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Financial innovations in Polish agriculture – barriers, challenges and perspectives of development

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Abstract:
Financial innovations may strongly improve the productivity, growth and competitiveness of the agricultural sector, the quality of products, as well as the income situation of farms. The main objective of the paper is to identify challenges and perspectives of development for financial innovations in agriculture. The research methodology is based on an eclectic approach, including a literature review with elements of case studies an . Although there are many classifications of financial innovations, there is a strong need to include some important peculiarities of farm households that are strongly linked with various entities in the agri-food sector. The detailed analyses should include both demand-side and supply-side factors. The variability of macroeconomic situation (vide: COVID-19 crisis) and its implications in fiscal/monetary policies), the dynamic processes in the financial system (i.e. an growing importance of the FinTech sector) can contribute to the challenges for development of financial innovations in Poland. The limitations may refer to the quality of human and social capital on rural areas (e.g. lower level of financial literacy compared to in urban areas).

Keywords: financial innovations**,** agricultural finance, farm households.

JEL Codes: O30, Q14, Q18.

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1. Introduction

Growing innovativeness is treated as important factor for improving the productivity, growth, competitiveness of the agricultural sector, improving the quality of products, as well as the income situation of farmers. Furthermore, innovative solutions can foster the adaptation of agricultural activity to the environment (Ministerstwo Rolnictwa i Rozwoju Wsi, 2019, p. 196). According to the report of GPFI (2015, p. 37), financial innovations „ (…) with an evolving agriculture and new experiences and innovations in agricultural finance, more can be done to build the inclusiveness of agriculture and rural communities in general, and underserved groups in particular.". Financial innovations should be considered within the general definition of innovation proposed by Schumpeter who claimed that the so-called 'creative destruction' (process, in which the new technologies were replacing earlier solution)s stimulates economic development in a dynamic - this process was called creative destruction (Schumpeter, 1960).

Although, as Błach convincingly (2012, p. 23) noted, "financial innovations have accompanied the development of the financial system (…)", the role of some of them is strongly linked to "an escalation of the global financial crisis". It should be noted that financial innovations may be presented from the perspective of the financial system, segments of the financial market or selected instruments (Błach, 2012, p. 23).

While the issue of financial innovations for enterprises has been strongly explored, there has been a research gap related the agricultural sector. First, there is the lack of definitions of "financial innovation" that has been accepted in the environment of economists and practitioners. Second, the social and economic needs of farm households determines needs for partial adaptation of innovative solutions.

The main objective of the paper is to identify barriers, challenges and perspectives of development for financial innovations in agriculture. The article employs an eclectic approach, including a literature review with elements of case studies as exemplification of innovative solutions.

The remainder of the article is following. First, we present drivers of financial innovations in agriculture. The next section describes typologies of financial innovations (with a particular attention to agriculture) and provides two examples. The fourth section identifies barriers challenges and perspectives of development. The article concludes with recommendations..

2. Drivers of financial innovation in agriculture

Financing farm households should include "signum specificum" of farm households that should be treated as 'hybrids', combinations of two economic organizations, namely family firms and households. This implies to various implications from the perspective of the role of farm households in the financial system. There is plethora of definitions of "farm households", that are useful for various purposes (inter alia, public policy, agricultural law, central statistics). This results from the fact that the family household generated the dominant part of the income from agricultural activity.

Two examples show the diversity of approaches to the definition of 'a farm':

- According to Economic Research Service United States Department of Agriculture (ERS USDA, 2020), "A farm is defined as any place from which $1,000 or more of agricultural products were produced and sold, or normally would have been sold, during the year".
- According to OECD (2001, cit. United Nations, 1984), "A household is considered to be an agricultural household when at least one member of the household is operating a holding (farming household) or when the household head, reference person or main income earner is economically active in agriculture"

Farm households have become economic entities that are oriented to operating in perfect competition conditions (vide: New Zealand, Australia) or in conditions with financial intervention (e.g. EU countries with the Common Agricultural Policy, USA, Canada, Japan). The growing share of nonfarm

income in the total income indicated that the model of farm is still transforming.

The justification of tackling with financial innovation in agriculture by public organisation is different in developed and developing countries. This stems, inter alia, from the fact that institutional environment (mainly, political stability and independent monetary policy) is important from the perspective of stability of financial systems. The problem of financial innovations in agriculture can be considered from various perspectives, including highlighting the demand side as a "weaker" partner to financial institutions.

Based on empirical findings of Kata (2013), credit constraints in rural areas (and more specifically, in the agricultural sectors) may be a driving force for new types of financial innovations (mainly, related to banking). Factors affecting the choice of products/services in a specific bank include (Kata, 2011):

- the quality and durability of relations with the bank (trust, knowledge of staff, direct contact), quality of banking services (speed, friendly procedures),
- an access to information and counselling, as well as" the offer of banks to adapt to their individual needs "(*Ibidem*, p. 194);
- physical service (including the network of bank branches and ATMs as well as bank opening hours).

The importance of the price attractiveness of the offer (only the one from a not too far away and "trusted" bank), the offer related to access to the bank via electronic channels (e-banking) has not been underlined by respondents (*Ibidem*).

The literature underlines that reducing imperfections in financial markets, as well as the need to remedy or at least minimize information asymmetries, are perceived as the need to generate financial innovation in agriculture:

- a significant need to provide public goods for farmers;
- differences between private and social costs of financial activity (e.g. spillover effects, negative externalities);
- imbalance of market forces, including the existence of a market where participants cannot make sub/optimal financial decisions and need institutional protection.

According to Langenbucher (2005), there are many limitations to agricultural financing related to both supply- and demand perspective (table 1).

Table 1. The Supply and Demand Sides of Agricultural Financing.

The Supply Side	**The Demand Side**

Small size average farm, low population density, higher loan servicing costs due to limited volumes and high information costs	Agribusinesses suffer from poor, insufficient collateral and non enforceability of security due to lack of land and property rights, high costs, and lengthy or lacking registration and foreclosure processes
Lack of collateral or adequate security	Low affordability for farmers of market interest rates and higher margins (up to 2% higher than standard SME loans) that reflect the risk adequately
Lack of technical knowledge at the bank level to evaluate and analyze the creditworthiness of agribusinesses	Insufficient cash flow planning; farms are not obliged to keep accounts or financial statements; cash flows are hard to assess when clients sell directly to consumers
No specialized product offered by the financial intermediaries to better meet the financing need of the agricultural sector: rural sector requires preharvest financing to buy inputs that can only be repaid after harvest and show much more uneven cash flows than urban borrowers, leading to repayment in less frequent installments, which increases the risk and monitoring costs for financiers	Repayment schedules are often difficult for the clients to meet-standard repayment schedules are not adapted to seasonality of the business
No branches or limited network in rural areas, thus difficulties to reach and market to farms.	Lack of legal education at the farmers' level. ▪
Risk correlation when lending to farms: all borrowers are affected by the same risk, such as low market prices and reduced yield due to weather	Farms are often successors of cooperatives, which are rather complex to deal with
Underdeveloped communication and transportation infrastructure	Lack of initiative and articulated demand for finance by agribusinesses, especially in primary agriculture

Source: Langenbucher (2005).

It is worth nothing that Jaffe (2016) underlined the problem of market failure as the real driving force of green innovations, some of which may be described as financial innovations. He enumerated some detailed problems related to the aforesaid market failure, namely (Jaffe, 2016):

- "environmental externalities;
- knowledge is non-rival and hard to exclude.
- discovery, development, diffusion of new technology typically involve very different agents, so transactions costs can be major issue;
- adoption externalities;
- adoption decision subject to demonstrable cognitive bias".

Furthermore, financial innovations in agriculture and, more broadly, in rural areas, may be driven by the public administration that is interested in dealing with an asymmetrical information between rural formal lenders and agricultural producers. The quality of human and social capital in rural areas is still regarded as an important factor that decreases farm creditworthiness (Pambo, 2015).

It should be added that innovation in banking systems may be determined by the following factors (Marcinkowska, 2012):

- releated to markets,
- regulations,
- associated to demand-side,
- related to technology.

The classification as above may be also useful for financial innovations in agriculture. It should be noted that most solutions directed to farm household refer to long-term crediting, current financing (financial liquity management) and hybrid approaches based on combination of insurance and credit products. Ülgen (2013) focuses on the nexus between innovations and regulations. He underlines that "regulation should not prevent innovations but seek to ensure that they will be designed and implemented to allow the productive system to drive outcomes suitable as regards the sustainable economic development".

3. Financial innovations in agriculture – typology and examples

The Lumpkin's classification (2009) of financial innovation is very useful and is based on the classification of Tuffano from 2002. It is important from the point of view of innovation users. This classification can be applied to financial innovations regarding sources of long- and short-term financing. The distinguishing feature of the classification is the characteristic of the market situation that is important for creator who generates innovations (box 1).

Box 1. The Lumpkin's classification of financial innovations

- Innovations that complete incomplete markets (ie where unmet needs or customer preferences).
- Innovations aimed at mitigating the negative consequences of the principal / agent problem and minimizing transaction costs.
- Innovations reducing the negative social and economic effects of information asymmetry.
- Innovations leading to the reduction of broadly understood marketing costs.
- Innovations as a reaction to regulatory changes (e.g. especially present in the banking sector of EU countries).
- Innovation as a response to globalization and growing risk (not only on financial markets, but also related to production risk in agribusiness).
- Innovations as a response to technological shocks and shocks.

Source: based on Lumpkin (2010).

The Oslo Manual (OECD/Eurostat, 2005) for measuring innovation defines four types of innovation: product innovation, process innovation, marketing innovation and organisational innovation. Dudek et al. (2018, p. 12) stated that OECD's typology is, in particular, very helpful for identification innovations that are not of a product or process nature. This applies to marketing innovations that were previously often considered process innovations. Eco-innovations are idenfied as the special category of innovations in agriculture.

Tabaka (2015) provided the typology of innovations that may be more specificic to agricultural production, namely:

- economic innovations (e.g. renewable energy sources, collective heating of households)
- social innovations (e.g. creating and developing short food chains)
- organizational innovations (e.g. new models of farm management)
- tecbnological innovations (e.g. new technologies for the use of biomass).

A significant group of innovations at farm level may boost achieving sustainable development goals for agriculture. Nevertheless, a limited access to sources to credit/loans may be a significant barrier to adaptation of highly costly innovations.

Marcinkowska (2012) proposed an interesting typology of financial innovations that is based on elements of the financial system:

- new forms and types of financial innovations (e.g. financial conglomerates),
- new segments of financial markets (e.g derivatives markets)
- new products and financial services (.e.g. reverse mortgage)
- New infrastructural solutions (e.g. mobile payments systems)
- New law regulations and environmental recommendations (e.g. new regulations related capital adequacy)

From the perspective of financial innovation in agriculture, the classification presented as above may also refer to financial innovations in agriculture. This

refers in particular 'new products and financial services' and 'new infrastructural solutions'.

According World Bank (2005), four areas in agricultural finance may be identified, warehouse receipts and collateral securitization mechanisms; risk management products; supply chain finance; and technology. As far as the first two categories

There are two cases of financial innovations in Polish agriculture. We present as below:

- "Postal banking": a business model of the so-called a postal bank (Bank Pocztowy) as an example of financial innovation. This bank operates in postal branches throughout the country (although their number is systematically decreasing, particularly unprofitable branches in rural areas, not being the seat of communes, are being closed). According to Czechowska (2014), the innovation of this bank relates fact that that Bank Pocztowy targeted at "the group of elderly people or people employed in small enterprises or farms in villages and small towns". Furthermore, as Czechowska (2014, p. 54) stated" the assumed goal of the bank, in the form of an increase in revenues from the sale of financial services, was to be achieved through the largest distribution network in Poland" (approximately 5,000 Post Offices).
- Complex farm financing based on cross-selling strategy (e.g. 'Rachunek 4x4 Rolnika" including simple online bookkeeping service for farmers, "Rachunek AgroPartner", "Finansowanie biezące" (current financing) includes:
    - Kredyt obrotowy agro (a short-term loan loan in a credit account that is necessary to finance current needs related to the conducted agri-food business processes)
    - 'Kredyt skupowy' (Purchase credit) – a special working capital loan for financing the purchase and storage of seasonal agricultural products,
    - 'Linia kredytowa Agro' (Agro credit line) - overdraft facility, designed to finance current needs of agribusiness.

4. Agricultural financial innovations: from barriers to perspectives for development

Skórnicki (2015) enumerated following factors that may be treated as barriers for innovativeness of Polish agriculture.

- specificity of agriculture,
- fear of novelty, high average age of farmers
- a significantly lower level of education compared to city dwellers and
- shortage of own funds(additionally, low debt level).

As presented in table 2, the typology of barriers for innovations (in general) may be adapted to the agricultural sector that is strongly supported by public financial aid (the level of subsidy rate is relatively high compared to other sectors). Furthermore, a crucial part of innovations should be supported by public financing or PPP initiatives. The strong dispersion of farm households (incl. may results to relatively high costs related to boosting demand for the new solutions.

Table 2. Barriers for financial innovations in agriculture

Factors	Specification	Detailed remarks to Polish situation
Cost factors	The high level risk Too high costs Public sources of funding	The agriculture is treated by financial as a very risky business.
Knowledge-related factors	Limited market data	The lack of obligatory accounting in Polish agriculture results in a limited creditworthiness.
Market factors	Unknown demand for products and processes	The strong dispersion of farm households in Poland
Institutional factors	Legislation, legal regulations Property rights	The significance of traditional co-operative banking for agricultural crediting, the payment agency (ARiMR) that is responsible for delivering Rural Development Programme subsidies
Other factors	The lack of demand for financial innovations	The psychological profile of farmers as users of potential innovations should be analysed.

Source: own elaboration based on typology proposed by OECD (2005).

World Bank (2005) emphasizes some benefits related to using 'new technologies' in agricultural finance: first, "lower per unit costs" and "higher volume productivity"), second, using technology is indirect improvement of operations through better risk management. From the Polish perspective Technology can be used to create local data repositories that can be aggregated through data consortia to form broader data sets and more statistically

significant risk mitigation analysis. Table 3 presents how various investments in technology may be use as drivers of financial innovations in agriculture.

Table 3. Examples of technology-based innovation in financing Agricultural Business Practices To Address Limitations In Lending

Problem	**Impact**	**Mitigation**	**Agricultural Business Process – examples***	**Assessment of the impact of the problem in Poland ****
Poor infrastructure and geographically dispersed clients	Reaching rural clients is difficult and formal financial services reach those closest to the urban centers. Cost to clients of banking in the formal sector are prohibitive. Close monitoring of lending and portfolio by lenders is difficult.	Electronic data transferred via automated teller machine (ATM), point-of-sale (POS), mobile phones, interactive voice response (IVR), Internet banking, smart cards.	Loan disbursements. Savings deposits and withdrawals.	Medium
Lack of credit history and information	Limited credit history (the lack of financial reports)	Scoring, biometrics technology, obligatory bookkeeping in agriculture	Building credit histories and data repositories. Loan origination—loan application processing and approval. Product servicing—collections. Client identification (with biometrics).	Medium/strong

Limited price information and price risk management tools	Risk of defaults due to price swings events limits lending. Lack of business acumen and information forces growers to sell suboptimally and not optimize premium or direct contracting.	Distance learning, scanning, Internet outlets, mobile phones, PDAs.	Improving market awareness and negotiation power Market information. Financial product marketing	Medium

Note: * selected by the author from Lagenbucher (2005), **author's opinion.
Source: adaptation based on Lagenbucher (2005).

We can identify some challenges for financial innovations in agriculture:
1/ factors related to the environment of the financial system
2/ factors related to changes in the financial system:
3/ factors related to the agricultural sector and its connection with the rest of economy,
4/ determinants related to farm households and farm operators
Ad. 1. The variability of macroeconomic situation (vide: COVID-19 crisis) and its implications in fiscal/monetary policies (incl. unconventional policies based on quantitative and qualitative easing) may increase the number of financial innovations based on credit products.
Ad. 2. The dynamic processes in the financial system (i.e. an growing importance of the FinTech/InsurTech sector, new regulations related to capital adequacy) can significantly contribute to the challenges for development of financial innovations in Poland. The new solutions based on the ICT (such as mobile applications) may be driver financial innovations that oriented to Polish farmers.
Ad. 3. The agricultural sector (compared to other sectors of the economy) is not heavily indebted. This is due to the important role of subsidies under the Common Agricultural Policy, CAP (including investment grants under the second pillar of CAP). Nevertheless, the Common Agricultural Policy after 2020 will promote as the so-called 'new financial instruments' that may boost climate-smart initiatives.
Ad. 4. The better level educational background, access to even informal sources of data on innovation may affect a growing interest in financial innovations. The deeper connection of farms within food chains and networks means growing needs for new solutions related to current financing.

Perspectives of development for financial innovation in agriculture may refer mainly to crediting and they wil include, inter alia (Kata, 2013):

- products based on modern communication technology (ICT, applications for mobiles)
- cross selling various financial services (e.g. loans, insurance, guarantees) and non-financial services (consultancy, additional services),
- financial risk management instruments
- extending the offer of financial services and their individualization based on clear segmentation of customers and information about their preferences
- combination of modern solutions related to customer creditworthiness assessment, their credibility and collateral valuation (IT systems, data exchange platforms) with experienced and professional staff.

The author paid attention to vivid development of hybrid credit and insurance products (example, credit-linked insurance products).

Marzantowicz (2017) indentified three significant trends that can affect financial innovations (also in agriculture), namely:

1) "consolidation of the Polish banking sector may lead to more national initiatives, facilitating cooperation between startups, technology companies, academia and traditional players (domestic fintech accelerators / incubators)",

2) cooperation between regulators, the government and the environment providing financial services.

3) proactive cooperation between banks and startups (e.g. "Let's fintech with PKO BP" as the program of Polish PKO BP – the largest bank in Poland

Marzantowicz (2017) also added the technological changes that may boost generating new financial innovations („artificial intelligence, robotics, advanced automation and personalization"). New regulations should not be treated as barriers for financial innovations, but often „room for innovative business ideas". Benefits from applying financial innovations should be incorporated from the financial strategy of farm households (table 4).

Table 4. Benefits of applying financial innovations in the financial strategy of enterprises - assessment in the case of Polish farms

Financial innovations – area of financing	Assessment*	Financial innovations – area of risk management	Assessment
Reduction of transaction costs	H	Lowering transaction costs	H
Financial risk reduction	M	Stabilization of the rates of return on investment	H
Market risk management	M	Diversification of the investment portfolio	M/L
Lowering the cost of capital	M	Limitation of investment and operational risk	H
Access to new sources of financing	M*	Access to new investment opportunities	.L
Increasing the flexibility of the financing structure	M	Increasing the flexibility of the asset structure	L
		Market risk management	L
		Postponement or reduction of the tax burden on capital gains	n/a*

Note: * author's assessment of the significance of benefits from the perspective of the farm level: L – low, M – medium, H – high, n/a – not applicable.
Source: adapted from Blach (2012).

5. Concluding remarks

The dissemination of financial innovations in Polish agriculture may encounter serious problems in the CAP 2021-27. In general, our market-oriented farmers do not have any serious problems with access to external capital, largely coming from the financial market. Preferential loans (offered as the special lines by our payment agency, Agencja Restrukturyzacji i Modernizacji Rolnictwa) play a crucial role in reducing a financial gap in Polish agriculture. Leasing companies, suppliers of means of production and recipients of agricultural products also offer loans and often very innovative pre-financing. When considering the possible introduction of repayable instruments (e.g. in the form of new lines of preferential loans), it is necessary to use the current financial infrastructure and accumulated knowledge of banks as well as loan and guarantee funds. The microloan program that is offered by National Agricultural Support Centre (Krajowy Ośrodek Wsparcia Rolnictwa, KOWR) may be a good example (Ministerstwo Rolnictwa i Rozwoju Wsi, 2019, p. 184).

The agricultural policy of the EU after 2020 will emphatically supports the importance of developing smart-oriented agriculture. Financial innovation may boost smart farming. Nevertheless, coordination and reasonable regulations should be implemented. Further research should be oriented towards finding an answer to the question of whether and where associations can be seen between the progressing financialization of agriculture, or properly competing and cooperating agri-food chains, and, in general, intelligent development of the food economy. There has been talk for at least a dozen years about paradigm

on Sustainable Finance. The issue requires more in-depth research, will be to recognize whether and which financial instruments can affect the sustainability of farms, but also their sustainable, intelligent and shock-resistant development.

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