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## IMPACT OF CLIMATE CHANGE ON INVESTMENT ATTRACTIVENESS OF AGRICULTURAL SECTOR ENTERPRISES

### ВПЛИВ ЗМІНИ КЛІМАТУ НА ІНВЕСТИЦІЙНУ ПРИВАБЛИВІСТЬ ПІДПРИЄМСТВ АГРАРНОГО СЕКТОРУ

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The article proves that the trend of climate change has a direct impact not only on the economic development of any enterprise, but for the whole country and the world as a whole. The environmental factor is one of the most influential for the agricultural sector. It is established that an important task for the effective adaptation of the agro-industrial enterprise to global climate change is a clear understanding of the consequences, risks and vulnerabilities in the short, medium and long term. This will allow the company's managers to understand the trend of climate change and how to influence the company in the future against the background of these problems. Studies show the negative consequences of climate change and the forms of their manifestation, which threaten the investment attractiveness of the enterprise. The main ones are: instability of temperature indicators in the field of water resources, soil degradation and the spread of diseases and pests of crops. The task of adapting Kernel agroholding to the new conditions of agricultural business taking into account the conditions of climate change is proposed.

**Keywords:** investment attractiveness, climate change, agriculture, instability.

В статті доведено, що клімат має величезне значення, оскільки під впливом основних факторів кліматоутворення – тепла, вологи, тривалості світлового дня – формується відповідна рослинність. З рослинами тісно пов'язані тварини. Тенденція зміни клімату має безпосередній вплив не тільки на економічний розвиток будь-якої підприємства, а для всієї країни і світу в цілому. Також слід зазначити, що екологічний чинник є одним із найвпливовіших для аграрної сфери діяльності. Ціллю статті є висвітлення тісноти змін кліматичних умов та їх безпосередній вплив на розвиток аграрного сектору економіки України та інвестиційну привабливість на мікрорівні на прикладі конкретного підприємства. Важливим завданням для ефективної адаптації агропромислового підприємства до глобальної зміни клімату є чітке розуміння наслідків, ризиків та вразливості у коротко-, середньо- та довгостроковій перспективі. Це дозволить менеджерам компанії розуміти тенденцію зміни клімату та як впливати на тлі цих проблем на компанію в подальшому. Проведені дослідження свідчать

про негативні наслідки від зміни клімату та форми їх прояву, які загрожують інвестиційній привабливості підприємства. Основні з них такі: нестабільність температурних показників у сфері водних ресурсів, деградація ґрунтів і поширення хвороб і шкідників сільськогосподарських культур. Запропоновано завдання з адаптації агрохолдингу «Кернел» до нових умов ведення сільськогосподарського бізнесу з врахуванням умов зміни клімату, зокрема забезпечення моніторингу і контролю гідрометеорологічних умов на перспективу; розробка і запровадження науково обґрунтованої сівозміни; запровадження нової сфери діяльності: бджільництво; адаптація систем меліорації; запровадження системи крапельного зрошування. В статті зроблено висновок, що проблема екологічних інвестицій наразі дуже актуальна, на тлі глобального потепління, нестачі вологи, та безлічі інших кліматичних факторів, підприємствам потрібно працювати над вдосконаленням своїх технологій, переосмисленням вирощуваних культур, контролювання сівозміни. З кожним роком кліматичні зміни будуть змушувати компанії витрачати все більше ресурсів. Сільськогосподарські підприємства задля підтримання інвестиційної привабливості повинні впроваджувати нові технології, у боротьбі з екологічними проблемами, та визнати, що зміни у вирощуванні культур, на тлі кліматичних змін, неминучі.

**Ключові слова:** інвестиційна привабливість, зміна клімату, сільське господарство, нестабільність.

В статье доказано, что тенденция изменения климата оказывает непосредственное влияние не только на экономическое развитие любого предприятия, но и для всей страны и мира в целом. Экологический фактор является одним из наиболее влиятельных для аграрной сферы деятельности. Целью статьи является освещение тесноты изменений климатических условий и непосредственное влияние на развитие аграрного сектора экономики Украины и инвестиционную привлекательность на микроуровне на примере конкретного предприятия. Важной задачей эффективной адаптации агропромышленного предприятия к глобальному изменению климата является четкое понимание последствий, рисков и уязвимости в кратко-, средне- и долгосрочной перспективе. Это позволит менеджерам компании понимать тенденцию изменения климата и как влиять на фоне этих проблем в дальнейшем. Проведенные исследования свидетельствуют о негативных последствиях от изменения климата и форм их проявления, которые угрожают инвестиционной привлекательности предприятия. Основные из них: нестабильность температурных показателей в сфере водных ресурсов, деградация почв и распространение болезней и вредителей сельскохозяйственных культур. Предложены задачи по адаптации агрохолдинга "Кернел" к новым условиям ведения сельскохозяйственного бизнеса с учетом условий изменения климата.

**Ключевые слова:** инвестиционная привлекательность, изменение климата, сельское хозяйство, нестабильность.

**Statement of the problem in general and its connection with important scientific or practical tasks.** The problem of investment attractiveness of agricultural enterprises of Ukraine is quite relevant today. This situation is due to the fact that active investment activities help to overcome the negative effects of the economic and environmental crisis. Investment attractiveness is an integral characteristic of individual enterprises – objects of future investment from the standpoint of prospects for their development, expanding the parameters of production and marketing, strengthening market position among competitors, efficiency of assets and their liquidity, solvency and financial stability, which may ensure an appropriate level of competitiveness of the entity. Therefore, one of the most important tasks facing each of them, and the economy as a whole, is to increase the investment attractiveness of the company, as well as against the background of global environmental problems, the fight against global climate change, because they directly affect economic situation in the enterprise itself.

The main global problems in terms of climate can be called: first, pollution: it will take millions of years to clean polluted air, water and soil. The

main polluters are industry and motor transport. The air is polluted by industrial facilities that emit various gases and toxins, as well as the use of natural fuels. Water and soil are polluted by oil spills, acid rain, nitrates, plastics, municipal sewage, and industrial waste. Secondly, global warming: human activities emit greenhouse gases into the atmosphere, which leads to the greenhouse effect (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride) [4]. This results in rising ocean and surface temperatures, melting polar caps, rising sea levels, and abnormal precipitation such as sudden floods, excessive snow, or desertification. Third, water pollution: clean drinking water is becoming an increasingly valuable resource that people are fighting for. This is a political and economic problem that needs to be addressed at the level of governments. In addition, the development of industry continues to pollute rivers and oceans with toxic substances that threaten the health of the world's population [9].

**Analysis of recent research and publications.** A review of the literature shows that many in-depth and large-scale studies have recently been conducted to study the impact of human-

ity on climate change, in particular on the role of agricultural activities in these negative processes [1]. The impact of climate on agriculture is obvious, but it is necessary to consider the reverse processes of increasing greenhouse gas emissions as a result of agricultural activities, which is becoming one of the major causes of climate change. On the one hand, agriculture is a significant source of greenhouse gases, as livestock and crop production are associated with emissions of carbon dioxide, methane and nitrous oxide. According to the annual reports on emissions that governments regularly submit to the Secretariat of the UN Framework Convention on Climate Change, agriculture accounts for about 15% of global greenhouse gas emissions [1, p. 9; 7, p. 5]. On the other hand, greenhouse gases change the climate and thus affect the production of livestock and crop products. At the same time, the share of agriculture in world GDP is about 4%, which indicates a fairly high carbon intensity of the agricultural sector. According to research, the production of agricultural products leads to emissions of three major greenhouse gases: carbon dioxide, methane and nitrous oxide [1, p. 12]. According to the latest data, agriculture accounts for almost half of the world's emissions of nitrogen oxides and methane [1, p. 29]. To date, in the framework of the Draft Strategy for Prevention and Adaptation to Climate Change of Agricultural Enterprises of Different Forms of Ownership, specialists of the Ministry of Agrarian Policy of Ukraine have identified priority issues that need to be addressed. Within the framework of our research, **the purpose of the article** is to highlight the proximity of climate change and their direct impact on the development of the agricultural sector of Ukraine's economy and investment attractiveness on the example of the agricultural holding "Kernel". Presentation of the main material of the study. Climate is of great importance, because under the influence of the main factors of climate formation – heat, moisture, length of daylight – the corresponding vegetation is formed. Animals are closely related to plants. Human economic activity is also determined by climatic factors. In more favorable climatic conditions, higher population density, concentration of industry. However, global warming is not only a problem for residents, but also has a significant impact on agriculture.

If we consider the investment attractiveness of the enterprise, it is influenced by both external and internal factors. It should be noted that the internal factors of the company can directly

affect, but the external factors of the company is difficult to influence, although perhaps one of these factors, as I said above, is the environmental problems of mankind.

Particular attention should be paid to this external factor as ecology, because in national practice, despite the relevance and severity of this issue, very little attention is paid.

The trend of climate change has a direct impact not only on the economic development of any enterprise, but for the whole country and the world as a whole. It should also be noted that the environmental factor is one of the most influential for the agricultural sector.

An Intergovernmental Panel on Climate Change (IPCC) was established in 1988 to compile statistics, determine the status and monitor the pace of climate change. Their Fifth Assessment Report revealed that:

1) From 1880 to 2012, the global average temperature increased by 0.85 C;

2) The global average sea level has risen by 19 sm due to global warming and melting glaciers;

3) Taking into account the current concentration and emissions of persistent greenhouse gases, the global average temperature may increase by 1-2 C by 2100 compared to 1990;

4) Compared with the period 1968–2005, sea level may increase by 40-63 sm by the end of this century [10].

Dr Ebergard Faust, Head of Climate Risks and Natural Hazards Research at MunchRe in Warsaw at the 34th AIAG Congress, said: "Insurance losses amounted to  $\geq 0.6$  billion US dollars, but these are not the final figures" [8].

The trend of climate change has a direct impact on the economic development of any country. For a more detailed study of the impact of this factor, the study was conducted on the example of Ukraine, as it is the largest agricultural country in Europe and climatic conditions have a direct impact on its economic stability [6].

It should be noted that 23% of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions are accounted for by the agro-industrial complex, as known from the Summary for Policymakers of the SRCCL. These gases are the main types of greenhouse gases in the world [5].

Given this situation, to study the impact of climatic conditions, it is advisable to consider an international company in the field of agricultural production.

One of the leading agricultural companies in Ukraine is Kernel Agroholding, which is the world's leading and largest producer and exporter of sunflower oil in Ukraine, as well as a

key supplier of agricultural products in the Black Sea region to more than 80 countries (Table 1).

A clear understanding of the consequences, risks and vulnerabilities in the short, medium and long term is a very important task for the effective adaptation of this agro-industrial enterprise to global climate change. This will allow the company's managers to understand the trend of climate change and how to influence the company in the future against the background of these problems.

Table 1

**Acreage of Kernel Holding S.A. in 2019 financial year and 2020 planning year**

	Acreage, thousand hectares		
	FY2019	FY2020	y-o-y
Corn	224.2	231.4	+3%
Sunflower	134.5	136.5	+2%
Wheat	100.0	97.1	-3%
Soybean	36.3	24.3	-33%
Other	34.1	23.3	-32%
<b>Total</b>	<b>529.1</b>	<b>512.7</b>	<b>-3%</b>

*Source: compiled by the authors according to the company's reports*

In general, Kernel Agricultural Holding and Ukraine's agriculture expect the following challenges to work productively, which will require significant financial, labor and time investments from the company to adapt to such changes.

Larger amplitudes of fluctuations in maximum and minimum temperatures in both summer and winter will require the introduction of new and genetic modification and adaptation of existing crops. Such research activities will require significant financial investment, taking into account the loss of current profitability due to additional time costs.

The study found that since the 1980s, average, average maximum and average minimum temperatures have begun to rise. But over the past 50 years, these figures have risen by 20%, 25% and 29%, respectively.

In the field of aquatic bioresources, climate change can lead to changes in rainfall, hydrodynamics and water balance of rivers, as well as significant shortages of fresh water.

Reducing summer rainfall will increase the frequency and severity of droughts, forcing the company to create new and improve old irrigation technologies. Due to climate change, the number of droughts in Ukraine has increased over the past 15 years, and their intensity has increased, leading to an increase in the number

of deserts in the country, burnout and reduced yields and great losses to crops.

An increase in seasonal and off-season floods and inundations poses a serious threat to the harvest. In this context, the most vulnerable are the mountainous regions of the Carpathians, settlements in the basins of the Dniester, Dnieper, as well as smaller rivers and more.

The next factor is soil degradation. For example, organic matter – "glue", which holds soil particles together and helps store water inside the soil – is currently being affected, which reduces the soil's ability to retain moisture, which plays a very important role, especially in dry years and after wintering all winter crops.

Also, one of the main factors of soil erosion is their excessive plowing, which is one of the most common mistakes of management of Ukrainian agricultural enterprises. This is a significant factor in the loss of soil's ability to retain moisture in the environment.

The next problem is the spread of infectious diseases and pests. Increasing the average annual temperature and amplitude fluctuations, changing the ripening regimes of crops increase their vulnerability to pests and disease epidemics, which leads to additional yield losses and financial costs to control them.

It is also important to monitor and control hydrometeorological conditions for the future and the company's responsible response to this situation. After all, such activities of the company will be adequate to the situation facing the company.

Global climate change can increase the capabilities of this agricultural holding due to weather and climate conditions. However, this is possible only with the effective adaptation of the agricultural company to the new conditions, synchronized with the pace of their change. Otherwise, global warming threatens to increase the instability of agricultural production. To adapt agriculture to changing climate conditions, it is necessary to assess the current conditions and model agro-climatic resources for the future.

As you know, one of the manifestations of climate change in Ukraine, where the main facilities of Kernel Holding S.A., is an increase in the number of warm days a year. Due to changes in temperature indicators of the cold period, spring plant development processes begin 2-3 weeks earlier. This will allow the company to sow crops earlier, and therefore to harvest them earlier. Such changes have a positive effect on the company, as it will spend less on special chemicals that are sprayed on sunflowers and various crops for faster ripening, and thus make products better and more organic.

However, it should be remembered that in order to manage agriculture effectively and preserve the soil, agricultural enterprises must adhere to crop rotations. However, a large number of farmers ignore these recommendations in order to obtain greater economic results. For example, the violation of crop rotations in favor of greater profits in the short term, which leads to soil depletion.

Due to the significant impact of climate change, it is necessary to introduce adaptive land reclamation. There are many types of land reclamation, but I would like to focus on drip irrigation. The essence of this technology is proportional watering of plants directly to the root zone. This method has been widely used in Israel since the 1950s in conditions of water scarcity and has shown its effectiveness.

In Ukraine, this practice is quite unpopular, but this method can dramatically reduce water consumption due to the fact that irrigation of the root zone occupies no more than 60% of the total area. In this case, each plant receives the required amount of water. Such a system does not cause soil erosion. Due to the fact that the leaves of plants are not moisturized, the risks of various diseases are reduced. Also, this system can fertilize plants, which allows more efficient and effective use of fertilizers. This reduces the required amount of fertilizer per unit area of the field and the resources spent on the fertilization process itself, which in itself significantly reduces the economic costs of the company. Due to this method of irrigation, the yield of sunflower increases to 5-6 tons per hectare [2].

The conducted research clearly shows the negative consequences of climate change and the forms of their manifestation that threaten this enterprise. The main ones are: instability of temperature indicators in the field of water resources, soil degradation and the spread of diseases and pests of crops.

However, it should be noted that there are also positive effects of climate change. Namely, the change in the increase in the number of warm days a year and the early start of spring field work 2-3 weeks earlier.

We proposed the task of adapting the agricultural holding "Kernel" to the new conditions of

agricultural business, taking into account the conditions of climate change. The main ones are:

- 1) Ensuring monitoring and control of hydro-meteorological conditions for the future;
- 2) Development and implementation of scientifically sound crop rotation;
- 3) Introduction of a new field of activity: bee-keeping;
- 4) Adaptation of reclamation systems. Introduction of drip irrigation system.

**Conclusions.** In the environment of agricultural producers there is a set of risks and threats, under the influence of which the main aspects of enterprises are formed and on which their investment attractiveness depends. By their nature and source, they can be attributed to the category of risks that pose a risk of losing investment attractiveness to the enterprise and the entire agricultural sector of Ukraine.

In conditions of increasing aridity of the climate, it is necessary to take systematic and scientifically sound measures to adapt agricultural production to new climatic conditions. Resistance to the constant shortage of moisture in agriculture is achieved by accumulating and maintaining it through the constant use of modern energy-saving technologies for growing crops, minimizing tillage, reducing the time of spring field work, and generally comply with regulations for all technological operations. These measures contribute to the sustainable development of Ukraine's agricultural sector, as they are based on the principles of the golden rule of ecology, which must always be implemented at the farm level – global environmental problems are solved locally.

The problem of environmental investment is currently very relevant, against the background of global warming, lack of moisture, and many other climatic factors, companies need to work on improving their technologies, rethinking crops, controlling crop rotation. Every year, climate change will force companies to spend more and more resources. Agricultural enterprises must implement new technologies in the fight against environmental problems and recognize that changes in crop production, against the background of climate change, are inevitable.

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