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THE USE OF INNOVATIONS IN AGRICULTURE SECTOR IN RUPUBLIC OF KAZAKHSTAN

Yerkimbekuly Rauan

Doctor of Economics, **Kazakh National Agrarian University, Almaty**, Kazakhstan
E-mail: rauan.85R@mail.ru

Annotation.

The introduction of the remote sensing in the field of agriculture creates opportunities for more effective and efficient farming practices and for adoption of precise agricultural techniques in the Republic of Kazakhstan.

Key words: agriculture, remote sensing, agrarian sector, Kazakhstan.

The research methodology is based on the comparative approach.

Introduction. Land use has played the significant role in the economic life of different societies since the dawn of the human civilisation. The agricultural revolution gave birth to agrarian practices and animal husbandry which turned land into the factor of production. Even in the twenty first century land is directly or indirectly necessary for manufacturing of nearly all goods and commodities. The globalisation of production chains proved that production cannot grow indefinitely because of limited resources on this planet [1]. As a result, resources should be used rationally.

There is no doubt that the rational use of agricultural lands has the significance for developing the agricultural sector of the Republic of Kazakhstan. It is worth mentioning that all regions of Kazakhstan are facing challenges caused by the soil degradation. The potential of agricultural production is severely limited by humus stock degradation, soil nutrient loss and decline in vegetation diversity. As a result, agricultural lands should be subject to the special treatment and protection measures [2].The expansion of the agricultural production without modernising equipment and introducing new and more resource efficient technologies could increase carbon dioxide and soil nitrous oxide emissions. As a result, erosion, soil degradation and environmental pollution could decrease are of arable and pasture lands.

The research results. The current economic and technologic conditions in the Republic of Kazakhstan require more precise approach to farming practices, e.g. automated plant feeding systems. In the next 7-10 Kazakhstani farms need to adopt the precise agricultural practices and automatise their production in order to stay competitive in the global agricultural market. Increasing anthropogenic pressure on the natural habitat makes studying and assessing economic damage of the agricultural activity based on the materials obtained from various remote sensing sources more and more relevant for soil conservation and restoration. The practical and scientific significance of remote sensing data is constantly increasing in the research of global, continental and regional changes in biosphere and climate, in forecasting natural and anthropogenic disaster, in assessing and eliminating damage caused by the economic activity. The main users of aerial photography data used to be geologists, geographers, foresters, agronomists and cartographers. The researchers used to analyse the aerial photograph in the laboratory to directly extract useful information from it, then plotted it on one of the base maps and determined the areas to be visited during the field work. After the fieldwork is completed, the researcher used to re-evaluate the aerial photographs and used the data obtained from the field surveys to create the final map. Using these methods, many different thematic maps were prepared for release: geological, land use, topographic, forests, soils and crops. However, the cost of aerial surveys has declined while drones are continuing to drop in price. Therefore, it could be estimated that more and more smaller business owners in the Republic of Kazakhstan would be able to afford a drone by the middle of this century. For instance, using drones for remote sensing would allow more and more private farms and agricultural enterprises in Kazakhstan to use arable lands more efficiently. It is worth mentioning that adopting efficient agricultural practices is impossible without understanding the current state of arable lands in the Republic of Kazakhstan. The remote sensing techniques could be used for collecting reliable information about the agricultural land quality at the regional level in Kazakhstan. Using drones for surveying could allow quickly and accurately determine the agricultural land area, monitor changes in the crop quality, identify the cases of crop loss (e.g. spoilage, flood, hurricane or fire) and theft. The most important part of the remote sensing is analysing images taken from a drone. The analysis could be performed either by using visual techniques or by allowing a computer to do this work if the data is available in the digital form.

The computer analysis could be based on comparing the grayscale (discrete range) values of each pixel in images taken on the same day or on several different days. The image analysis systems classify the specific features of the shooting plan in order to draw up the thematic map of the area. The modern image reproduction systems make it possible to reproduce on a colour television monitor one or several spectral bands worked out by a satellite with an MSS scanner. The movable cursor is then set on one of the pixels or on a matrix of pixels located within the certain specific feature, for example, a reservoir. The computer correlates all four MSS bands and classifies all other parts of the satellite image that have similar sets of digital numbers [3]. The researcher can then colour-code the “water” areas on a colour monitor to create the “map” showing all the bodies of water on the satellite image. This procedure, known as guided classification, allows you to systematically classify all parts of the analysed image. It is possible to identify all major types of the Earth’s surface. The described classification schemes using a computer are quite simple, but the world around us is complex. For instance, water does not necessarily have a single spectral characteristic: within the same shooting plan, water bodies can be clean or dirty, deep or shallow, partially covered with algae or frozen, and each of them has its own spectral reflectivity (and therefore its own digital characteristic). The interactive digital image analysis system (IDIAS) uses an unregulated classification scheme. IDIAS automatically places each pixel in one of several dozen classes [4]. After computer classification, similar classes (e.g. five or six water classes) can be grouped into one.

On the other hand, many parts of the Earth's surface have rather complex spectra which makes it difficult to unambiguously distinguish between them. An oak grove, for example, may appear spectrally indistinguishable from a maple grove in satellite images. In terms of spectral characteristics, oak and maple are broad-leaved trees. The computer processing by algorithms for identifying the content of the image can significantly improve the MSS image compared to the standard one.

Today there are many types of drone models designed to perform various functions in the agricultural industry. All of them are distinguished by their efficiency, simplicity, reliability and convenience of design, precision in work and environmental friendliness. Drones are able to successfully cope with the task of compliance monitoring with the agrotechnical standards (including the soil cultivation quality) and monitoring crops using cameras installed on them, conducting real-time aerial photography and transmitting data for processing and analysis. Drones are indispensable for creating plans and maps of agricultural lands (now in 3D format), developing new land plots. The recent discoveries in the field of drone making allows to carry out spectral analysis of the soil [5]. This makes it possible to determine the exact moisture content and the amount of mineral and organic substances in each land plot, to control the growth and monitor the current state of crops, to define prospects for the future harvest. The agricultural enterprises in the Republic of Kazakhstan could highly benefit from applying drones to plant seeds. In this case, the drone "shoots" seed capsules containing the growth stimulator and all the elements necessary for the successful development of a plant into the soil. In one hour of operation, a drone is capable of placing seeds with high accuracy on a field up to 4 hectares. Kazakhstani farmers could benefit from drones equipped with ultrasonic scarers which would protect crops from rodents and birds. Their application for irrigation, applying fertilizers, pesticide treatment could be carried out remotely with high accuracy, preventing the dispersion of clouds to neighbouring crops. The innovative development of the agricultural sector of the Republic of Kazakhstan during the global economic crisis is possible through adoption of robotised and automatised systems. These type if systems would ensure that drones would fly to the fields according to the schedule, would collect the necessary information and transfer it to an automated processing system after returning, and would self-recharge after completing all tasks. In the near future adoption of the remote sensing could be a breakthrough in the world of agricultural commerce in the Republic of Kazakhstan. Therefore, there is need to open courses and degree programmes at technical colleges and universities across different regions of Kazakhstan to train, retrain and educate future UAV (unmanned aerial vehicle) operators. The next technological breakthrough in the agricultural sector of the Republic of Kazakhstan would be the complete automation of production. For example, there are already automated robots for harvesting strawberries. The next stage of agricultural development could be the creation of such types of harvesting robots that could automatically determine and would switch the harvesting program for different types of agricultural crops. To understand the possibility of automating methods for the rational use of remote sensing materials, it is necessary to build the algorithmic model of processes. The mathematical-algorithmic model describing the cause-and-effect relationships (behind increase in the rational use level of arable lands in the agricultural sector) can consist of the following stages: Implementation of the package of measures to improve the rational use of remote sensing materials. Increased access for more farmers to remote sensing materials. Opportunities for more efficient collection and analysis of information for a larger number of farmers.Motivating more farmers in Kazakhstan to engage in precision farming. Increasing the rational use level of arable lands among agricultural enterprises and farmers involved in the agrarian sector.

The development of agricultural productivity in Kazakhstan is impossible without reducing energy costs and resource inputs through the introduction of robots. For example, thanks to the collection and analysis of the big data they will be able to accurately treat the location of weeds, spraying only the required dose of pesticides. On the other hand, it is also possible to use laser technology for the weed control. This may be beneficial for organic farming which tries to minimise the use of harmful chemical fertilizers. Small sensors and cameras could provide warnings to farmers at times when different types of crop threats would arise. For example, a farmer could be notified about the presence of pests in his/her plot of land.

Conclusion. To sum up, the set of measures for to improving the methods of rational use of remote sensing materials include the following points:

- developing a computer program that will inform a farmer in advance about non-flying days for a drone and possible breakdowns of a drone or its sensor. This program would notify farmers about this by SMS-messages, e-mails or calls. It is possible to create the government run system or to get a private company as the government contractor. social networking service like Facebook where farmers can discuss remote sensing issues and offer solutions; introducing the legal ban on imports of drones with low payload in relation to their own weight; creating an online resource which will be subsidised from the state budget. This resource should describe how to use and repair drones, where to buy spare parts. Moreover, this online resource may contain information about the nearest service centres (for repairing drones); financial and legislative incentives for developers of software products for collecting, processing and analysis of the data that would be collected from a drone.

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