p-ISSN 0044-1600
e-ISSN 2392-3458

Problems of Agricultural Economics

www.zer.waw.pl

4(341) 2014, 68-86

Translation from Polish

MICHAŁ SOLIWODA
Institute of Agricultural and Food Economics
– National Research Institute
Warsaw

AGRICULTURAL FINANCE IN THE FACE OF CONTEMPORARY ECONOMIC AND SOCIAL CHALLENGES – DEVELOPMENT PERSPECTIVES

Abstract

The agricultural sector has been participated and is still participating in cash processes. The growing interest in the issues of risk management, a deeper connection of the agricultural sec-tor with the financial infrastructure, progressive social changes in the Polish countryside (inter alia, aging, part-time farming, migration of rural population to urban and suburban areas), as well as in the economic, political surroundings of agricultural holdings provide backdrop for reflections on the prospects of development of agricultural finance. The article aims to discuss the role of agricultural finance in the system of economic sciences. The research objectives are as follows: (1) to identify associations between agricultural finance and other research areas, including agrarian policy, (2) to diagnose the current state of research in the field of agricultural finance in Poland and abroad, (3) to determine the prospective/potential areas of research with-in this subdiscipline, evaluating the possibility of using different methodological approaches. The challenge posed to agricultural financiers of agriculture will be determining details of agri- cultural policy instruments (including CAP). Agricultural finance will increasingly come into contact with problems requiring an interdisciplinary or even cross-science approach. It seems necessary to deepen the use of more advanced quantitative methods, for example, researching the financial aspects of risk management in agriculture.

Keywords: agricultural finance, insurance, economic and social challenges, CAP, development perspectives.

Introduction

Finance – as a practice area at first – has accompanied the man from the moment when money emerged as a legal tender (Weatherford J. 1997). As long ago as late Middle Ages, a quite detailed accounting practice was developed. The first banks in Italian city-states (Genoa, Milan, Florence) triggered intensive money circulation, accompanying trade with the Levant (Allen R. 2011). The primitive accumulation of capital, as a consequence of international trade since mid-15th century, as well as of increased money circulation and productivity in agriculture, formed basis for the market economy to develop, along with the foundations for financial infrastructure. (see Kaliński J. 2004). The oil crisis of 1970s had radically affected the determinants of financial process in the international context (see Kaliński J. 2004). In consequence of destabilisation of the global monetary system1, solutions for managing different kinds of risk associated with business activity were expected. This gave an impetus for rapid development of practical solutions and methodical concepts in finance (e.g. interest rate and exchange rate risk modelling, management of financial institutions).

In the Polish system of sciences, finance is a relatively new discipline in the area of "economic sciences". The following factors were decisive for isolating finance as a separate area of study: the autonomy of research tools, and also a slightly different area of interest compared to related disciplines, i.e. economy and management sciences (see Komunikat Centralnej Komisji do Spraw Stopni i Tytułów No. 7, 2010).

As rightly noted by J. Franc-Dąbrowska (2010), agriculture was an important point of reference for classical economists (A. Smith, D. Ricardo), and a farm was an object of theoretical considerations (e.g. in the Ricardo's corn model). Until mid-19th century, the agricultural sector was a very important sector in the national economies, as it generated a significant share of GDP. In result, it actively participated in monetary phenomena, and it continues to do so. Currently, the issue is getting increasingly complex, since Poland – as a EU member – has its part in creating the Common Agricultural Policy (CAP), which affects the functioning of agricultural holdings and agricultural areas (Hill B. 2012). An analysis of the flow of funds in Polish agriculture (accounting for the sphere of market interventions and rural development) reveals that in 2012 a clear stagnation in revenues from sales of goods and services was recorded, and at the same time the level of subsidisation decreased. Even though the relationships associated with self-financing of agriculture improved, the coverage ratio of agricultural loans with bank deposits of agricultural entities (agricultural holdings and companies) reached the historic minimum (A*naliza produkcyjno-ekonomiczna*... 2013). The increased interest in risk management issues (Theuvesen L. et al. 2014), stronger links between the agricultural sector and financial infra-

[1] Fluctuating exchange rates started to be used, replacing the exchange rates based on bullion (gold, silver).

structure, and social changes that are taking place in Polish rural areas (e.g. aging of people who manage agricultural holdings, part-time farming, migration of rural population to urban and sub-urban areas) and also in business and political environment of agricultural entities, provide a backdrop for reflections on developmental prospects for agricultural finance[2].

The aim of this study is to identify the role of agricultural finance in the system of economic sciences. The following three research objectives have been formulated: (1) to identify associations between agricultural finance and other research areas, including agrarian policy, (2) to diagnose the current state of research in the field of agricultural finance in Poland and abroad, (3) to determine the prospective/potential areas of research within this sub-discipline and to evaluate the possibility of using different methodological approaches. This article presents methodological and scholarly deliberations. At the end, conclusions and recommendations are given.

Agricultural finance in the system of economic sciences: interactions with agrarian policy

Finance – in a broad sense, as a study of monetary phenomena – constitutes an autonomous and evolving scientific discipline, which can be characterised as an extremely broad one. Thus, in may be problematic to place this discipline in the system of sciences (Table 1). Moreover, the researchers have proposed many different classifications within the framework of "finance". The best known division of the "finance" discipline into sub-disciplines is by subject areas. The following areas were identified, e.g.: household finance, finance of enterprises (including corporate finance), public finance (generated by fiscal practices), international finance (Korenik D., Korenik S. 2004), and finance of international organisations[3]. Isolating agricultural finance, same as agricultural economics, results from the sectoral division of economic disciplines[4] and is justified by the American scientific system. According to a well-known JEL Classification[5] the field "agricultural finance" can be identified. The US approach indicates close relationships between agricultural finance and other areas of research, covering the agricultural sector (Table 2).

[2] Agricultural finance should be regarded as both a field of scientific discipline, exploring the problems of the rural sector (addressed e.g. by this article) and as an element of practice of "servicing" monetary phenomena involving entities of agricultural sector and institutions connected with this sector (e.g. paying agencies).

[3] L. Oręziak (2009) identifies also the European Union finance, as a sub-discipline integrating deliberations at the macro-, mezzo- and micro-level.

[4] In this context, reference should be made to early attempts at classification of economic sciences at the first Congress of Polish Science (1951), namely the propositions of O. Lange and H. Chołaj, who distinguished the so-called branch (sectoral) economics. The "fragmentation" of economic sciences into highly detailed areas (of economics) was criticised at the second Congress of Polish Science (1971), when J. Lewandowski proposed that the "theory of money" should be distinguished, as a field similar in scope to the current "finance" discipline (Flejterski S. 2007a).

[5] The JEL classification system was developed for use in the Journal of Economic Literature (hence the JEL acronym), and is generally used for linking scholarly literature with given fields of economics.

It is undeniable that the development of finance practice, and the resulting new theoretical concepts, closely connected with methodological approaches, increased the level of interdisciplinarity of finance. If we treat interdisciplinarity as associations with related economic disciplines (economy – as the "mother" discipline[6], management studies, and – to a modest degree – commodity science), then we face the problem of interdisciplinarity[7]. A cross-field approach implies that finance is a part of a network of connections with other science disciplines, first of all, with social sciences (including e.g. sociology, psychology, public policy studies), legal sciences, and even biological and medical sciences[8]. Table 3 presents links of "agricultural finance" with various areas of science[9]. It should be expected that associations of various kinds will be more complex. This is a result, first of all, of the existing research gaps and problems, the "traditional" analysis of which (using methods characteristic for economical sciences) brings little progress.

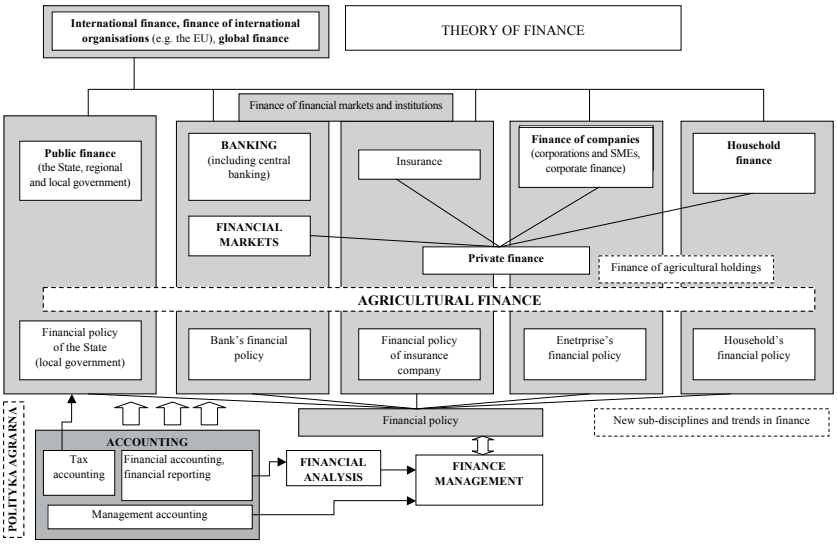

Fig. 1. Agricultural finance within the structure of the "finance" scientific discipline.
Source: sdaptation of S. Flejterski (2207a).

[6] It should be borne in mind that finance has its roots in the theory of economics, with its key categories such as income, costs, efficiency, or economic viability. Close relations with economy still exist. As S. Flejterski (2007b, pp. 18-19) states "finance has its economic dimension: mega-, macro-, mezzo- and micro". Moreover, an analysis of several phenomena defined in monetary terms makes no sense if the relationships between financial processes (as a set of interrelated phenomena) and the real sphere is neglected.

[7] The problem of inter-field connections has been noticed in the competitions organised by the National Science Centre (e.g. SYMFONIA).

[8] Namely, areas of study that are common for finance and e.g. "life sciences", such as neurofinance.

[9] These include scientific disciplines and sub-disciplines, and also interdisciplinary field of studies.

Table 1

Finance according to different scientific classifications applicable in Poland

Scientific classification system	Place of "finance"
Classification based in the Ordinance of he Minister of Science and Higher Education of 8 August 2011 on the areas of knowledge, fields of science and art, and scientific and artistic disciplines (Journal of Laws of 2011 No. 179, item 1065)[a]	Area of social sciences Field of economic sciences Disciplines: economy, **finance**, management studies, commodity sciences
OECD classification[b]	**5. Social Sciences** 5.2. Economics and Management – no "finance" category distinguished Economics, Econometrics; Industrial relations; Business and Management
Classification of the National Science Centre (NCN)	**HS – Arts, Humanities and Social Sciences** **HS4 – Individuals, institutions, markets** (covers "fields" such as: economics, finance, management, demography, social and economic geography and urban studies) HS4_1 Macroeconomics (including economic balance, economic growth, business cycles in global economy, labour economic HS4_2 Microeconomics and institutional economics HS4_3 Econometrics and statistical methods HS4_4 Population dynamics and demographic processes HS4_5 Population, economy, social and economic development, sustainable development **HS4_6 Financial markets, banking, corporate finance, public finance** HS4_7 Behavioural economy, consumption and customer behaviour, marketing HS4_8 Organisation management, strategic management, concepts and methods of management, logistics HS4_9 Management of human resources, employment and wages HS4_10 Public economics, social infrastructure, public administration HS4_11 Living conditions and standards, income distribution, poverty HS4_12 International economics HS4_13 Economic and social geography HS4_14 Land management, urban studies HS4_15 Other related subjects

[a] After the entry into force of the amendments of acts on the higher education system, the issues related to the scientific classification are regulated by the minister competent for science and higher education (earlier it was the competence of the Central Commission for Academic Degrees and Titles. bThe OECD classification is used in Poland by the National Centre for Research and Development (NCBiR). Source: own compilation.

Table 2

Agricultural finance in the US JEL Classification of Economic Sciences

JEL Code	Research area (sub-area)
Q	**Agricultural and Natural Resource Economics • Environmental and Ecological Economics**
Q1	**Agriculture**
Q10	General
Q11	Aggregate Supply and Demand Analysis• Prices
Q12	Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets
Q13	Agricultural Markets and Marketing • Cooperatives • Agribusiness
Q14	**Agricultural Finance**
Q15	Land Ownership and Tenure • Land Reform • Land Use • Irrigation • Agriculture and Environment
Q16	R&D • Agricultural Technology • Biofuels • Agricultural Extension Services
Q17	Agriculture in International Trade
Q18	Agricultural Policy • Food Policy
Q19	Other

Source: own compilation based on: JEL Classification System (2014).

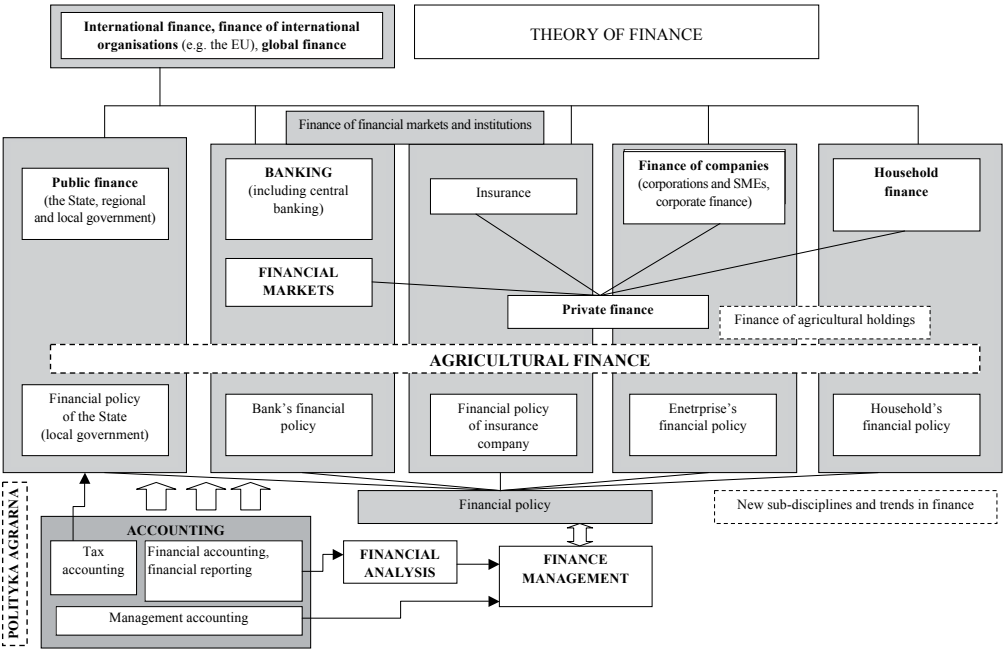

Fig. 2. The process of creating public policy – interactions with financial resources.
Source: modification of B. Hill (2012).

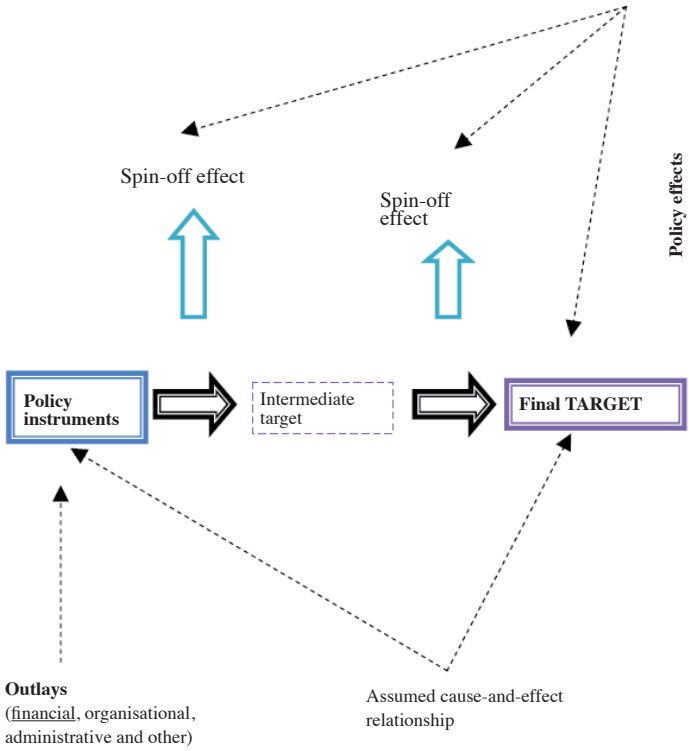

Fig. 2. The process of creating public policy – interactions with financial resources.
Source: modification of B. Hill (2012).

Figure 1 illustrates the links between agricultural finance and other sub-disciplines/areas of finance. It should be noted that an analytical approach is required here, typical of public finance (e.g. analysis of the flow of funds in agriculture, taxation of agriculture), as well as an approach typical for finances of companies or of households (e.g. the impact of the EU subsidies on financial condition of agricultural holdings). It is also important to take into consideration the accounting system[10] that generates the "input data" for the purposes of financial analysis.

[10] Past practice indicates that academic achievement in the area of accounting and financial reporting is assessed within the framework of the scientific discipline "finance".

Table 3

Links between "agricultural finance" and other areas of science

Scientific area	Components of scientific areas which interact with "agricultural finance"
Economy	Microeconomic basis of cost accounting (fixed costs, variable costs), economies/diseconomies of scale in agricultural production, economic rent theory, inter-temporal choice theory, political choice theory, financial economics (including interest rate theory), monetary and budgetary policy as elements of "applied" microeconomics, international competitiveness theories
Management studies	Management of process and operations in agricultural production, project management (e.g. investment projects, projects financed from the EU funds), strategic analysis, the so-called public management – related to the activity of paying agencies, management function in finance management of the agricultural holding
Public policy studies	Identifying objectives, hierarchisation, constructing public policy instruments (first of all the CAP and national agricultural policy) of financial nature (e.g., direct payments, repayable financial instruments in public policy)
Psychology	Exploration of psychological motives behind financial decisions (e.g. connected with saving, incurring debts, investing, insuring oneself) of individual entities, close associations with the behavioural approach in finance
Sociology	Making use of methodological tools (using field studies, constructing measurement tools, preparation of survey questionnaires); the so-called economic sociology, exploring e.g. the state-economy interactions of special importance. Rural sociology (e.g., problems of social/economic exclusion in rural areas, income disparities)
History	Identifying regularities in social and economic phenomena, systematising the financial thought (like the economic thought)
Geography	Socio-economic geography: location theory, demography; physical geography: variability of climate and weather conditions, agro-meteorology
Law and administration studies	The EU law, tax law, insurance law, bank law, agricultural law – as total law applicable to agricultural system, administrative law (applicable to the institutional environment of agriculture, e.g. paying agencies)
Mathematics	Statistical methods (including the increasingly popular non-classical methods of statistical inference), mathematical programming
Information technology	VBA language – financial controlling in agricultural holdings, programming languages used in statistical-econometric packages
Agricultural sciences	Detailed plant cultivation, animal production, genetics and agricultural biotechnology

Source: own compilation, adaptation of ideas of (Korenik D., Korenik S. 2004; Rószkiewicz M. i in. 2003).

Agrarian policy constantly comes into contact with the practice and theory of agricultural finance. Moreover, the issues expressed through positive agricultural finance[11] are a kind of "base" in the process of creating agricultural policy, comprising: (1) formulation of problems, (2) identification and determination of policy objectives (policy formulation), (3) policy implementation through selection of appropriate instruments and tools, (4) impact of policy instruments (policy impact). It is also significant that there exist reciprocal connections between the

[11] Like in economics, we may distinguish positive finance ("what is the situation?"), normative finance ("what the situation should be?", and, as proposed by Flejterski (2007(a), applied finance ("what to do to make the situation as it should be?").

final step of creating agricultural policy and the first two steps, taken by decision makers (Hill B. 2012). Thus agricultural policy "poses" problems that may be addressed using research tools developed, e.g. by agricultural finance. Hill explains that each instrument of agricultural policy (including an instrument typically financial in its nature, such as support in the form of investment grants or direct payments) is a component of a complex system, comprising both the outlays (including financial and organisational resources and administrative support) and the outcome (e.g., increased income of farmers). The mechanism of creating public policy (including agricultural policy) is presented in Figure 2. Sometimes, the use of certain instruments causes certain side effects or spin-offs[12]. Moreover, the extensive methodological base used in management accounting or finance management[13], in combination with the achievements of public finance, provides necessary tools for evaluating the impact of agrarian policy.

The state of contemporary research on agricultural finance

Research on agricultural finance, both in Poland and abroad, is performed in scientific centres that have extensive experience in the scope of agricultural sector economics. Table 4 presents a review of the most important problems in current agricultural finance, based on selected best known and most frequently quoted German and US researchers. In Germany, a quite strong holistic approach is pursued, resulting from the interdisciplinary treatment of the problems of agricultural sector (within the framework of Agrarmanagment), which is reflected especially in articles and monographs of two researchers: M. Odening (Humboldt-Universität zu Berlin) and O. Mußhoff (Georg-August-Universität Göttingen). On the other hand, the US research tradition results from the strong links between entities of the agricultural sector and financial infrastructure and also highly developed capital markets – as agribusiness environment. It should be pointed out that risk management, in particular the construction of modern insurance instruments and assessment of effectiveness of insurance schemes for crops and livestock, is an important area of agricultural finance of today. It is also worth noting that US researchers (e.g. A.K. Mishra) make advanced empirical studies on the impact of agricultural policy channels on the functioning of agricultural holdings. Also, a clear interest can be observed in the research focused on the problems occurring in developing countries (e.g., credit squeeze).

[12] Hill (2012) gives the following example: payments for British framers for maintaining agricultural production on hilly areas, originally determined based on the number of livestock animals. Excessive intensification of animal production resulted in negative changes in natural environment.

[13] It should be noted that some issues, e.g., the assessment of investment projects efficiency or financial planning, are a common area for finance management and management accounting.

Table 4

Current agricultural finance in the world – a review

Major research problems	Researchers: "representative" scientific work	Methodological orientation	Contribution to the development of agricultural finance
		GERMAN RESEARCHERS	
Financial aspects of risk management in agriculture (including business insurance), additionally: grounds for investment decisions in agricultural holdings	**Martin Odening** Mußhoff O. et al., 2011 (including Odening M.); Hüttel S. et al., 2010 (including Odening M., Mußhoff O.)	Mathematical modelling (including the copula function), stochastic stimulations, econometric methods (including generalised Tobit model)	Defining the effects of risk mitigation that may be obtained with the use of **weather options** (precipitation level) in wheat production, the degree of hedging based of the construction of the option contract. Explaining the **motives of the unwillingness** (reluctance) of farmers to **undertake investing activity**, taking into account the effects of real options and imperfect equity options
Financial aspects of risk management in agriculture, investment decisions in agricultural holdings	**Oliver Mußhoff** joint work with M. Odening: Hüttel S. et al., 2010 (including Odening M., Mußhoff O.); Maart-Noelck S.C., Mußhoff O., 2013	Mathematical modelling (including the copula function), stochastic stimulations of econometric methods (with focus on binary models and multiple regression), economic experiment	(1) See item 1 (M. Odening) Broadening the analytical framework for **investment decisions in agricultural holdings** (with economic experiment): comparing the observed investment decisions with the classical theory of investment and real option theory
Financial aspects of risk management in agriculture; credit decisions in agricultural holding	**Norbert Hirschauer** Hirschauer N. et al., 2014; Mußhoff O., Hirschauer N., 2012	Diagnostic survey method (with extensive statistical analysis), mathematical modelling methods, economic experiment methods	Development of economic experiment methodology: problem of taking into account inconsistent objects of research. Possibility to use simulation games to analyse the impact of agricultural policy on financial decisions of people who manage agricultural holdings.
		US RESEARCHERS	
Evaluation of the effects of financial interventions in the agricultural sector (taking into account the role of off-farm income as well as agri-environmental issues)	**Ashkok K. Mishra** Mishra A.K. et al., 2014; Uematsu H., Mishra A.K., 2012.	Econometric models (with the focus on binary models: logit and probit models), mathematical modelling	Broadening the framework of analysis of **the determinants for closure of agricultural activity** (including government payments and off-farm income). Identifying the **determinants of income in organic farms**, estimating the average treatment effect (ATE) for organic certification.

cont. Table 4

Financial aspects of risk management in agriculture (including crops insurance); additionally credit squeeze in agriculture (with reference to developing countries)	**Calum G. Turvey** Turvey C.G., 2012; Turvey C.G., Kong R., 2010	Mathematical programming, simulation methods (including Monte Carlo), comprehensive statistical analysis of survey results (cluster analysis)	Using mathematical programming for defining the **optimal "production portfolio"** of an agricultural holding with different variants of insurance, including the insurance of the whole farm income. Identifying factors that drive farmers to purchase **modern insurance products** (including weather insurance).
Financial aspects of risk management in agriculture (financial mathematics)	**Charles B. Moss** Moss Ch.B., 2010; Salois M.J., Moss Ch.B., 2011	Mathematical programming, adaptation of theoretical models (CAPM, valuation of real options)	(1) Systemising risk modelling methodology for agricultural holdings. (2) **Generalised exponential discounting approach**, in the NPV model, through inclusion of quasi-hyperbolic discounting element – empirical verification has revealed the existence of statistical significance of the quasi-hyperbolic factor.

Note: the researchers were selected based on "Google Scholar" search engine, taking into account bibliometric indices.

Source: own compilation.

Table 5 presents a review of major problems in contemporary agricultural finance in Poland. It should be noted that finance as a scientific sub-discipline develops in various scientific centres, not only in universities of life sciences. Researchers, who focus on the issues of agricultural finance as the dominating area of their exploration, also undertake studies going beyond the agricultural sector. The financial aspects of risk management in agriculture are quite an important area for developing agricultural policy, however, acute research shortages in this scope occur. Polish researchers are very much interested in the issues involved in the assessment of financial condition of entities operating in the agricultural sector (both large-area agricultural holdings having legal personality and farms owned by natural persons). Over the last two decades, a significant progress was observed in the development of methods of financial analysis, tailored to special needs of natural persons. To sum up, the research methods used in Polish agricultural finance are somewhat less complex, compared to those used abroad. This does not help in disseminating the results of studies in agricultural finance globally.

Table 5

Current agricultural finance in Poland – a review

Major research problems	Researchers: "representative" scientific work	Methodological orientation	Contribution to the development of agricultural finance
Assessment of the effects of financial interventions in the agricultural sector	**Jacek Kulawik** (1) Kulawik J., Płonka R., 2013; (2) Kulawik J., 2010	Literature studies, meta-analytic approach, logical methods, documentation method, statistical and econometric methods (with focus on regression analysis)	(1) Selection of a bunch of financial analysis indicators **to evaluate economic and financial efficiency of agricultural holdings**, and to assess the impact of the EU subsidies. (2) Extending the framework of "classical" **financial analysis** (mostly financial efficiency) of large-area holdings by taking into account interactions within local, national, international and global environment.
Taxation of agriculture and social insurance system	**Marian Podstawka** (1) Podstawka M., Gołasa P., 2011a; (2) Podstawka M., Gołasa P., 2011b	Documentation method, economical analysis of law, simulation method	(1) Methodology of assessment of **Tax Expenditures (TEs) in Polish agriculture;** the costs of introducing income tax in agriculture (costs of tax services and tax authorities) may exceed the expected revenues from taxes, which encourages further research and public debate on the issue. (2) Proposal and assessment of **the reforms of taxation regime in agriculture and changes in social insurance scheme**, taking into account social issues.
Assessment of the financial condition of agricultural holdings (with special focus on profitability and liquidity)	**Zbigniew Gołaś** (1) Gołaś Z., Kurzawa I., 2014; (2)Gołaś Z., 2010	Method of financial ratio analysis, multi-dimensional comparative analysis, statistical and econometric methods (with preference given to logit models), heuristic methods	(1) Postulate to decompose synthetic profitability measures to accurately identify the reasons for variations in the levels of this financial category. (2) Conceptual approach to systemic analysis of efficiency and profitability in agriculture, based on the applicable harmonised EU financial report, the so-called Economic Accounts for Agriculture
Management of financial liquidity in agricultural holdings, and in the entities of agri-business	**Mirosław Wasilewski** (1) Wasilewski M., Gałecka A., 2013; (2) Wasilewski M., Felczak T., 2011	Method of financial ratio analysis, statistical methods (descriptive statistics), method of case studies, documentation method	(1) Interpretation of partial **strategies for financial liquidity of agricultural holdings**, based on income and risk, depending on the assumed profitability of assets (2) Synchronisation of partial strategies of enterprises in a long-term financial strategy as well as a short-term working capital strategy – to ensure desirable rates of return for the owners.
Equity structure of agricultural undertakings, the use of profit in agricultural undertakings	**Justyna Franc-Dąbrowska** (1) Franc-Dąbrowska J., Kobus P., 2012; (2) Franc-Dąbrowska J., 2010	Econometric methods (with focus on binary models), literature studies	(1) Postulate to treat the **cost of equity** as a transaction cost (which is a consequence of the scarcity of this good), and "better" management of this resource in agricultural undertakings. (2) Proposing a concept for theoretical model of profit management, systematising the approach to profit, dividend and dividend policy in agricultural undertakings.
Linking the agricultural sector with financial institutions	**Ryszard Kata** (1) Kata R., 2013; (2) Kata R., 2011	Literature studies, diagnostic survey methods, statistical methods, heuristic methods	(1) Identification of behavioural and demographic factors affecting **credit decisions of farmers.** (2) Proposal of tools aimed at ensuring desirable (for economic growth and development of agriculture) features of connections between banks and agricultural holdings.

Note: the sequence in which the researchers are presented is based on the date when they were awarded the degree of doctor habilitowany (*doctor habilitatus*); the review covers scientists who focus their research mostly on the agricultural sector. The problems of agricultural finance are also addressed by S. Juszczyk (2013) and D. Zawadzka (2013).

Source: own compilation.

Development perspectives for agricultural finance – areas of study and methodological approaches

Formulating recommendations concerning the functioning of small farms, with lower than average production level[14] will become a challenge for the finances of agricultural undertakings. Even though the pressure on restructuring processes and on higher concentration and improved economic and financial results is absolutely right, there remains a problem of farms with very limited opportunities to find jobs outside of agriculture or to increase income (in particular, the off-farm income). Another problem is associated with the so-called agricultural professional groups or people who treat agriculture as a hobby, or as F. Tomczak (2005) has put it – "non-agricultural niche activity". Relying on financial measures/indicators, which account for family farm income and the so-called entrepreneur's profit, is rather problematic. Greater emphasis should be put on subtleties of sustainable agriculture. As rightly pointed out by J.St. Zegar (2012), according to this model, the motives behind development of agriculture are, e.g., "multifunctionality, environmental capacity, increasing significance of knowledge, accounting for consumer needs, and important role of the state".

When one adapts the E.A. Helfert's (2004) concept of enterprise, agricultural holdings may be treated as an "integrated cash flow system", activated by the manager. In family farms, unlike in agricultural enterprises in the form of capital companies, there is no clash between interest groups: managers, owners and frequently the environment[15]. In a traditional farm, the burden of responsibility for financial decisions lies with persons managing the farm who are, at the same time, the heads of the household.

A subtlety of CAP is its focus on rural areas which, same as the rural sector, should be undergoing sustainable development. Thus, emphasis is placed

[14] There are several problems affecting finance management in family farm households, e.g.: (1) seeking to improve the family living standards is usually connected with delaying the investment processes on the farm; (2) implementing typical production management tasks and making strategic financial decisions at the same time, and in addition using a longer planning perspective, in result of which a lower discount rate is applied; (4) labour for the needs of the farm provided by family members; in effect person running the farm pays less attention to economic imperatives (maximising profits, increasing productivity), focusing on the engagement of family members in agricultural production; (5) the goals of agricultural holding change in the course of family cycle, reflecting e.g. the aging of persons managing the farm, the changing supply of labour force available for the farm, and the changing labour market, as well as the primacy of family needs; (6) inter-generational transfers: in many entities, maximising income is not the aim of their activity; the transfer of assets and property rights (in succession processes) is the main reason why long-term planning should take precedence over well-informed decisions. Linking a household with agricultural entity – as a place of work – results in significant difficulties in drawing a demarcation line between production and consumption. Moreover, combining the ownership and the managerial function brings about chaos, as members of agricultural family must allocate their time for various functions they perform on the farm. Another issue is the conflict that may result from the functions performed, the selection of which depends on the age and gender (Gasson R., Errington E. 1993).

[15] Nevertheless, combining a farm with a household is a decisive factor for complexity and specificity of financial processes.

on sustainable management of natural resources and also on counteracting climate change (climate actions)[16]. As regards challenges for agricultural finance, **close integration with rural development is a must**. From the methodological perspective, it is an increasingly big challenge to calculate agri-environmental payments and to evaluate programmes with the right assessment criterion that would account, e.g. for economic efficiency at the level of agricultural holding, the sector or the EU, and for the transaction costs[17] as well as the amount of public spending (Zegar J.St. 2012; Targetti S. et al. 2010, Dobbs Th., Pretty J. 2008). From the point of view of the sub-discipline analysed, it is important to understand the existing associations with environmental economics, or to put it more broadly, with natural resources economics. As J. Kulawik (2014) rightly puts it „agri-environmental problems make up a very complex structure of various interdependencies, not fully identified, requiring interdisciplinary knowledge and experience, as well as effective economic and environmental models for their analysis and simulations, and also improved policy tools to achieve the assumed objectives". The above suggests that the agricultural financier dealing with agri-environmental issues should have at his/her disposal very solid research tools, going beyond the customarily accepted framework of the sub-discipline. Thus, such researcher must have rudimentary knowledge of agricultural sciences (e.g. agronomy, animal husbandry, agricultural engineering), and even biological sciences.

As J. Ziółkowska (2005) rightly points out, due to changes in the macro-environment of agricultural holdings and to constant development of enterprises, we are witnessing a quality evolution that is taking place (e.g. focus on the value of economic entity, dynamical approach based on cash flows, instead of "classical" static approach). Since the accession of Poland to the EU, the situation in finance management changed little. This may be due to significant delays in adopting various innovations (including organisational innovation or innovation in methods of management), compared to other sectors of the economy[18]. **The increasingly complex social and demographic changes taking place in rural areas should be noticed by agricultural financiers.** The problem remains of multi-faceted impact of socio-demographic features (such as education, age and gender of person managing the agricultural holding) on financial condition of the holding.

[16] One of long-term strategic objectives is "to achieve sustainable territorial development of rural economy and rural communities, including creation and safeguarding of jobs" (European Commission 2014).

[17] Also administrative and operating costs should be taken into account (A&O costs).

[18] Introducing gradually accounting records (at the beginning, in a simplified form, namely adopting the cash approach), and then basic financial accounting (showing at least monetary income) on commercial farms that satisfy specific conditions (e.g. the value of marketable production above a certain limit), as in Polish balance sheet law. The existing petrified "backwardness" of people managing agricultural holdings does not foster quality changes, which would be very much desirable on Polish rural areas. After all, farmers should not be forced to organise their financial policy, but rather be motivated to aim at improving integrated effectiveness (including financial effectiveness) of their farms. It might be helpful to engage agricultural advisory centres, as employees of such centres have accumulated knowledge and experience form their participation in the Polish FADN system.

Table 6

Assessment of perspectives to apply research methods/approaches in agricultural finance

Research method	Assessment of application perspectives[a]	Remarks
Case study	⇔	Case study is indispensable when it is not possible to obtain data from representative samples, however, it is of illustrative nature
Logical methods: induction, deduction, analysis and synthesis	⇔	Base methods, in particular in studies of "eclectic" nature (review papers)
Economic experiment method	⇧	Limited application due to the necessity to reject the "homo economicus" as the agent of economic decisions paradigm
Mathematical methods (mathematical modelling)	⇧	The growing popularity of Monte Carlo simulation, Markov chain and cupola functions in agricultural finance is noteworthy
Statistical methods	⇔	Analyses of multi-dimensional cross-cutting/time series Discriminant analysis, cluster analysis
Cyber methods	⇧	Increased interest in using artificial neuron networks, including to predict the financial condition of agricultural holding
Econometric methods	⇧	Microeconometric models[b] of financial risk, models for cessation of activities for agricultural undertakings (in the form of capital companies), selection models regarding the equity structure in agricultural holdings
Diagnostic survey method	⇔	More advanced methods for processing collected empirical data will be used in the future
Comparative methods	⇧	Comparative methods will be used more frequently at international level (e.g. comparative studies on financial conditions of agricultural holdings in the EU)
Heuristic methods	⇔	It may be particularly useful to transfer concepts from other disciplines of science

[a] Increased popularity of a given method, decreased popularity, ó no significant changes.

[b] The issue of financial microeconometrics is discussed in more detail by M. Gruszczyński (2012).

Source: own compilation.

The agent taking decisions concerning financial resources does not always act in accordance with the rules of economic rationality. In result, there is a justified need to break down the barriers imposed by scientific purism. Challenges relating to, e.g., incurring debt, saving, and attitude towards risk encourage some researchers to "go beyond the limits" of economic sciences. Breaking down the barriers between economic sciences and medical sciences resulted in isolating **neuroeconomics** (and also **neurofinance**) as a separate discipline, the target of which is to distinguish "neural correlates of economic decisions and assessments" (Zaleśkiewicz T. 2012). Explorations in the field of neurofinance aim to identify brain areas responsible for human expectations regarding financial profit/loss and for making choices involving deferred gratification (Zaleśkiewicz T. 2012).

Table 6 presents a review of possibilities to use selected research methods in agricultural finance in the future. It is anticipated that greater focus will be put on

research conducted with the use of more advanced quantitative methods (first of all mathematical modelling, and also econometric models developed in the framework of the so-called empirical finance of enterprises). Making use of qualitative data will involve construction of binary models (e.g., Tobit model, probit model). It seems that papers based on case studies alone will play a supplementary role. As regards heuristic methods, the so-called transfer of ideas from other disciplines will play a growing role. This will be a consequence of exploring, to a growing degree, the interdisciplinary or even cross-field research problems.

Conclusions and recommendations

1. Assuming that a shift towards sustainable agriculture will require a higher level of integration with other sectors of domestic economy, whereas restructuring of agriculture will also involve improved management methods in agricultural holdings19, we should expect increasingly new challenges facing the agricultural finance. On the other hand, the ongoing socio-demographical changes in rural areas20, along with the imperative for environmental sustainability, result in growing complexity and subtlety of the issues of financing the agriculture and rural areas.
2. The CAP has significantly contributed to changes in economic and financial situation of agricultural holdings in Poland. Nevertheless, the CAP is evolving, which is a result, e.g., of pressure on competitiveness of the EU in international trade in agri-food products, and on limiting budgetary support, in particular subsidy instruments. The proposal to use financial instruments other than subsidies, as envisaged by RDP, may turn out to be a *novum*. Determining the "technicalities" of agricultural policy instruments (e.g., calculating payments, methods of evaluating project effectiveness – mid-term or ex post) is a challenge that agricultural financiers will have to address.
3. Agricultural finance will increasingly face problems that require interdisciplinary or even cross-field approach. This may naturally raise concerns associated with crossing the borders of a given science discipline. The issues pertaining to equity structure of agricultural holdings or financial risks that they face are an example where "traditional" research methods, typical for economic sciences, may prove inadequate.
4. In the age of statistical/econometric packages (available based on a free license and open software, such as R or GRETL) the problem lies not in having access to certain tools and procedures but in appropriate, informed selection, fit for a given research problem. In the contemporary agricultural finance, there exists a tendency (visible in particular in the USA and Germany) to use more and more advanced quantitative apparatus (including stochastic simulations).

[19] These issues are discussed in more detail – in the context of sustainable development – by A. Kowalski (2013).

[20] The CAP seeks the ways to counteract some changes (e.g., internal migration) – e.g. actions motivating young farmers envisaged by the RDP.

5. Polish researchers of agricultural finance face a challenge of organising the existing knowledge and methodologies, in the form of scientific monograph, following German example. Even though among the vast amount of economic publications there are many dedicated to enterprise finance and public finance, there exists a market niche for a concise work, a kind of compendium systematising the achievements of different schools of thought. Publishing a monographic work on finances of the agricultural sector would provide an impetus for greater integration of the academic milieu. Such a monograph, moreover, will be helpful for the employees of agricultural advisory centres, as well as for undergraduate, graduate and PhD students exploring agricultural finance (not only at life science universities but also at universities that have not yet accumulated experience in economic-agricultural research).

References

Allen R.: Global economic history: a very short introduction. Oxford University Press, New York 2011.

Analiza produkcyjno-ekonomiczna sytuacji rolnictwa i gospodarki żywnościowej w 2012 roku (ed. A. Kowalski). IERiGŻ-PIB, Warsaw 2013.

Dobbs Th., Pretty J.: Case study of agri-environmental payments: the United Kingdom. Ecological Economics, 68, 2008.

Flejterski S.: Metodologia finansów. Podręcznik Akademicki. PWN, Warsaw 2007a.

Flejterski S.: Przedmiot, struktura i metoda nauki finansów [in:] Elementy finansów i bankowości (edited by S. Flejterski, B. Świecka). CeDeWu, Warsaw 2007b.

Franc-Dąbrowska J., Kobus P.: Koszt kapitału własnego - dylematy wyceny. Zagadnienia Ekonomiki Rolnej, No. 1, 2012.

Franc-Dąbrowska J.: Teoretyczne i praktyczne aspekty gospodarowania zyskiem w przedsiębiorstwach rolniczych. Wydawnictwo SGGW, Warsaw 2010.

Gasson R., Errington A.: The farm family business. CAB International, Oxon 1993.

Gołaś Z., Kurzawa I.: Zastosowanie uporządkowanego modelu logitowego w analizie rentowności branż przemysłu spożywczego. Zagadnienia Ekonomiki Rolnej, no. 1, 2014.

Gołaś Z.: Propozycja systemowej analizy wydajności i dochodowości pracy w rolnictwie. Zeszyty Teoretyczne Rachunkowości, vol. 57, no. 113, 2010.

Gruszczyński M.: Empiryczne finanse przedsiębiorstw. Mikroekonometria finansowa. Difin, Warsaw 2012.

Helfert E.A.: Techniki analizy finansowej. PWE, Warsaw 2004.

Hill B.: Understanding the Common Agricultural Policy. Earthscan, Oxon 2012.

Hirschauer N., Mußhoff O., Maart-Noelck S.C, Gruener S.: Eliciting risk attitudes – how to avoid mean and variance bias in Holt-and-Laury lotteries. Applied Economics Letters, vol. 21(1), 2014.

Hüttel S., Mußhoff O., Odening M.: Investment reluctance: irreversibility or imperfect capital markets? European Review of Agricultural Economics, vol. 37, issue 1, 2010.

JEL Classification System / EconLit Subject Descriptors; Retrieved from: https://www.aeaweb.org/econlit/jelCodes.php?view=jel (access date: 6.10.2014).

Juszczyk S.: Amortyzacja w ekonomice agrobiznesu. Wydawnictwo SGGW, Warsaw 2013.

Kaliński J.: Historia gospodarcza XIX i XX w. PWE, Warsaw 2004.

Kata R.: Endogeniczne i instytucjonalne czynniki kształtujące powiązania finansowe gospodarstw rolnych z bankami. Prace Naukowe Wydziału Ekonomii Uniwersytetu Rzeszowskiego, Monografie i Opracowania, no. 14. Wyd. Uniwersytetu Rzeszowskiego, Rzeszów 2011.

Kata R.: Czynniki behawioralne i demograficzne wpływające na korzystanie przez rolników z kredytów inwestycyjnych. Zeszyty Naukowe SGGW w Warszawie – Ekonomika i Organizacja Gospodarki Żywnościowej, no. 103, 2013.

Kay R.D., Edwards W.M., Duffy P.A.: Farm management. McGraw-Hill, New York 2012.

European Commission. Rural development in 2014-2020; http://ec.europa. eu/agriculture/rural-development-2014-2020/index_pl.htm (access on: 8.10.2014).

Komunikat Centralnej Komisji do Spraw Stopni i Tytułów nr 7/2010. Zakres dyscyplin „ekonomia", „finanse" i „nauki o zarządzaniu" w ramach dziedziny „nauki ekonomiczne. Retrieved from: http://www.ck.gov.pl/index.php/komunikaty-ck/29-k-o-m-u-n-i-k-a-t-n-r-72010 (access date: 8.10.2014).

Korenik D., Korenik S.: Podstawy finansów. PWN, Warsaw 2004.

Kowalski A.: Perspektywy rozwoju rolnictwa europejskiego [in:] Znaczenie rolnictwa – perspektywa historyczna i międzynarodowa (aut.: B. Klepacki, A. Kowalski, F. Tomczak, J. Wilkin, J.St. Zegar). IERiGŻ-PIB, Warsaw 2013.

Kulawik J., Płonka R.: Subsydia a efektywność ekonomiczno-finansowa gospodarstw rolnych osób fizycznych. Zagadnienia Ekonomiki Rolnej, no. 3, 2013.

Kulawik J.: Efektywność przedsiębiorstw wielkotowarowych w rolnictwie. Zagadnienia Ekonomiki Rolnej, no. 3, 2010.

Kulawik J.: Wybrane aspekty finansowe programów rolnośrodowiskowych. Zagadnienia Ekonomiki Rolnej, no. 1, 2014.

Maart-Noelck S.C., Mußhoff O.: Investing today or tomorrow? An experimental appro- ach to farmers' decision behaviour. Journal of Agricultural Economics, vol. 64, issue 2, 2013.

Mishra A.K., Fannin J.M., Joo H.: Off-farm work, intensity of government payments, and farm exits: evidence from a national survey in the United States. Canadian Journal of Agricultural Economics, vol. 62, issue 2, 2014.

Moss Ch.B.: Risk, uncertainty and the agricultural firm. World Scientific, Singapore 2010.

Mußhoff O., Hirschauer N.: Planspiele als experimentelle Methode der Politikfolgenabschätzung: Das Beispiel der Stickstoffextensivierung. 52nd Annual Conference, Stuttgart, Germany, September 26-28, 2012, German Association of Agricultural Economists (GEWISOLA), 2012.

Mußhoff O., Odening M., Xu W.: Management of climate risks in agriculture – will weather derivatives permeate? Applied Economics, vol. 43, issue 9, 2011.

Narodowe Centrum Nauki. Panele NCN; http://www.ncn.gov.pl/finansowanie-nauki/ panele-ncn (access on: 8.10.2014).

OECD, Revised Field of Science and Technology (FOS) Classification In The Frascati Manual; http://www.oecd.org/science/inno/38235147.pdf (access date: 8.10.2014).

Olson K.D.: Economics of farm management in a global setting. John Wiley & Sons, Hoboken 2011.

Oręziak L.: Finanse Unii Europejskiej. PWN, Warsaw 2009.

Podstawka M., Gołasa P.: Oszacowanie wielkości Tax Expenditures w polskim rolnictwie. Roczniki Naukowe SERiA, v. 13, issue 1, 2011a.

Podstawka M., Gołasa P.: Ubezpieczenia społeczne i opodatkowanie działalności rolniczej, stan obecny i perspektywy zmian. Ubezpieczenia w Rolnictwie. Materiały i Studia, no. 40, 2011b.

Rószkiewicz M., Perek-Białas J., Węziak-Białowolska D., Zięba-Pietrzak A.: Projektowanie badań społeczno-ekonomicznych. Rekomendacje i praktyka badawcza. PWN, Warsaw 2013.

Salois M.J., Moss Ch.B.: A direct test of hyperbolic discounting using market asset data. Economics Letters, vol. 112, issue 3, 2011.

Targetti S., Viaggi D, Cuming D., Sarthou J.P., Choisis J.P.: Assessing the costs of measuring biodiversity: methodological and empirical issues. Paper prepared for presentation at the 120th EAAE Seminar "External Cost of Farming Activities: Economic Evaluation, Environmental Repercussions and Regulatory Framework", Chania, Crete, Greece, date as in: September 2-4, 2010.

Theuvsen L., Frentrup M. Bronsema H. Pohl Ch.: Risikotragfähigkeit im Risikomanagementprozess: Konzeption und praktische Anwendung eines kennzahlengestützten Scoringsystems zur Analyse landwirtschaftlicher Familienbetriebe. Berichte über Landwirtschaft, Band 92, Heft 1, Mai 2014.

Tomczak F.: Gospodarka rodzinna w rolnictwie. Uwarunkowania i mechanizmy rozwoju. IRWiR PAN, Warsaw 2005.

Turvey C.G.: Whole farm income insurance. Journal of Risk and Insurance, vol. 79, issue 2, 2012.

Turvey C.G., Kong R.: Weather risk and the viability of weather insurance in China's Gansu, Shaanxi, and Henan provinces. China Agricultural Economic Review, vol. 2, issue 1, 2010.

Uematsu H., Mishra A.K.: Organic farmers or conventional farmers: where's the money?

Ecological Economics, vol. 78, June 2012, 2012.

Wasilewski M., Felczak T.: Strategia płynności finansowej przedsiębiorstw rolniczych w zależności od rentowności aktywów. Zeszyty Naukowe SGGW w Warszawie – Ekonomika i Organizacja Gospodarki Żywnościowej, no. 91, 2011.

Wasilewski M., Gałecka A.: Płynność finansowa a przepływy pieniężne w gospodarstwach rolniczych Lubelszczyzny. Zeszyty Naukowe Wydziału Nauk Ekonomicznych i Zarządzania Uniwersytetu Szczecińskiego: Finanse, Rynki Finansowe, Ubezpieczenia, no. 59, 2013.

Weatherford J.: The history of money. Three Rivers Press, New York 1997.

Zawadzka D.: Kredyt w decyzjach finansowych przedsiębiorstw rolniczych w Polsce (ze szczególnym uwzględnieniem podmiotów z regionu Pomorza Środkowego). Zarządzanie i Finanse, no. 2/2, 2013.

Zegar J.St.: Współczesne wyzwania rolnictwa. PWN, Warsaw 2012.

Accepted for print: 12.12.2014.