this village people generally do not trust each other in matters of lending and borrowing money	4.90	17.55	47.35	24.90	4.90	0.41

Source: Own calculations: data from the SCARLED survey.

Applying MSP procedure (adequate for ordinal variables) helped to state, that only two statements from listed above constitute one scale: item “Most people can be trusted” and reversed item “You should be very careful in your relation to others” (originally the items are negatively related). Other statements indicate different traits. As only two items regarding the same latent trait were identified, there was no basis to construct an aggregated indicator of general trust using the proxy measures obtained. Therefore only original measures obtained from the questionnaire can be further analysed (four ordinal variables measured on 5-point Likert scale).

It is interesting, that the group that on average agree with statement “Most of the people in the village know each other” is more well off, of higher income band, perceives better economic prospects and owns bigger area of land. It indicates that more socially active farmers (knowing people in the village) are those economically better off.

For other analysed statements regarding general trust and general relation in the village, any interesting relations were not found, therefore this group of variables is not included in further analyses.

#### 4.5 Trust towards people and organisations

The next part of the survey regarded trust towards different groups of people and different institutions. Respondents were presented with list of groups of people and institutions (presented in Table 16). They were asked, how much they trust people or institutions in each of the categories specified. They were requested to rate the answers

from 1 (very small extent of trust) to 5 (very high extent of trust). The answers acquired are presented in the table below.

The most distrusted groups were central institutions: political parties (over 50% of respondents have very small extent of trust towards them) and central governmental officials (almost 40% of respondents have very small extent of trust towards them). The most trusted are neighbours and inhabitants of respondents' village, more than 70% of respondents have high or very high extent of trust towards them, followed by teachers, doctors and nurses and shopkeepers - almost 50% of respondents have high or very high extent of trust towards those groups of people. This means, that, in general, people are trusted more than institutions and, also, that the closer distance to person/institution, the more trusted it is.

**Table 16. Trust towards different types of people and institutions - share of respondents among all 245 households analysed**

	Very small extent	Small extent	Medium extent	High extent	Very high extent	Lack of answer
	(1)	(2)	(3)	(4)	(5)	(0)
Local governmental officials	7.35	20	40.82	29.39	2.45	0
Central governmental officials	38.78	33.88	21.63	4.90	0.82	0
Police	1.22	15.92	52.65	27.76	2.04	0.41
Teachers	0	6.53	40.82	46.94	5.31	0.41
Doctors and nurses	1.22	6.53	40.00	47.76	3.27	1.22
Shopkeepers	0.41	3.27	43.67	49.39	2.04	1.22
Strangers	9.80	20.82	51.02	15.10	2.04	1.22
Neighbours	0.41	1.22	23.67	62.45	11.84	0.41
Inhabitants of your village	0.41	1.63	24.08	61.22	11.02	1.63
Political parties	51.43	28.98	10.61	6.53	1.22	1.22

Source: Own calculations: data from the SCARLED survey.

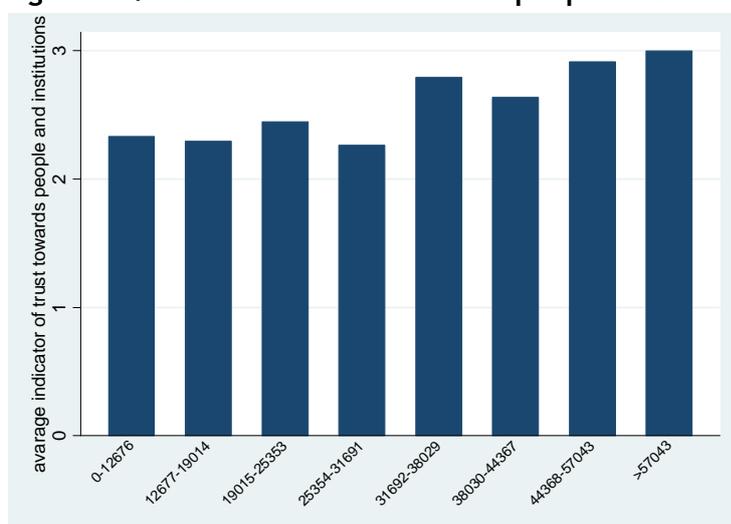
The next step taken was an attempt to verify, if answers about trust to all groups specified may be used to construct one aggregated indicator of trust towards people and institutions. There was used the extension of Mokken model for polytomous item scores (see paragraph 2.1 for the introduction). MSP procedure performed in STATA helped to distinguish two scales representing two latent traits. Within the first one following items were suited: (trust towards) local governmental officials, police, teachers, doctors and nurses, shopkeepers, strangers, neighbours and inhabitants of your village. This trait was called trust towards people and local institutions. In this group neighbours turned out to be the most trusted group (this item is the easiest one) and strangers were the least trusted group (this item is the most difficult). Following items constitute the second scale: trust towards central governmental officials and trust towards political parties. This trait was called trust towards central institutions. Trust towards political parties is more difficult than trust towards central governmental officials. As trust towards political parties and central governmental officials is very low in rural area, it may be connected with general unpopularity of those groups and seems not to be a good measure of trust towards people and institutions. Therefore, only one aggregated indicator on the basis of variables regarding trust towards people and organizations was constructed: an **indicator**

of trust towards people and institutions constructed as a total score of 8 items which constitute the first scale distinguished by the IRT model.<sup>13</sup>

Alternative method, factor analysis performed on polychoric correlations' matrix (see paragraph 2.1 for the introduction), used for 8 selected by the IRT model items, confirmed that they contribute to one factor. On the basis of the model estimated, an alternative indicator of trust towards people and institutions was counted. This new indicator is highly correlated with sum of scores (the first indicator proposed), the correlation is 0.99, but it has much more levels than the simple sum of scores.

This new indicator, factor analysis based, was used in visualizations presented in figures below, which help to analyse trust towards people and institutions by different households' characteristics.

**Figure 14. Indicator of trust towards people and institutions by income bands**



Source: Own calculations: data from the SCARLED survey.

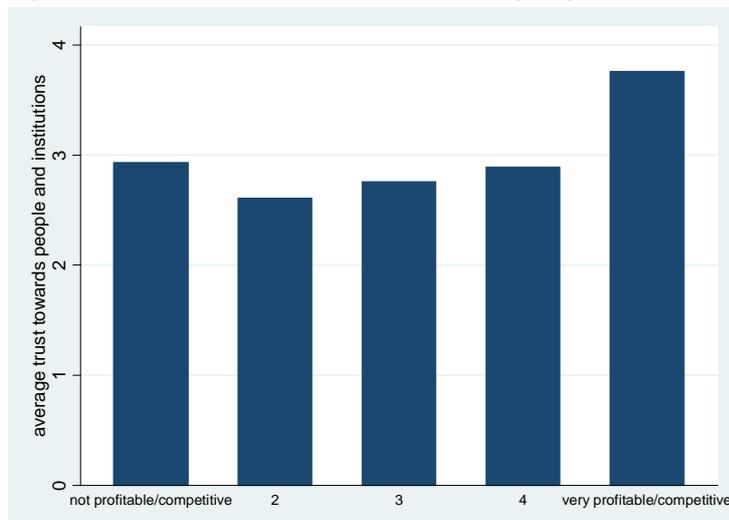
As it can be seen in Figure 14, on average, farmers having higher extent of trust towards people and organizations, are those from higher income bands.

Figure 15 is a base for a conclusion, that a relation between trust towards people and institutions and economic prospects is not linear, although the most trusting farmers are those having the best economic prospects.

From Figure 16 it can be concluded, that the trust towards people and institutions is the highest in prosperous regions.

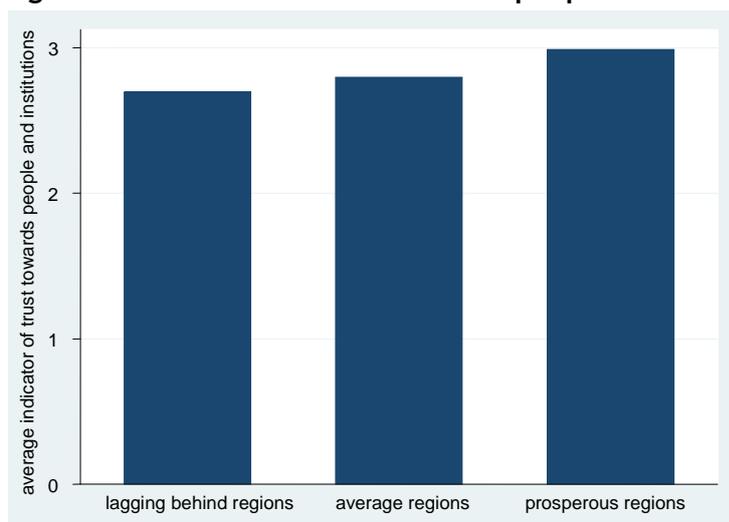
<sup>13</sup> Original item scores 1-5 were transformed into 0-5 as it is customary while using nonparametric item response theory (Sijtsma, Molenaar 2002).

**Figure 15. Indicator of trust towards people and institutions by economic prospects**



Source: Own calculations: data from the SCARLED survey.

**Figure 16. Indicator of trust towards people and institutions by type of regions**



Source: Own calculations: data from the SCARLED survey.

An analysis of the survey results concerning trust towards people and organisations has shown that:

- respondents trust more people than institutions and the closer distance to person/institution, the more trusted it is;
- trust towards central government officials and trust towards political parties was very low and represented different latent trait than other items so those two items were excluded from further analyses;
- on the basis of 8 questions about trust towards: local governmental officials, police, teachers, doctors and nurses, shopkeepers, strangers, neighbours and inhabitants of your village, there was a possibility to built an aggregated indicator of trust towards people and organizations;

- higher trust towards people and organizations is slightly connected with being better off.

#### 4.6 Relations with neighbours

Respondents were also asked to describe their relations to their 4 direct neighbours, using the scale from 1 to 5, where “1” means a friend and “5” signifies hostile relationship. Answers obtained are presented in Table 17.

**Table 17. Relations to direct neighbours - share of respondents who chose the given answer among all 245 households analysed**

Relationship:	friend ◀◀	◀◀	◀◀ ▶▶	▶▶	▶▶ hostile relationship	lack of answer
	(1)	(2)	(3)	(4)	(5)	(0)
with neighbour 1	18.37	48.98	26.94	3.67	2.04	0
with neighbour 2	17.14	49.39	30.61	2.04	0.82	0
with neighbour 3	15.10	50.61	30.20	2.04	0.82	1.22
with neighbour 4	15.10	49.80	27.76	4.90	0.82	1.63

Source: Own calculations: data from the SCARLED survey.

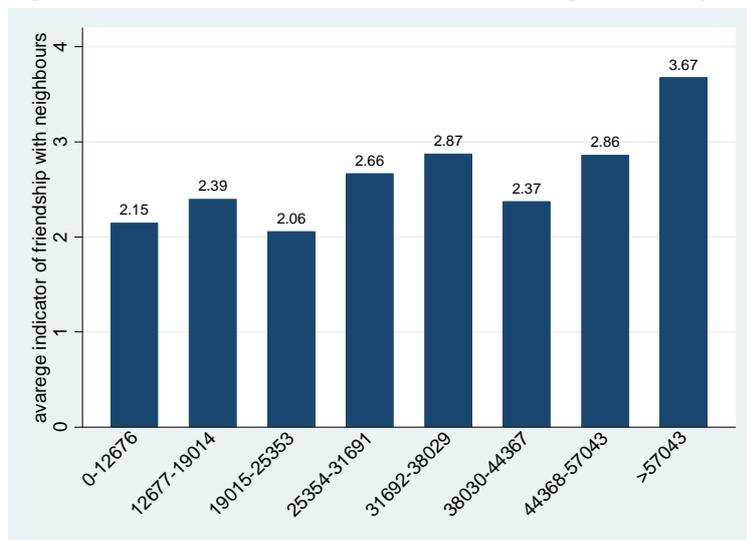
Answers for those questions turned out to be highly correlated, which means that farmers had a tendency to indicate either all 4 of their relationships to direct neighbours as friendly, or all 4 as hostile.

Both MSP procedure (based on nonparametric IRT model) and factor analysed performed on polychoric matrix clearly indicated one scale, so it was possible to build an aggregated indicator of relations with neighbours. As before, two alternative indicators were built: sum of scores and an indicator based on factor analysis' results.<sup>14</sup> In the figures below, the indicator based on factor analysis is used.

Figures from 17 to 20 show accordingly: general tendency for farmers having better relations with neighbours to come from higher income bands (Figure 17); in general, farmers cooperating informally have worse relations with neighbours (Figure 18); indicator of relations with neighbours is positively correlated with indicator of trust towards people and institutions (Figure 19); the more prosperous the region the farmers come from, the better relations with neighbours they have (Figure 20).

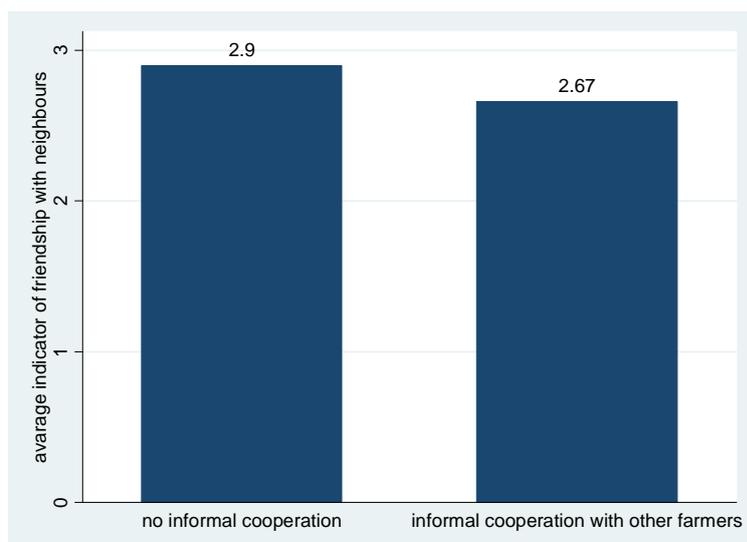
<sup>14</sup> Before constructing both of the factors answers were reversed, which means that the higher the indicator of relations with neighbours, the better those relations are.

**Figure 17. Indicator of relations with neighbours by income band**



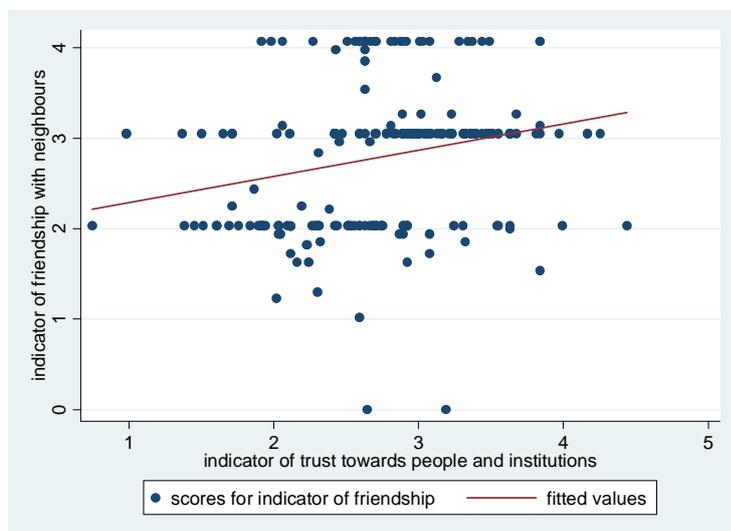
Source: Own calculations: data from the SCARLED survey.

**Figure 18. Indicator of relations with neighbours by informal cooperation among farmers**



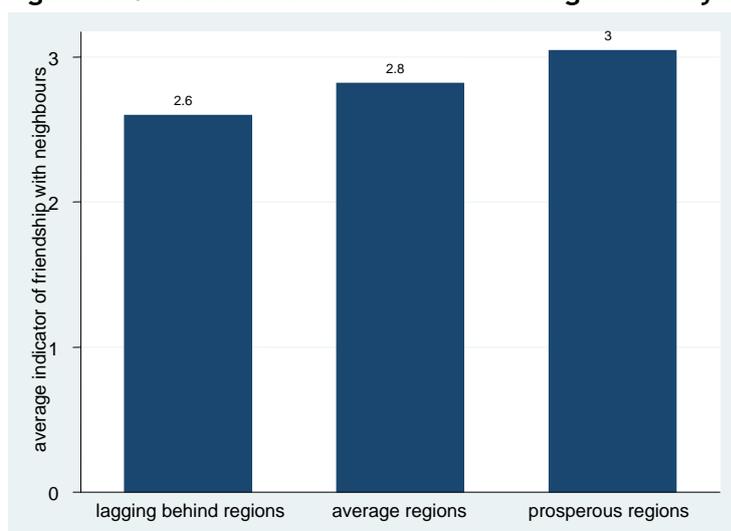
Source: Own calculations: data from the SCARLED survey.

**Figure 19. Indicator of relations with neighbours by indicator of trust towards people and institutions**



Source: Own calculations: data from the SCARLED survey.

**Figure 20. Indicator of relations with neighbours by type of region**



Source: Own calculations: data from the SCARLED survey.

To summarize:

- on the basis of questions regarding relations with 4 direct neighbours, there was a possibility to built an aggregated indicator of relations with neighbours;
- better relations with neighbours are on average connected with higher income, lower informal cooperation, higher trust towards people and institutions and bigger prosperity of the region the farmers come from.

#### 4.7 Participation in the elections

Another proxy of social capital that can be built based on the survey's data is an indicator of election participation (attendance in the elections). Within the survey respondents were asked if they voted in the last elections: local, national, presidential and EU. The actual question asked was: "Many people find it difficult to get out and vote. Did you vote in the last elections?". The answers obtained are presented in Table 18.

**Table 18. Voting in the last elections - share of respondents who chose the given answer among all 245 households analysed**

Voting in the last election:	YES (%)	NO (%)
Local	87.76	12.24
National	83.67	16.33
Presidential	86.53	13.47
EU	87.35	12.65

Source: Own calculations: data from the SCARLED survey.

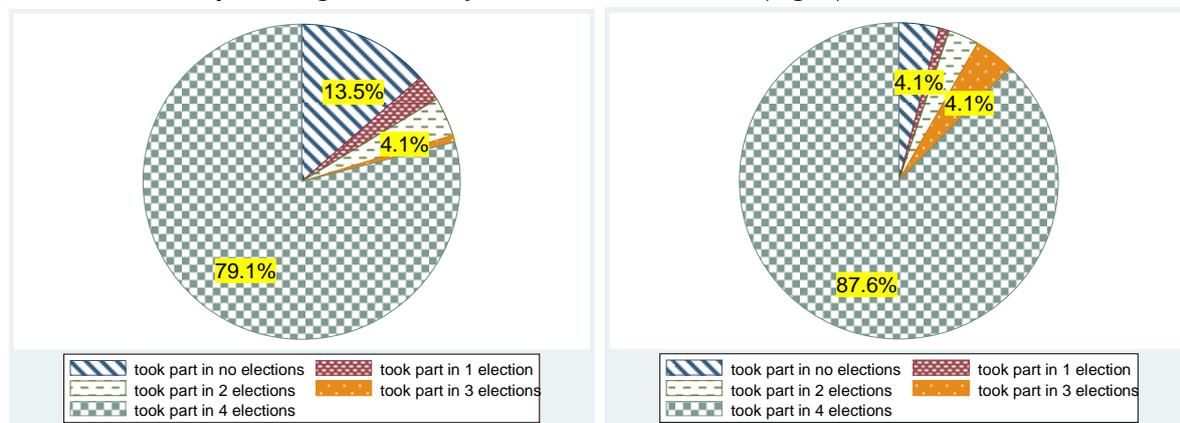
Answers for all parts of the question were highly correlated, which means that if a respondent voted in local election, there was high probability, that he also voted in other types of elections.

All questions regarding participation in different kinds of elections create one strong scale, which was checked through MSP procedure. The least popular elections (the most difficult item) are national elections, the most popular (the easiest items) are local elections.

There was created an indicator of attendance in the elections, as a sum of answers for all 4 questions, where "0" is indicating an respondent who did not participate in any of elections, and "4" is a result for a respondent participating in all 4 types of elections. This indicator gives an ordering for respondents in terms of their participation in elections. There was also created alternative indicator of attendance in the elections, with use of factor analysis performed on tetrachoric correlations matrix. The factor analysis performed also justified building one indicator of participation in elections, as it also clearly indicated one factor. The indicator created with help of factor analysis is highly correlated with the simple sum of scores (correlation of 0.98).

Figure 21 compares voting behaviours (using the sum of score as voting indicator) between farmers who do not cooperate informally with other farmers and those who do cooperate. There are 245 households analysed: 148 not cooperating and 97 cooperating. As it can be seen at the figures, those informally cooperating took part in all 4 elections more often than those not cooperating (around 88 % and 79 %), and also did not take part in any of elections less often (around 4 % and 13.5 %). Except for this relation between voting and informal cooperation with other farmers, no other regularity was found to explain which type of households votes more often.

Figure 21. Share of respondents participation in different types of elections - among 135 households not cooperating informally with other farmers (left) and among 93 households cooperating informally with other farmers (right)



Source: Own calculations: data from the SCARLED survey.

To summarize:

- more than 80% of respondents voted in each of the type of elections;
- on the basis of questions regarding participation in 4 types of elections: local, national, presidential and EU, there was a possibility to built an aggregated indicator of attendance in the elections;
- there is a positive relation between attendance in the elections and informal cooperation.

## 5 DETERMINANTS OF INFORMAL COOPERATION AMONG FARMERS

In this part of the study the importance of different determinants for cooperation among Polish farmers is analysed. At first, preliminary verification of the role of social capital in facilitating informal cooperation and the significance of different production factors availability for this phenomenon was researched. Finally, logistic regression model was used as the method of identification of variables determining the presence of informal cooperation among farmers (more detailed information on the statistical methods used is presented in the methodology section - paragraph 2.2).

### 5.1 The role of social capital in facilitating informal cooperation among farmers - cluster analysis

An analysis of the role of social capital in facilitating informal cooperation among farmers was based on the previously created indicators of individual social capital.

**Table 19. Cluster profiling variables characterizing the level of social capital**

Variable	1 N = 104	2 N = 134	SAMPLE mean	Cluster sig. F-test
Readiness to cooperate	1.16	1.99	1.63	47.07*
Trust towards people and local institutions	19.5	18.72	19.06	2.04
Relations with neighbours	3.25	2.41	2.78	102.80*
Attendance in the elections	2.91	3.95	3.50	50.14*

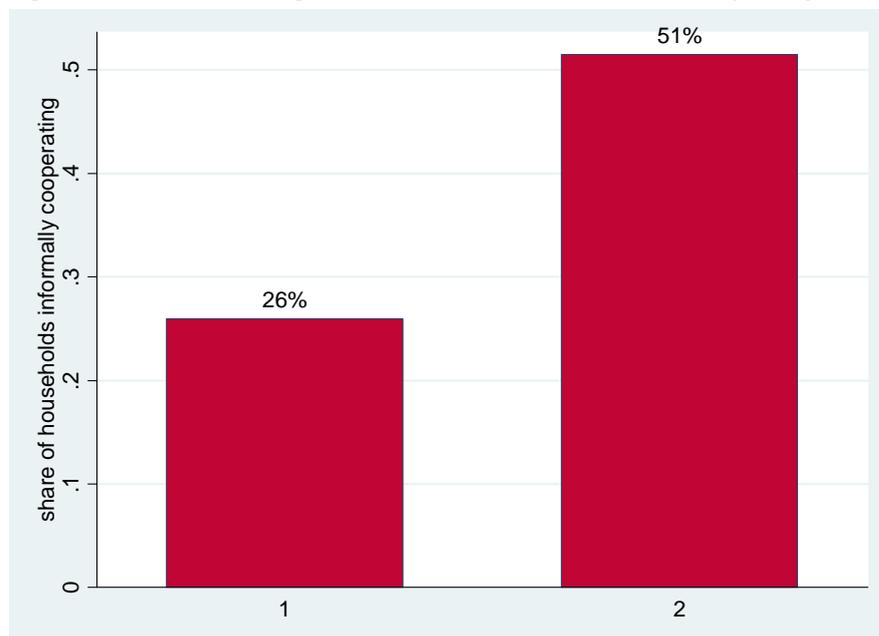
\* Significant at 5% level

Source: Own calculations: data from the SCARLED survey.

Using these indicators as the basis for clustering, and following clustering procedure presented in the methodology section, two clusters were achieved (Table 19). Farm households belonging to cluster 1 represented higher level of trust towards people and local institutions, and on average had better relations with neighbours, while farms belonging to cluster 2 revealed higher readiness to cooperate and the level of civil engagement (measured by voting in the elections). As the cluster validation variable the share of farms cooperating informally was used. Farming households belonging to cluster 2 cooperated with other farmers almost twice more often than farms from cluster 1 (Figure 22). Such results suggest that readiness to cooperate and civil engagement are of key importance in explaining the level of informal cooperation.

Further this expected relationship is tested by logistic regression model (see paragraph 5.3).

Figure 22. Share of agricultural households informally cooperating with other farmers



Source: Own calculations: data from the SCARLED survey.

## 5.2 Own production factors as determinants of informal cooperation - cluster analysis

An answer to the research question concerning influence of a level of own production factors as determinant of informal cooperation was supported by clustering procedure (see methodology section) and as the result three cluster solutions were achieved (Table 20):

Cluster 1 - farming households equipped with all essential machinery and specialized (as well as expensive) ones: harvesting machinery, milk device and lorry. The average acreage reached 22.1 ha. These farms were run by the youngest farmers - 42.9 years old with basic vocational education. Farms from this cluster were focused on agricultural activity - household head spent almost 99% of time for farming, these farms also the most often used credit for production and marketing.

Cluster 2 - households equipped with the basic machinery such as: tractor, plough but lacking mostly sowing, chemical spraying and harvesting machinery. These group of farmers cultivated on average only 4.5 ha (much below the sample and country average). These farms were run by farmers at the average age of 46 years old with basic vocational education. Households from this cluster were focused on off-farm activities (only 19.4% of time spent on working on-farm). Also in over 85% of households at least one of the members was involved in wage employment.

Cluster 3 - households equipped with basic machinery: tractor, plough, sowing machine but lacking more specialized ones: harvesting machinery, milk device and lorry. The average farm size - 6.3 ha. These farms were run by farmers at the average age of 55 years old with the lowest level of education. They were focused on agricultural activity - 99.2% of time spent on-farm. In more than 40% of farms household's member was involved in wage employment.

**Table 20. Binary and continuous cluster profiling variables characterizing the level of owned production factors**

Variable	1 N = 51	2 N = 81	3 N = 112	SAMPLE N = 244	
<b>Binary (%)</b>					
Tractor	100.0	69.1	78.6	79.9	
Plough	94.1	69.1	81.3	79.9	
Sowing machinery	92.2	48.1	67.9	66.4	
Chemical spraying equipment	82.4	30.9	40.2	45.9	
Harvesting machinery	54.9	8.6	14.3	21.3	
Milk device	39.2	9.9	12.5	17.2	
Lorry. Truck	11.8	8.6	5.4	7.8	
Livestock	90.2	70.4	85.7	81.1	
Agricultural education	37.3	33.3	29.5	32.4	
Working in agriculture before 1990 (household head)	88.2	77.8	88.4	84.8	
Household member in wage employment	27.5	85.2	42.9	53.7	
Household member self-employed	3.9	12.3	2.7	6.1	
Credit for production and marketing used in 2006	45.1	9.9	17.9	20.9	
Farming with household's labour only	74.5	96.3	88.4	88.2	
					<b>Cluster sig. F-test</b>
<b>Continuous (mean)</b>					
Total cultivated land area (ha)	22.1	4.5	6.3	9.1	157.05 ***
Total number of plots	9.2	4.3	3.7	5.0	48.87 ***
Distance to most distant plot (km)	5.4	1.6	1.8	2.4	23.33 ***
Age of household head	42.9	45.9	54.5	49.3	18.11 ***
Level of education <sup>a)</sup>	2.2	2.3	1.7	2.0	20.52 ***
% time on-farm (household head)	98.8	19.4	99.2	72.6	947.49 ***

Significance level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

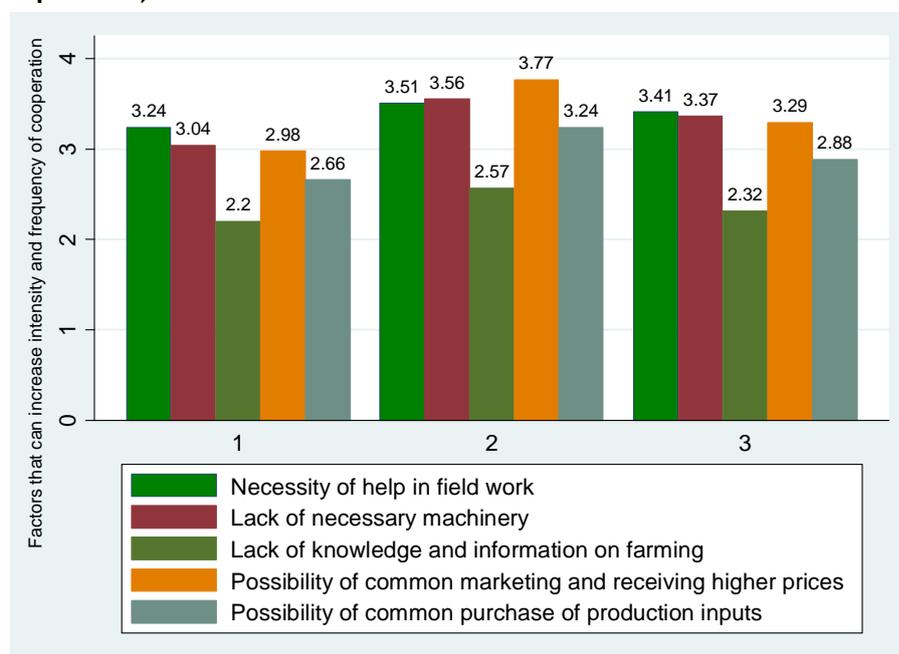
- a) Education is described by the scale divided into four levels: 1 - Incomplete primary school, Primary school and Middle school; 2- Basic vocational; 3 - General secondary school, Other secondary school; 4 - Post-secondary, Bachelor, Engineer, Tertiary education.

Source: Own calculations: data from the SCARLED survey.

Farmers from cluster 1 (well equipped with production factors) cooperated informally the least often (15.7%) while farmers from cluster 2 (the smallest farms equipped with the basic machinery and head of household focused on wage employment) cooperated the most often (53%). Ca. 40% of farmers from cluster 3 (medium-sized farms equipped with the basic machinery and focused on farming) cooperated informally. These results confirm that the level of production factors can be considered as a determinant of cooperative behaviour among Polish farmers.

Figure 23 depicts the average opinion on the factors that can increase intensity and frequency of cooperation among farmers. Farms from cluster 2 and 3 indicated on average all potential factors as more important than farms from cluster 1. Such an attitude to cooperation can be interpreted as farms' strategy to overcome the deficiencies in production factors.

Figure 23. Average opinion on the factors that can increase intensity and frequency of cooperation among farmers (rating scale: not important at all 1>>>5 the most important)



Source: Own calculations: data from the SCARLED survey.

### 5.3 Social capital and availability of production factors as determinants of informal cooperation - logistic regression model

As mentioned in the methodology section, logistic regression model was used after previously applied cluster analysis in order to identify statistically significant variables explaining the presence of informal cooperation among farmers.

The following hypothesis is to be verified: different components of social capital (readiness to cooperate, trust towards people and local institutions, relations with neighbours, attendance in the elections) positively influence (facilitate) informal cooperation; farmers being better equipped with production factors necessary for conducting agricultural activity (physical capital, natural resources, human capital) cooperate informally less frequently.

Table 21 presents parameter estimates with their respective standard errors, t-statistics and probability values. As it could be expected based on cluster analysis, readiness to cooperate and civil engagement are significant and positively influence the probability of informal cooperation. Among different machinery equipment owned by farms, only 'sowing machinery' shows statistically significant (0.086) negative impact on informal cooperation. Also other 'machinery' negatively influence cooperation but the significance level is rather small. 'Total cultivated area' negatively influence cooperation what could be probably related with its dominating role in determining the scale of agricultural production. Farms cultivating bigger acreage are better equipped, thus do not engage in informal cooperation so often as smaller (in terms of acreage) farmers. 'Agricultural education and higher level of households' general education reduces the probability of informal cooperation. These results are in compliance with assumptions that better knowledge on farming and general knowledge, increase likelihood of being self-sufficient in agricultural activity. Also engagement of the household's members in self-employment activity negatively affect cooperation. 'Farming with household's labour only' reduces probability of informal cooperation. It can be explained by farms' sufficient level of labour force necessary for farming (no need for help in field works). Four village dummies variables are significant and positively influence informal cooperation: Bzianka, Chrzczany, Witoszów Dolny and Wróblowa. The first two villages are represented by farms with poor machinery equipment and above average readiness to cooperate and civil engagement (Annex 1). In the latter two villages farmers are equipped with machinery around sample average and the indicators of readiness to cooperate, and civil engagement are below or around sample average.

The pseudo coefficient of determination stands at 0.37 and the Chi2 goodness-of-fit test indicate that all variables are jointly significant in the model. 79.32% of values are correctly classified. Positive predictive value stands at 74% and negative predictive value stands at 83.21%.

**Table 21. Logit model: determinants of informal cooperation among Polish farmers**

Dependent variable: Informal cooperation	B	Std. Error	t	Sig.
Readiness to cooperate	1.005 *	0.548	1.834	0.067
Trust towards people and local institutions	0.164	0.331	0.496	0.620
Relations with neighbours	-0.109	0.342	-0.318	0.751
Attendance in the elections	1.486 *	0.802	1.852	0.064
Tractor (dummy)	-0.040	1.003	-0.040	0.968
Lorry, truck (dummy)	-0.351	0.790	-0.444	0.657
Plough (dummy)	1.229	1.056	1.164	0.244
Sowing machinery (dummy)	-.956 *	0.556	-1.717	0.086
Harvesting machinery (dummy)	-0.127	0.619	-0.204	0.838
Chemical spraying equipment (dummy)	-0.486	0.504	-0.963	0.335
Total cultivated land area (ha)	-.077 *	0.045	-1.709	0.087
Total number of plots	0.041	0.070	0.581	0.561
Distance to the most distant plot (km)	-0.005	0.085	-0.058	0.954
Age of household head	-0.020	0.017	-1.201	0.230
Agricultural education (dummy)	-1.494 ***	0.532	-2.807	0.005
Level of education (dummy)	-.878 *	0.477	-1.840	0.066
% time on-farm (household head)	-0.003	0.006	-0.413	0.680
Household member in wage employment (dummy)	0.540	0.509	1.061	0.289
Household member self-employed	-1.807 **	0.914	-1.976	0.048
Farming with household`s labour only (dummy)	-1.594 ***	0.614	-2.595	0.009
Livestock (dummy)	0.109	0.492	0.222	0.824
Bzianka (no.2)	2.000 *	1.070	1.869	0.062
Chrzczany (no.3)	3.632 ***	1.073	3.385	0.001
Białyszewo (no. 4)	1.352	1.209	1.118	0.264
Sławsk Wielki (no. 5)	1.038	1.081	0.960	0.337
Święck Wielki (no. 6)	1.513	1.025	1.476	0.140
Witoszów Dolny (no. 7)	3.260 ***	1.090	2.991	0.003
Ulasek (no. 8)	0.624	1.127	0.553	0.580
Wróblowa (no. 9)	3.569 ***	1.070	3.334	0.001
Constant	-1.230	2.044	-0.602	0.547
No. of observations	237			
LR chi2(30)	118.29			
Prob > chi2	0.0000			
Pseudo R2	0.3689			

Significance level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Computation of variance inflation factor used for detection of the multicollinearity of the regressors indicated mean VIF equal to 2.30 which can be interpreted as low multicollinearity.

Source: Own calculation based on data from SCARLED survey.

## 6 ECONOMIC EFFECTS OF INFORMAL COOPERATION

As it was hypothesised in the methodology section, informal cooperation, among other factors, is expected to positively influence the level of farm's commercialisation. In order to verify this presumption, multiple regression model was calculated. This stage was preceded by factor analysis (creation of one indicator of machinery equipment and two indicators of current households' aims for agricultural production) (detailed information is presented in Annex 2 - Table 24 and Table 25).

Table 22 presents the parameter estimates, standard error, t-statistics and probability values. Variables describing different kinds of informal cooperation, except 'common transportation means', are statistically significant (at the level of 0.05 or 0.1) in explaining the level of commercialisation. However, 'common use of machinery' reveals its negative impact which is in conflict with expectations. This result could be interpreted as follows: common use of machinery enables farms to access to lacking equipment necessary for agricultural production, however it also means that these farms represent weak production structures, thus cooperation does not lead to achieving marketable surplus, but only to sustaining current level of production<sup>15</sup>. Other forms of informal cooperation like common purchase of production inputs and help in field work show positive impact on commercialisation. Among significant variables describing production potential, only an indicator of machinery equipment positively influence the share of agricultural output sold. It is somewhat surprising that 'total cultivated area' is not a significant production factor increasing the level of commercialisation. 'Providing services to others with own machinery' is found as negatively affecting commercialisation - farmers devoting considerable part of time on providing services are probably less focused on own production. It is worth stressing that older age of household head also constitutes an impediment to marketable production (significance level is rather small - 0.13). Percentage of time spent by household head on-farm shows negative impact on commercialisation, which is not consistent with intuition suggesting that focusing on agricultural production should result in greater farm's market integration. On the other hand, it can be stated that more time spent on-farm allow farmers to differentiate production structure towards products (production of which is more time-consuming) that can be consumed within the farm like livestock or vegetables. This line of reasoning is to some extent confirmed by the negative influence of 'livestock' dummy variable on the level of commercialisation. It is likely caused by farmers' approach that own production which can be consumed within the farm is not purchased on the market, thus the share of sales is relatively smaller. Distance to the nearest urban centre used in the model as a proxy for external transaction costs in access to the market, represents an important impediment to commercialisation. As it was expected, the proportion of consumption from own production and the 'food provision' aim for production reduces the farms' degree of integration in agricultural markets. Farms focusing on pecuniary objectives shared with farming lifestyle are more likely to be integrated in agricultural markets.

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<sup>15</sup> This supposition would need more detailed investigation which is not possible using collected data.

**Table 22. Determinants of commercialisation**

Dependent variable: Share of agricultural output sold during 2006	B	Robust Std. Error	t	Sig.
Factor: machinery equipment	16.838 *	8.883	1.896	0.095
Provide services to others with own machinery (dummy)	-9.881 **	3.054	-3.236	0.012
Total cultivated land area (ha)	0.194	0.183	1.060	0.320
Total number of plots	0.108	0.452	0.240	0.817
Distance to the most distant plot (km)	0.326	0.310	1.050	0.325
Age of household head	-0.185	0.108	-1.712	0.125
Agricultural education (dummy)	1.876	2.765	0.679	0.517
Level of education (dummy)	0.871	3.199	0.272	0.792
% time on-farm (household head)	-0.126 **	0.039	-3.227	0.012
Farming with household labour only (dummy)	-4.240	3.723	-1.139	0.288
Distance to the nearest urban centre (km)	-0.212 ***	0.037	-5.706	0.000
Livestock (dummy)	-14.641 **	5.275	-2.775	0.024
Share of food consumption from own production in household's total food consumption	-0.1786 **	0.060	-2.981	0.018
Informal cooperation: common use of machinery (dummy)	-12.453 **	4.639	-2.684	0.028
Informal cooperation: common transportation means (dummy)	12.461	7.232	1.723	0.123
Informal cooperation: common purchase of production inputs (dummy)	13.796 *	6.029	2.288	0.051
Informal cooperation: help in field work (dummy)	6.684 *	3.244	2.060	0.073
Factor: pecuniary/non-pecuniary objectives and farming lifestyle	10.423 ***	2.139	4.874	0.001
Factor: food provision	-9.807 ***	1.436	-6.831	0.000
Constant	94.799 ***	10.435	9.084	0.000
No. of observations	233			
R-squared	0.5444			

Significance level: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Remarks: To obtain robust standard errors of estimators with regard to observations' dependences between villages the *vce(cluster village)* STATA command was used. This ensure that the observations are independent across groups (villages) but not necessarily within groups.

Source: Own calculation based on data from SCARLED survey.

In order to avoid multicollinearity<sup>16</sup> which results in obtaining biased estimators, we calculated another multiple regression model in which regressors were extracted, by applying factor analysis, from the set of variables used in the previous model (see Table 22, Table 23 and Annex 2).

Table 26 summarises the results of calculations by presenting all factor loadings for 28 variables on the nine factors. The next step was labelling all factors according to variables that are the most correlated with them (first of all factor loadings higher than 0.6 or lower than -0.6 were taken as measure of correlation, however in some cases factor loadings higher than 0.4 or lower than -0.4 were also considered). Factor (1) 'equipment with basic machinery' comprises three variables indicating equipment with tractor, plough and sowing machinery. Factor (2) 'pecuniary/non-pecuniary objectives and farming lifestyle' combines variables describing the current aims for agricultural production (mostly providing work for members of household, generating cash income and enjoying farming). Factor (3) 'livestock and food provision' shows that animal production, share of food consumption from own production in household's total food consumption and the aim of production 'to provide food for the household' are closely linked. Factor (4) 'informal cooperation' reflects the close relation between variables describing three types of informal cooperation: common use of machinery and transportation means, and also common purchase of production inputs. Factor (5) 'land, specialized agricultural machinery and providing services' combines variables describing utilized land, equipment with harvesting machinery (also chemical spraying machinery which is equally split among factor (1) and (5)) and providing services to others with own machinery (also split among two factors: (5) and (9)). Factor (6) 'land dispersion' is mostly linked to two variables: 'total number of plots' and 'distance to the most distant plot' (also distance to the nearest urban centre is related to this factor). Factor (7) 'peripherality and lack of help in field work' comprises variables characterizing the distance to the nearest urban centre and the lack of informal cooperation in helping in field work. 'Total cultivated land area' is also related to this factor but at lower level. Factor (8) 'household head's characteristics' is mainly linked to the age of household but also to some extent to the type and level of education, and percentage of time spent on-farm. Factor (9) 'specialized non-agricultural machinery, providing services and employing workers' combines variables describing equipment with lorry or truck and providing services to others as well as employing workers.

On the basis of factor analysis it can be concluded that three types of informal cooperation<sup>17</sup> constitute an independent factor with respect to other production factors. Only 'help in field work' is related to other factor comprising 'distance to the nearest urban centre and 'the acreage of total cultivated land'.

Finally, the factor scores of nine extracted independent factors were computed to replace variables used in the previous regression model (see Table 23). The new model is highly significant and explains ca. 50% of the variance of the share of agricultural output sold.

Factor (4) 'informal cooperation' positively influence the level of commercialisation (significant at the level of 0.01). 'Peripherality and lack of help in field work' negatively affect the share of output sold which also means that engagement in this type of informal

<sup>16</sup> Besides the low value of mean VIF equal to 1.52 (model from Table 22) the high value of tetrachoric correlation coefficients calculated for variables describing different types of informal cooperation may indicate the existence of multicollinearity.

<sup>17</sup> Common use of machinery and transportation means, and common purchase of production inputs.

cooperation positively influence commercialisation. 'Equipment with basic machinery' represents positive influence on dependent variable but significance level is rather small (0.13). As it was expected, factor (2) also positively influence commercialisation. It means that farms aimed at generating cash income, providing work for household members and enjoying farming are closer integrated in agricultural markets. Factor (3) reveal negative impact of animal husbandry and food self-supplying on commercialisation. 'Land, specialized agricultural machinery and providing services' has low significance level however it is worth stressing that positively affect farmers' market integration. 'Household head's characteristics' negatively influence the share of agricultural output sold. This result denotes that older farmers represent lower tendency to commercialisation, but agricultural education and higher level of general education decides about greater market integration. The percentage of time spent on-farm negatively influence commercialisation (for possible explanation see page 62). Neither, 'land dispersion' nor 'specialized non-agricultural machinery, providing services and employing workers' are significant variables in explaining the level of commercialisation.

**Table 23. Determinants of cooperation (independent factors extracted from the set of variables)**

Dependent variable:		B	Robust Std. Error	t	Sig.
Share of agricultural output sold during 2006					
(1)	Equipment with basic machinery	5.540	3.248	1.706	0.126
(2)	Pecuniary/non-pecuniary objectives and farming lifestyle	13.282 ***	1.911	6.949	0.000
(3)	Livestock and food provision	-12.071 ***	1.046	-11.544	0.000
(4)	Informal cooperation	5.670 ***	1.655	3.426	0.009
(5)	Land, specialized agricultural machinery and providing services	0.915	0.611	1.497	0.173
(6)	Land dispersion	0.519	1.548	0.335	0.746
(7)	Peripherality and lack of help in field work	-3.533 *	1.661	-2.127	0.066
(8)	Household head's characteristics	-7.104 ***	1.169	-6.076	0.000
(9)	Specialized non-agricultural machinery, providing services and employing workers	-0.864	1.975	-0.438	0.673
	Constant	64.034 ***	2.207	29.014	0.000
No. of observations		233			
R-squared		0.4986			

Significance level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Remarks: To obtain robust standard errors of estimators with regard to observations' dependences between villages the *vce(cluster village)* STATA command was used. This ensure that the observations are independent across groups (villages) but not necessarily within groups.

Source: Own calculation based on data from SCARLED survey.

To summarize, it should be stated that the results of the two applied models (Table 22 and Table 23) differ significantly in reference to variable describing the role of informal cooperation in form of common use of machinery, in explaining the level of commercialisation. In the first model 'common use of machinery' negatively affect farmers' market integration. In the second model, this type of cooperation along with common transportation and purchase of production inputs positively influence commercialisation. Factor analysis which preceded the multiple regression analysis guarantee that all extracted factors are independent and for this reason the final conclusions are based on result of the second model<sup>18</sup>.

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<sup>18</sup> However, one must be aware that factor analysis loses 32% of information included in the set of 28 variables (see page 59).

## **7 CONCLUDING REMARKS**

The Deliverable provides several conclusions regarding the importance of social capital and cooperation for farmers' market orientation.

Informal cooperation among farmers seems to be a substitute of economic resources and it may serve as "capital of the poor". It is the most common among worse off farmers from different regions, but most often from lagging behind regions. The most important benefits from informal cooperation indicated by farmers are related to access to lacking machinery and decrease in production costs. This type of cooperation looks very basic and traditional and it seems that there is a lack of long term strategy and market orientation behind it. More advanced forms of cooperation are limited due to the low profitability of production, the lack of possibilities to receive higher prices through common sales and the lack of possibilities to receive lower prices for production inputs.

In the opinion of the respondents, the most important factors that can increase intensity and frequency of cooperation among farmers are: necessity of help in field work, lack of necessary machinery and possibility of common marketing and receiving higher prices for agricultural products.

Among four indicators of individual social capital: readiness to cooperate, trust towards people and local institutions, relations with neighbours and civil engagement, the first and the last one are of key importance in explaining the level of informal cooperation. This result, to some extent, confirms the hypothesis that social capital facilitates informal cooperation among farmers, however not all selected components are significant. It is somewhat surprising that in general, farmers cooperating informally have worse relations with neighbours - it seems that farmers may avoid business cooperation in order not to break good relations with neighbours.

Informal cooperation is to a large extent determined by the level of farms' owned production factors. Farmers classified to the group of the best equipped with production factors cooperate informally the least often. Farmers equipped with the basic machinery and cultivating relatively small acreage (both focused on wage employment or on farming) cooperate informally the most often.

Logistic regression model reveals that among different machinery equipment owned by farms, only sowing machinery shows statistically significant negative impact on informal cooperation. Also other 'machinery' negatively influence cooperation, but the significance level is rather small. Farms cultivating bigger acreage are better equipped, thus do not engage in informal cooperation so often as smaller (in terms of acreage) farmers. Also better knowledge on farming (agricultural education) and in general (higher level of education) increases likelihood of being self-sufficient in agricultural activity. The "locality" of villages is also found as an important factor determining the level of informal cooperation.

The results of multiple regression analysis show that those farm households which cooperate informally in form of common use of machinery and transportation means, common purchase of production inputs and helping in field work, represent higher level of commercialisation. Thus, informal cooperation can be considered as strategy allowing farmers overcoming deficiencies of production factors or lowering the costs of operating.

The results of the analysis could be used to formulate the following policy recommendations concerning the importance of social capital and cooperation for

farmers' market orientation. Informal cooperation should be rather perceived as a substitute for lacking production factors. Therefore, measures focused on modernisation of farms are the most important to increase the level of commercialisation. Rural Development Policy includes currently such measures (for example modernisation of agricultural holdings) and they should be carefully monitored to enable evaluation of their impact. However, for several farms informal cooperation seems to be the only strategy allowing to conduct agricultural production as an additional source of income. According to the survey results, households which most often cooperated informally were focused on off-farm activities and represented the smallest farms equipped with the basic machinery. Therefore, it can be argued that other policy measures - also going beyond agricultural and rural policy - are required for such households.

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ANNEX 1 - indicators of differences between villages	Variable	Andryjanki N = 27	Bzianka N = 27	Chrzczany N = 28	Białyszewo N = 25,	Sławsk Wielki N = 26	Święck Wielki N = 26	Witoszów Dolny N = 27	Ulasek N = 27	Wróblowa N = 30
Tractor		100.0	66.7	53.6	96.0	65.4	88.5	81.5	93.1	76.7
Plough		96.3	70.4	53.6	100.0	69.2	88.5	77.8	93.1	73.3
Sowing machinery		92.6	44.4	35.7	88.0	65.4	73.1	66.7	79.3	56.7
Chemical spraying equipment		63.0	29.6	14.3	76.0	42.3	50.0	48.1	69.0	26.7
Harvesting machinery		14.8	11.1	7.1	36.0	30.8	19.2	33.3	41.4	3.3
Milk device		51.9	3.7	7.1	56.0	15.4	15.4	11.1	0.0	0.0
Lorry, truck		0.0	11.1	7.1	16.0	7.7	3.8	3.7	13.8	6.7
Livestock		92.6	63.0	78.6	72.0	84.6	80.8	63.0	100.0	90.0
Agricultural education		40.7	0.0	35.7	32.0	19.2	34.6	18.5	37.9	70.0
Working in agriculture before 1990 (household head)		88.9	100.0	60.7	76.0	84.6	76.9	92.6	82.8	100.0
Household member in wage employment		25.9	66.7	67.9	52.0	46.2	46.2	44.4	51.7	80.0
Household member self-employed		3.7	0.0	17.9	12.0	3.8	7.7	0.0	0.0	13.3
Credit for production and marketing used in 2006		51.9	0.0	0.0	32.0	23.1	23.1	11.1	41.4	6.7
Farming with household`s labour only		81.5	88.9	82.1	84.0	88.5	88.5	92.6	89.7	96.7
<b>Involvement in informal cooperation</b>		<b>7.4</b>	<b>63.0</b>	<b>78.6</b>	<b>12.0</b>	<b>23.1</b>	<b>30.8</b>	<b>59.3</b>	<b>13.8</b>	<b>63.3</b>
Continuous (mean)										
Total cultivated land area (ha)		17.8	3.1	5.6	15.2	9.8	7.6	10.0	10.8	2.9
Total number of plots		7.3	5.9	2.0	3.4	3.3	4.5	7.3	6.0	5.3
Distance to most distant plot (km)		4.9	2.3	0.3	2.9	1.1	1.2	2.4	5.3	1.3
Age of household head		45.2	57.1	51.1	44.5	51.0	44.6	51.7	45.4	52.4
Level of education		1.7	1.8	2.1	2.2	2.2	2.4	1.9	1.6	2.1
% time on-farm (household head)		89.6	61.3	51.8	72.2	73.5	82.2	85.9	91.9	56.9
Interval variables (means)										
Readiness to cooperate		2.1	1.7	2.4	1.3	1.3	1.7	1.2	1.1	1.8
Trust towards people and local institutions		21.8	15.7	22.0	19.0	19.1	18.4	15.3	20.1	20.0
Relations with neighbours		3.0	2.0	3	3.2	2.8	2.5	2.1	3.4	2.9
Voting in the elections		3.3	3.8	4	2.6	3.3	3.8	3.8	3.4	3.1

Source: Own calculation based on data from SCARLED survey.

## Annex 2

### Factor analysis - machinery used for agricultural production

As input data a matrix of tetrachoric correlation coefficients was used. The Kaiser-Meyer-Olkin criterion (MSA: measure of sampling adequacy) exceeded 0.7 proving the matrix as middling and therefore suitable for factor analysis (Stanisz, 2007). Bartlett's test of sphericity was statistically significant at the 1% level, rejecting the hypothesis that the correlation matrix was the identity matrix. By principal component analysis method with varimax rotation one factor was extracted from the set of 6 variables explaining 77% of the total variance in the included variables. Only factors with eigenvalue greater than 1 were used in the further analysis (Kaiser criterion).

**Table 24. Factor loadings (principal analysis, varimax rotation)**

Machinery equipment	Factor: machinery equipment
Tractor	0.9730
Plough	0.9316
Sowing machinery	0.9317
Harvesting machinery	0.7939
Chemical spraying equipment	0.8865
Milk device	0.7305

Source: Own calculation based on data from SCARLED survey.

### Factor analysis - current aims for agricultural production

As input data a matrix of polychoric correlation coefficients was used. The Kaiser-Meyer-Olkin criterion (MSA: measure of sampling adequacy) exceeded 0.7 proving the matrix as middling and therefore suitable for factor analysis (Stanisz, 2007). Bartlett's test of sphericity was statistically significant at the 1% level, rejecting the hypothesis that the correlation matrix was the identity matrix. Only factors with eigenvalue greater than 1 were used in the further analysis (Kaiser criterion). By principal component analysis method with varimax rotation two factors were extracted from the set of 6 variables explaining 72% of the total variance in the included variables.

**Table 25. Factor loadings (principal analysis, varimax rotation)**

Attitudinal statements	Factor: pecuniary/non-pecuniary objectives and farming lifestyle	Factor: food provision
To provide food for the household	0.2045	<b>0.8326</b>
To provide work for household members	<b>0.7962</b>	-0.1406
To enjoy farming	<b>0.8185</b>	0.1297
To generate cash income	<b>0.8191</b>	-0.2163
We only produce for the provision of safe food for the household	-0.3001	<b>0.7997</b>
We do not produce for pecuniary reasons	<b>-0.6127</b>	<b>0.6510</b>

Remark: Factor loadings higher than 0.6 and less than -0.6 are marked as bold.

Source: Own calculation based on data from SCARLED survey.

### Factor analysis - independent factors affecting the level of commercialisation

As input data a matrix of correlation coefficients was used (Table 26). The Kaiser-Meyer-Olkin criterion (MSA: measure of sampling adequacy) exceeded 0.77 proving the matrix as middling and therefore suitable for factor analysis. Bartlett's test of sphericity was statistically significant at the 1% level, rejecting the hypothesis that the correlation matrix was the identity matrix. Only factors with eigenvalue greater than 1 were used in the further analysis (Kaiser criterion). By principal component analysis method with varimax rotation 9 factors were extracted from the set of 28 variables explaining 68% of the total variance in the included variables.

**Table 26. Factor loadings (principal analysis, varimax rotation)**

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Tractor	<b>0.9239</b>	0.1323	0.0366	-0.0288	0.0459	0.1016	0.0167	-0.0116	0.0278
Lorry, truck	0.0152	-0.0184	0.0769	-0.0823	0.1861	-0.0004	-0.0168	-0.1498	<b>0.7011</b>
Plough	<b>0.9366</b>	0.0912	0.0590	-0.0423	0.0166	0.0453	0.0058	0.0530	0.0057
Sowing machinery	<b>0.7866</b>	0.1325	-0.0451	-0.0767	0.1798	0.0749	0.1978	-0.0565	0.0376
Harvesting machinery	0.1760	0.2591	-0.0302	-0.0200	<b>0.7673</b>	0.0895	0.0554	0.0128	0.1459
Chemical spraying equipment	<u>0.4679</u>	0.2623	-0.0273	-0.1730	<u>0.4055</u>	0.1156	0.1772	-0.2411	0.0432
Provide services to others with own machinery	0.0731	-0.1159	0.1966	0.2326	<u>0.4101</u>	-0.0079	0.0538	-0.0105	<u>0.5584</u>
Total cultivated land area (ha)	0.3225	0.3864	-0.1968	0.0044	<u>0.4417</u>	0.3070	<u>0.4021</u>	0.0316	0.0642
Total number of plots	0.2384	-0.0102	0.0428	-0.1198	<u>0.4467</u>	<b>0.6167</b>	-0.0965	-0.0715	0.0930
Distance to the most distant plot (km)	0.1220	0.1031	-0.0413	-0.0804	0.0631	<b>0.8031</b>	0.0624	-0.0917	-0.0064
Age of household head	-0.0855	-0.1459	0.1300	-0.0165	-0.1062	-0.2276	-0.0762	<b>0.7504</b>	0.0299
Agricultural education	0.0994	0.1542	0.2082	-0.1922	-0.2478	-0.0300	0.2151	<u>-0.4631</u>	0.3034
Level of education	-0.0775	-0.0596	-0.3398	-0.0669	0.2857	-0.2732	0.0522	<u>-0.4264</u>	0.1730
% time on-farm (household head)	0.1827	0.3994	-0.0098	-0.2092	0.1659	0.1066	0.1889	<u>0.5819</u>	0.0823
Farming with household labour only	-0.0524	-0.2197	0.2267	-0.0845	0.0592	-0.0546	-0.0170	-0.2082	<b>-0.6467</b>
Distance to the nearest urban centre (km)	0.1142	0.0615	-0.0030	-0.0716	-0.2320	<u>0.5174</u>	<b>0.6208</b>	0.0835	-0.0326
Livestock	0.1584	0.2747	<b>0.6769</b>	-0.0749	0.1389	0.0794	0.0861	0.1155	0.0890
Share of food consumption from own production in household's total food consumption	0.0819	-0.0220	<b>0.7774</b>	0.0266	-0.2291	-0.0483	-0.1565	-0.0549	0.1203

Factor loadings (principal analysis, varimax rotation) cont.

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9
Common use of machinery	0.0207	0.0577	-0.0922	<b>0.8032</b>	-0.0461	0.0235	-0.1325	0.0119	0.0792
Common transportation means	-0.2918	0.1238	0.0053	<b>0.7242</b>	-0.0198	-0.1132	-0.0258	-0.0693	0.0311
Common purchase of production inputs	-0.0339	0.0925	0.0506	<b>0.7677</b>	0.0233	-0.1189	0.0867	0.0007	-0.0594
Help in field work	-0.1457	-0.1120	0.1651	0.0432	-0.2460	0.0919	<b>-0.7305</b>	0.1112	-0.0448
To provide food for the household	-0.0655	-0.1141	<b>0.7837</b>	-0.0093	0.0958	-0.0358	-0.0722	0.0768	-0.1408
To provide work for household members	0.1322	<b>0.7170</b>	0.1104	-0.0639	0.2652	0.0990	0.0164	0.2522	-0.0868
To enjoy farming	0.0675	<b>0.6239</b>	0.3128	0.0748	-0.1637	-0.0807	0.3336	-0.0276	0.0229
To generate cash income	0.2090	<b>0.7387</b>	0.1223	0.1007	0.0750	0.0899	0.2395	-0.1383	-0.0419
We only produce for the provision of safe food for the household	-0.1607	<i><u>-0.5715</u></i>	<i><u>0.4178</u></i>	-0.2840	-0.0130	-0.0429	0.3110	0.1287	-0.0984
We do not produce for pecuniary reasons	-0.1530	<b>-0.7698</b>	0.2204	-0.1493	-0.1228	-0.0223	0.0557	0.0601	-0.1399

Remark: Factor loadings higher than 0.6 and less than -0.6 are marked as bold; those higher than 0.4 and less than -0.4 are underlined and in italics.

Source: Own calculation based on data from SCARLED survey.

