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CHANGES IN THE MACROENVIRONMENT AND NEW THREATS TO FARMS

Key words: agricultural farms, external threats, animal welfare, GHG emission reduction, climate changes, farm resilience, extensification

ABSTRACT. In the context of agriculture, numerous significant long-term trends are emerging. Some of these pose threats to farm operations. They can be categorized as threats related to pressure to achieve climate and environmental targets under emission reduction, animal welfare and biodiversity policy, climate changes, structural changes in the farm environment, increasing technological pressure, changes in consumption patterns and unequal conditions of competition in international markets. This study aimed to identify phenomena perceived as threats to agricultural activities and the general mechanisms of their impact on agricultural farms. It is prepared based on a literature review. It was found that the effect of some threats can be mitigated through proper farming practices and increasing production scale. Other threats, including those arising from enforced climate and agricultural policies, have consequences that necessitate economic support for farms or compensation for losses, for example, through subsidies. Insurance may be useful only for protection against well-known threats of measurable risk. One can state that currently published research results still insufficiently recognize how emerging threats alter the outcomes of agricultural farms, what strategies farmers adopt, and which of these are effective for particular production types and given production scales.

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INTRODUCTION

Farms and the agriculture industry as a whole operate in a turbulent environment. The impact of the environment on farms exceeds considerably beyond the relatively well-studied interaction of natural and economic environment elements. At present, factors such as rapid climate change, social pressures pertaining to the impact of agriculture on the environment and animal welfare, as well as the institutional introduction of requirements for extensification of production and resource conservation measures appear to be of increasing relevance. Another concern, still unrecognised, are demographic factors. These, and similar, factors are perceived by farmers as threats to the functioning of their farms.

Agriculture is an economic sector that is affected by many exogenous factors. Some of them have the characteristics of measurable risk, and some are uncertain events, which makes it impossible to apply countermeasures to them [Sadowski 2023]. The sources of these unpredictabilities can be natural (e.g. floods, droughts, spring frosts, health risks), economic (e.g. price changes, changes in raw material prices), political (e.g. international agreements, sanctions, wars), technological (e.g. new production methods, new energy sources) or social (behavioural changes, new consumer preferences). Some of the phenomena mentioned proceed slowly and some appear suddenly. With regard to agriculture, the development of social trends such as vegetarianism or sustainable consumption can be identified as a long-term process [Rutkowska 2018]. Broadly understood globalisation processes are an example of an important condition of a supra-local, long-term character. For Polish farms, functioning within the framework of the Single European Market, the instruments of agricultural policy, which are an essential factor of political and legal nature, are of great importance, while eliminating, at least partially, the influence of the general economic situation on global markets [De Castro et al. 2020, Cortignani and Coderoni 2022]. A strong trend of increasing importance of environmental and climate issues has been observed in the European Union for a long time [Polityka Insight 2021] and it constitutes a new challenge for agriculture. Similarly, in the area of technological changes, solutions such as artificial intelligence (AI) and precision agriculture are being introduced, to which farmers will have to adapt [Zeverte-Rivza et al. 2023]. Nevertheless, while it is possible to adapt to long-term and predictable events, unfavourable, unpredictable and sudden events, referred to as "black swans" [Taleb 2020] it is very difficult to adapt.

Recent years have been fraught with events of an uncertain nature which, in the case of agriculture, may have resulted in difficulties in making current decisions. The unpredictability of the future causes it to be very difficult to plan the direction of production or the use of production techniques. Since agriculture is characterised by a relatively long production cycle and it usually takes more than a year from the decision to, for example,

sow a crop to the sale of the final product, it is difficult to determine precisely what the economic effects of the activities will be. During this time, prices may change significantly for local (inflation), but also global reasons.

Agriculture is dependent on the weather, which is increasingly changeable. The link between production results and costs incurred and climatic conditions does not exist to the same extent in other economic sectors. The functioning of agricultural farms is also increasingly regulated by principles and measures under the Common Agricultural Policy.

Agriculture, like any sector of the economy, is subject to the changing influences of the environment. A notable distinguishing feature of this sector is that it strongly depends on natural conditions. In Poland, as in most European countries, the sector is dominated by family farms. This fact increases the sensitivity of farms to changes in the environment due to the dependence of the income and employment situation of family members working on the farm on such changes [Pietrzak and Ziętara 2022].

In Poland, there is still a strong fragmentation of agriculture, the number of farms reaches 1.3 million, with an average area of about 11 ha. Within the years 2010-2020, 192,000 farms vanished, i.e. almost 13% of their number from 2010. Such rapid changes mean that there are significant forces leading to the liquidation of farms. It can be assumed that in some farms exit strategies from agriculture can be implemented [Wojewodzic and Mikołajczyk 2011], which in some cases can be assessed positively.

The analysis identifies economic, social, political, international, and technological conditions that may be perceived as threats to farms and can significantly influence farm activity.

MATERIAL AND METHODS

The study aims to determine what phenomena are perceived as threats to agricultural activities and what the general mechanisms of their impact on agricultural farms are. The issue was addressed by taking into account the perspective of Polish agriculture.

The study is of a review nature and was prepared based on the literature on the examined issue. The authors searched for publications in the Elsevier and Springer databases and in the repositories of articles maintained by Polish journals related to agricultural economics. In the first stage, based on the literature, a set of threats was identified and repeatedly indicated in publications. In the second stage, research results regarding mitigation techniques for the identified most important threats in the macro-environment of farms were searched and compared. The publications were inspected and analyzed between September and December 2023.

RESEARCH RESULTS

THREATS IN AGRICULTURE

In the agricultural sector, threats and associated risks are usually classified as follows: production, market, institutional, personal and financial ones. In the literature on the subject, production risks are most often analysed, and a comprehensive approach taking into account all risks is only a small percentage of research [Komarek et al. 2020]. Moreover, in addition to these mentioned risks, there is also the impact on agriculture of more difficult-to-measure, but noticed by farmers and influencing their decisions, trends of a nature of threat, which are perceived as leading to an increase in the difficulty of running farms, negatively affecting the level of production and income, but also significantly limiting the freedom to use their resources. It also negatively affects willingness to continue farm activity.

The basic form of limiting the effects of the realization of risks on farms is the appropriate organisation of resources and production on the farm – and where possible and justifiable – the transfer of risks off the farm through insurance [Wąs et al. 2021b]. Still, insurance in agriculture can address only a small fraction of emerging risks, those of an insurable nature. Farmers, recognising the threats, assess their nature. Based on their individual assessment, they may adopt various attitudes towards the observed phenomena. These attitudes could be described similarly as strategies: withdrawal, survival, reactive. The effect can be, on the one hand, withdrawal from agricultural production, while on the other hand, the development of the farm increasing its resilience at the same time [Meuwissen et al. 2019, Bertolozzi Caredio et al. 2022].

Today in the countries of the European Union, and more broadly in developed countries, a number of external threats are identified in agriculture, which significantly affect the operation of farms and their production and economic performance. These threats can be associated with the major megatrends affecting agriculture: the lack of necessity for domestic production due to international ties, changes in the structure of consumption, rapid technical and technological progress, environmental focus, reduction of livestock production. The spheres into which the identified threats can be grouped can be put as follows:

1) pressure to meet environmental goals:
   - under the Common Agricultural Policy (e.g., European Green Deal, obligation to rotate crops, maintaining and increasing biodiversity, extensification of production, obligation to increase the share of organic farming, conservation agriculture, animal welfare requirements),
   - on the part of society (e.g., expectation to reduce emissions from agriculture, expectation to expand protected areas);

2) climate change:
   – longer periods without precipitation,
   – higher average temperatures during the growing season,
   – limited water retention capacity,
   – increased prevalence of animal diseases and weed resistance (pandemics: ASF and avian influenza; weed resistance to herbicide active ingredients);
3) structural changes in the agricultural environment:
   – increased concentration of customers and expectation of large supply batches,
   – low income from agriculture on small and medium-sized farms relative to income from non-farm labour,
   – large supply of non-farm labour;
4) increased pressure for changes in production technology towards mechanisation and precision agriculture:
   – dominance of technology suitable only for larger farms, including precision agriculture techniques solutions,
   – the need to ensure traceability of food origins;
5) socio-demographic changes:
   – the need for a very high level of knowledge to implement the demands of low-input and precision agriculture,
   – the lack of successors willing to take over the running of the farm,
   – the difficulty for young farmers to start a family;
6) unequal conditions of competition due to trade liberalisation, globalisation of supply chains and emission leakage:
   – excessive inflow of raw materials from countries without production restrictions,
   – relocation of production to countries with fewer restrictions on agricultural production,
   – high price fluctuations, depending on the global production situation.

CONSEQUENCES OF SELECTED THREATS TO FARM OPERATIONS IN THE LIGHT OF THE LITERATURE

Threats of varying degrees of severity occur in the environment of agriculture and the economy as a whole. The high incidence of catastrophic risks, political instability, or war are situations that are not conducive to development, as they block long-term planning [Gómez et al. 2015]. One of the most important issues these days is climate change and its implications for agriculture. While many analyses have been carried out, there is no clear answer as to whether this brings total benefits or losses to agriculture [Clarke et al. 2021]. For example, prolonging the growing season leads to an increase in yields.

Much depends on the region and even the situation of a particular farm. Nonetheless, this does not change the fact that there is greater variability in weather patterns, and there is no clear recognition of what are effective operating techniques [Lane et al. 2018]. The risk of drought and desertification is most often identified locally, and in this case the best course of action is irrigation [Rey et al. 2017], which, however, leads to an increase in emissions from agriculture [Ward 2022].

Another area that farmers perceive as a threat is the general pressure through many channels for greater environmental protection in agriculture. This is multi-faceted, ranging from habitat and area protection, animal welfare, but also emissions reduction and certification of food origin. Consumers, directly and through the public, expect solutions to be put in place in agriculture and the supply chain to reduce environmental impact even without real consideration of the interests of the farmer [Gaudig et al. 2021].

There is also general socio-economic pressure on environmentally friendly practices, animal welfare and even the reduction of animal production [Bertolozzi Caredio et al. 2022]. From the farmers' viewpoint, restrictions and excessive requirements, which are costly to comply with, usually lead to a reduction in production potential and a loss of income. Increasingly common threat is animal diseases. An example is ASF limiting pig production or poultry disease. Protection against these diseases is very expensive, but failure to provide any protection causes large losses, even leading to the bankruptcy of farms [Alarcon et al. 2014].

Additional requirements should not always be imposed as farmers create better conditions for the animals, as this involves reducing the incidence of diseases and associated losses, especially when there is a high concentration of animals. However, not all recommendations are justified. In some suggested solutions, even higher animal mortality or higher greenhouse gas (GHG) emissions have been observed [Moustsen et al. 2023]. Importantly, in larger herds, contrary to public opinion, animal welfare is often better than in smaller ones [Lindena and Hess 2022].

Aspects of environmental protection, emission reductions and extensification of agriculture have been strongly emphasised under the Common Agricultural Policy. Farmers perceive new mandatory activities as a threat to the economic efficiency of farming, e.g. crop rotation, the need to grow legumes, which limits income despite the use of subsidies [Cortignani and Dono 2020]. Maintaining the profitability of production in the conditions of mandatory extensification is difficult, especially in conditions of intensive agriculture and for smaller farms [Bertolozzi Caredio et al. 2022]. Some farmers do not want the reduction in production forced by the Green Deal and prefer not to use part of the subsidies, because it is associated with a smaller loss [Beckman et al. 2022]. It was established that the use of pro-environmental measures has primarily an economic motive [Wąs et al. 2021a], and new support measures should be introduced carefully because they may bring a different effect than expected [Kułyk 2023].

Farmers are aware of the responsibility for the environment and want to introduce changes on farms, although it is often expensive and brings less than intended effects [Valujeva et al. 2022]. The pace and scope of changes required on farms are increasing and exceed the ability of farmers to adapt [Vilkė et al. 2021]. For example, achieving the intended environmental effects requires diversification of production, greater complexity of processes, and this leads to higher costs [Zampieri et al. 2020]. For this reason, many zones in nature-protected areas are de-animalised and de-agrarianised [W. Musiał and K. Musiał 2019].

A related, but separately presented, threat is the pressure to reduce greenhouse gas emissions from agriculture. This is to be achieved, inter alia, by general extensification of production and reduction of livestock production. Due to the emission of methane and nitrous oxides, the restrictions are to apply first to cattle production and the level of nitrogen fertilisation. As established, emission reductions will lead to extensification, reduced production and lower farmers' incomes [Mielcarek and Rzeznik 2018, Wicki and Wicka 2022]. Furthermore, a lower production intensity usually means a higher level of GHG emissions per unit of production [Coderoni and Vanino 2022]. It is also stated that the introduction of organic production leads to a higher emissivity of production [Scuderi et al. 2021].

Demographic changes, depopulation of agricultural areas and the perception of agriculture in society are another of the already identified threats to the operation of the farm. A strong trend is becoming a reluctance to run small farms among potential successors [MRiRW 2023]. Successors mainly want to take over and run large farms with development potential and in good economic condition. Until now, the lack of a large enough scale of production was the primary factor in farms falling out of the market, which resulted from changes in production technology and concentration in the food industry [Morais et al. 2018, Foguesatto et al. 2020]. Only in some cases successors are interested in running small farms, usually treating it as an additional source of income.

Farmers without successors often do not want to dispose of land [Duesberg et al. 2017], which, however, means adopting a strategy of gradual withdrawal from production, or at least the lack of development investments. In Polish agriculture, and not exclusively, the lack of successors is becoming very common. This is often due to the lack of a succession plan, which would determine the opportunities for development in a given environment, but also the process of transferring power [Inwood and Sharp 2012].

Rapid changes in agriculture production techniques and technology bear the well-deserved name of a "technological mill". Many farms, especially economically smaller ones, cannot cope with such technological pressure. They can adopt a withdrawal strategy by carrying out divestment processes. The biggest challenges arise from the need to replace machines with new ones, and these are mostly dedicated to large farms. In smaller farms, it is also more difficult to comprehensively introduce good technologies that reduce

production risk [Chavas 2019]. Precision farming technologies conducive to reducing the impact of agriculture on the environment are very expensive and often do not match the conditions of smaller farms. Modern machines and complex production technologies require the acquisition of advanced knowledge by farmers in order to use them correctly. The reluctance to implement some of the techniques of better process control results from the possibility of outside remote supervision whether the farmer executes the process correctly [Bos et al. 2018]. Resistance to implementation may also result from the fact that fines are expected in the event of deviations from the required parameters [Troska 2023].

Yet, the need to identify the origin of food throughout the supply chain is increasingly emphasised [Traitler et al. 2017], e.g. to ensure the reliability of origin, but also to identify regional products with a certificate, which also requires investment and expensive certification. The market pressure for digitalization is very strong, especially in terms of cooperation between suppliers and recipients [Zeverte-Rivza et al. 2023].

A separate element perceived as a threat to the functioning of farms is the need to correctly apply and document the implementation of tasks under the CAP. Increasing the diversity of activities and the conditions for their implementation as part of eco-schemes leads to the situation that the farmer must use assistance of expensive advisers [Osinga 2021]. The increase in requirements and complication of the agricultural policy system is perceived even as deadly for farms [Hearde 2019], but also some hopes are associated with the fact that subsidies compensating for the extensification of production and additionally implemented processes will cover the loss of farm incomes [Osinga 2021].

Another source of uncertainty results from the pressure to liberalise food trade [Bertolozzi Caredio et al. 2022], which increases concerns about maintaining the competitiveness of production and the level of prices. The liberalisation of markets leads to stronger competition and affects the economic performance of farms [Jongeneel and Gonzalez-Martinez 2022]. On the other hand, farm adaptation processes are associated with an intensification of production that is undesirable in agricultural policy and higher GHG emissions [Läpple et al. 2022].

SELECTED MEASURES TAKEN BY FARMERS TO MITIGATE THE IMPACT OF THREATS ON THE FARM

Farmers can take a wide variety of actions to mitigate threats. Regarding natural hazards, diversifying the production structure and crop rotation is possible. The perception of the importance of a given threat/risk depends on various factors, including previous experience and the size of financial resources. Threats that farmers cannot cope with based on their experience, and resources are perceived as the major ones, and this concerns price and climate risks [Akhtar et al. 2018].

In small farms, efforts are made to supplement and diversify income sources, e.g. by working outside agriculture. In worse farming conditions, farmers can seek income by obtaining subsidies for greening production, maintaining extensive production, keeping biodiversity, etc. Subsidies then become the main source of farmers' income.

Concerning insurable risks, farmers are willing to use the insurance if it is subsidized [Bulut 2017], and they can reduce the high price risk by contracting production instead of deciding to sell at current prices [Ricome and Reynaud 2022].

The issue of farm resilience, including adaptability to changes, is widely analysed. The ability to adapt to changes in the environment is limited in farms by their potential, size and flexibility of resources and the production structure. Farmers cannot quickly change the production profile of their farms. However, they can still maintain economic viability by functioning in a specific natural and market environment [Meuwissen et al. 2019]. Moreover, it is impossible to determine the resilience of farms based on economic results alone, and the research results are not comparable due to methodological arbitrariness [Herrera 2017]. It was, however, generally found that larger farms are less sensitive to economic and production risks [Jankelova et al. 2017].

In assessing threats, farmers also consider risks resulting from regulations and state policy [Garvey et al. 2019]. Therefore, regulations regarding agriculture and farm support should be oriented toward activities acceptable to farmers, taking into account the limitations of different groups of farms operating in a specific environment.

CONCLUSIONS

Some of the changes in agriculture's natural, institutional and economic environment are recognised megatrends in the farm environment. The changes result in farmers perceiving new phenomena or increasing in influence of known phenomena as threats against which they can take various actions. Not everything that farmers perceive as a threat has been identified yet. The extent and type of actions to mitigate threats to farm operations can substantially differ between farms depending on their size, direction of production, or location.

Farmers consider the most important threats to the functioning of farms to be those related to the negative effects of climate change, pressure to strengthen the implementation of pro-environmental functions of agriculture, animal welfare requirements, and requirements to limit animal production. Another important threat, indirectly related to several others, is the policy of reducing greenhouse gas emissions from the agricultural sector. This would require a reduction in agricultural production or costly investments, which in both variants leads to a deterioration of profitability in agriculture.

Rapid changes in agriculture production techniques and technology also is perceived as a threat. The same touches on issues of precision agriculture techniques and digitalisation in agriculture. Many farms, especially smaller ones, cannot cope with such pressure. They can adopt a withdrawal strategy by carrying out a divestment process or may go bankrupt. The last major threat to farms is social and demographic changes, including the farmer's low prestige in society and low income. As a result, there is a lack of successors, even on some well-performing farms.

One can conclude that it is paramount when designing programmes for agriculture to have a good grasp of the attitudes of the addressees of the solutions introduced and to use the right tools to shape them. For example, there is no need to offer development support to a farm with no successor. It should be avoided to introduce measures to strengthen threats to farms. It is advisable to support the efficient transfer of production resources to other farms. Similarly, there may be no rationale for supporting the extensification of small-scale production, as this leads to the marginalisation of agricultural income and the de-agrarianisation of entire areas.

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ZMIANY W MAKROOTOCZENIU I NOWE ZAGROŻENIA DLA GOSPODARSTW

Słowa kluczowe: gospodarstwa rolne, zagrożenia zewnętrzne, dobrostan zwierząt, redukcja emisji GHG, odporność gospodarstw, zmiany klimatyczne

ABSTRAKT. W otoczeniu rolnictwa ujawnia się wiele długoterminowych znaczących trendów. Niektóre z nich mają charakter zagrożenia dla funkcjonowania gospodarstw. W ogólnym ujęciu można je podzielić na zagrożenia związane z: presją na osiąganie celów klimatycznych i środowiskowych, zmianami klimatu, zmianami strukturalnymi w otoczeniu gospodarstwa, rosnącą presją technologiczną, zmianami demograficznymi oraz nierównymi warunkami konkurencji na rynkach międzynarodowych. Celem pracy było rozpoznanie, które zjawiska postrzegane są jako zagrożenia dla działalności rolniczej i jakie są ogólne mechanizmy ich oddziaływania na gospodarstwa rolne. Stwierdzono, że oddziaływanie części zagrożeń może być zmniejszone przez poprawne praktyki rolnicze i wzrost skali produkcji. Inne zagrożenia, w tym te wynikające z forsowanej polityki klimatycznej i rolnej, mają skutki, które wymagają ekonomicznego wspierania gospodarstw lub kompensowania im strat, np. przez subsydia. Ubezpieczenia mogą być użyteczne w ochronie tylko w odniesieniu do dobrze znanych zagrożeń o charakterze mierzalnych ryzyk. W aktualnie opublikowanych wynikach badań wciąż mało rozpoznane jest to, w jaki sposób pojawiające się zagrożenia zmieniają wyniki gospodarstw rolnych, jakie strategie rolnicy przyjmują i które z nich są efektywne dla poszczególnych typów produkcyjnych i przy danej skali produkcji.

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