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THE IMPORTANCE OF INFORMATION TECHNOLOGIES IN INCREASING THE EFFICIENCY OF RESOURCES IN AGRICULTURE

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Abstract: This article deals with the substantiate role of information technologies in increasing the efficiency of resources in agriculture by learning international practices of usage information technologies and the importance of the usage of developed mobile application of optimization model in order to make it accessible even to those who are unaware of such modelling. It also considers the efficiency of a farm located in the Republic of Karakalpakstan by comparing the cultivated crop and other crop types, as well as the income of the previous year with the application based results. Based on the results the development of directions for efficient use of resources in the cultivation of the agricultural products with the help of the modern information technologies are also illustrated.

Keywords: agriculture, framing, information technologies, optimization model, mobile application, resources, crop, land.

Information technology is having a special importance as a significant component of agriculture. The reason for this is that the agricultural producers try to get accurate, reliable and complete information about a number of processes such as price formation, crop production, planting technology, land acquisition. It is argued that farmers need to be constantly informed about changes in crop diversities, changes in climate and soil conditions, as well as in planting technology, disease control, etc., despite the fact that they have grown a particular crop for many years.

Access to new information will enable farmers to increase the amount of profit by adapting abovementioned situations under existing conditions [3]. However, it is much more difficult to have such knowledge, as the high dependence of agriculture on local conditions raises the problem of adapting data to specific conditions.

Considering the problems mentioned, the use of information and communication technologies (ICT) is the most optimal solution. ICT creates an opportunity to develop methods for implementing activities in agriculture using electronic means such as e-commerce, e-banking services, e-governance and control, and so on.

Accordingly, download in an innovative way of such applications to mobile phones, i.e. smartphones and tablets, has resulted in the use of mobile commerce, mobile banking, mobile management, mobile surveillance and more. Applications like those have radically changed the way of doing a lot of activities. As a result, it is difficult to find a society in "global agriculture" that does not feel the impact of the ICT revolution.

Nowadays, most people are regular users of mobile phones and ICT consumers. Developed and developing countries are responding to such processes and problems by developing ICT policies, shaping the regulatory framework and establishing institutional infrastructure. Their goal is to improve and streamline electronic developments that serve to rapidly change the world in which we live.

The World Summits on the Information Society (WSIS) held in Geneva in 2003 and Tunis 2005 aimed to bridge the global digital divide by expanding access to ICTs in developing countries [4]. In such events, less attention was paid to agriculture than health and education, but these meetings focused on the development of ICT strategies

for all sectors, including agriculture.

Agriculture is one of the sectors that serve to ensure economic growth in poor and developing countries, and its importance in ensuring economic development has been confirmed by many scientific studies [1]. Agriculture also has significant linkage in its operations with other related sectors such as rural development, natural resource management, banking, insurance, media, governance, transportation and logistics management [2]. However, agriculture is facing many challenges in the coming period due to climate change, loss of biodiversity, drought, desertification, rising food prices and inefficiency of supply chains.

The sector is increasingly becoming knowledge-intensive, and the availability of the right information, at the right time, in the right format, and through the right medium, influences and affects the livelihoods of many stakeholders involved in agriculture and related fields [4]. It has been proven that enhancing the ability of farming communities to connect with the knowledge bank, industries and institutions through ICT will significantly improve their productivity, profitability, food security and employment opportunities [2].

According to the results of our research, the above-mentioned opportunities for the use of ICT are widely used today. In our opinion, finding new opportunities for the use of ICT and presenting them to members of society in a form that can be used by all, will serve to increase production capacity in agriculture and select the optimal use of available resources.

As it is known, optimization issues are widely used in economic research. The formulation and solution of this problem are described in many books and manuals, and a number of software programs have been developed to solve such problems. Today, the availability of different software packages has made it possible to add many measures and limitations to the models [5]. Such analytical results can be easily transferred to the decision maker. Leading software packages that are widely used in practice for the quantitative approach are MS Excel solver, LINGO / LINDO, QSB, QSOM, LiPS and GAMS.

The mentioned software packages are designed to solve general optimization models and to use them theoretical and practical knowledge and skills in formulation of problem and restrictions are required. However, the lack of knowledge and skills of a large number of farmers and farm managers working in the field of optimization models confines their ability to use such methods in decision-making. As a result, they are unable to make the most of their available opportunities.

In the course of our research, we focused on the issue of creating its mobile application in order to facilitate the use of the optimization model by overcoming the above-mentioned problems.

This application will allow agricultural producers to get the maximum income within their capabilities. In these processes users are not required to have knowledge of farm optimization. They just have to fill the gaps for entering the necessary information.

When creating this application for determining the resources used in the cultivation of products and setting their standards used "Exemplary technological maps for the care and cultivation of agricultural crops for 2016-2020". That technological map was developed by Ministry of Agriculture and Water Resources of the Republic of Uzbekistan, Uzbek Agricultural Research and Production Centre, Tashkent State Agrarian University, Agricultural Economics Research Institute. This application is designed for farms operating

in the Republic of Uzbekistan, which allows them to maximize their income by choosing the optimal option from given 16 types of crops to optimize their income and profit.

In the selection process of the products, special attention is paid to the level of widespread cultivation in agriculture producers of country, as well as low water consumption, which allows optimal use of resources in areas with water shortages.

The application is very simple to use, from which the user only needs to enter the following information. In the first stage:

1. Total land area of the farm (hectare)
2. Cotton growing area under the contract (hectare)
3. Wheat growing area under the contract (hectare)
4. The amount of fuel available on the farm (litres)
5. Limit of water allocated to the farm (tons / m3)
6. Number of permanent employees

Once this information is entered, the second step is taken. In the second stage, the farmer can choose crops from 14 other products, in addition to cotton and wheat, depending on their capabilities and soil composition.

It then moves on to the third step and user should enters the current market price of the selected product, as the price of the product may vary by region so it was considered appropriate for the farmer to enter this information. In the fourth step, the level of productivity of each selected product according to the farm conditions is entered and then pressed button where written the word "result". The application determines the level of available capacity of the farm and the maximum income it can receive within the specified products. The results will be shown on the screen.

We would like to consider the efficiency of a farm located in the Republic of Karakalpakstan by comparing the products and incomes of the previous year with the results determined on the basis of the application. The total sown area of the farm is 156.3 hectares, the contract for sowing cotton is 38 hectares, the contracted yield is 22.3 centner/ ha, the contract for sowing wheat is 45 hectares, the contracted yield is 16.6 centner/ha.

Types of crops grown by the farm, income and expenditure calculations for each type of product are given (Table 1).

According to the data, the farm planted 38 hectares of cotton, 45 hectares of wheat, 10 hectares of rice, 10 hectares of watermelons and 5.6 hectares of melons last year. The yield per hectare and the cost per kilogram of crop are also given in the table. The amount of labour and mineral fertilizers used to grow one hectare of crop is also mentioned. Based on the information provided the average profit from the sowing of cotton per hectare is 2023 thousand sums. It was determined that average profit of sowing wheat is 2890 sums, 6980 sums from rice, 4990 thousand sums from watermelon and melon (Table 1).

Table-1
Types of crops planted on the farm last year, their income and expenses

Type of crop:	cotton	wheat	rice	watermelon	melon
Planted land area	38	45	10	10	5.6
The average yield per hectare is centner.	23.7	40	40	150	150
Sale or market price of the product is UZS / kg.	3400	1500	2500	500	500
Fuel consumption per hectare:	70	50	50	30	30
The number of manpower required per hectare of land.	30	10	5	3	3
The average labor cost per hectare is in thousands soums	3895	498	300	200	200
Mineral fertilizers applied per hectare of land in kg / ha.	500	400	400	300	300
The average income from each hectare of land is in thousands soums	8058	6000	10000	7500	7500
The average cost per hectare in thousand soums	6035	3020	3020	2510	2510
The average profit from each hectare of land is in thousand soums	2023	2980	6980	4990	4990
Amount of total profit	76874	134100	69800	49900	27944

As well as resource, limits of the farm were also mentioned, with a total land area of 156.3 hectares, an available fuel capacity of 22715 litres, and an allocated water volume of 990300 m3. As a result, the farm managed to plant a total of 108.6 hectares of land and able to get a total income of 358618.0 thousand.

We tried to determine the optimal income of the farm within the available opportunities by including the data provided by the farm in the program and achieved the following results (Table 2).

In the first option, we selected only those products that were planted on the farm last year and determined that the farm could have an optimal income from planting 38 hectares of cotton, 83.98 hectares of wheat and 1.27 hectares of rice. In other words, within the existing restrictions, the farm has the opportunity to earn income in the amount of 582330.7 thousand sums. This amount is 1.62 times more than the income received by the farm last year.

Table 2
Program-based results

№	Crop name	Cultivated area (in hectares)	Received Income
1	Cotton (38 hectares under the contract)	38.00	187 053 629.34
2	Wheat (45 hectares under contract)	83.98	387 063 468.11
3	Rice	1.27	8 213 651.85
4	Melons	0.00	0.00
Jami:		**123.24**	**582 330 749.30**

Existing restrictions and their usage

Resources	Existing amount	Used amount
Total land area:	156.30	123.24
Amount of fuel and its consumption:	22 715.00	22 715.00
Amount of water and its consumption:	990 300.00	990 300.00
Number of permanent employees:	30.00	11.24

In this case, the farm uses only 12.24 hectares of the existing 156.3 hectares of land, as well as the main limitation is the amount of water and fuel, that is, their full use limits their access to land.

If we expand the types of crops, we may be able to make more profit by using less land. For example, if cotton, wheat, rice, melons, cucumbers, tomatoes and alfalfa are selected as crops, it is possible to earn 594474.1 thousand sums using 102.87 hectares of land (Table 3).

Table 3
Program-based results

№	Crop name	Cultivated area (in hectares)	Received Income
1	Cotton (38 hectares under the contract)	38.00	187 053 629.34
2	Wheat (45 hectares under contract)	45.00	207 413 460.00
3	Rice	10.52	68 147 710.19
4	Melons	0.00	0.00
5	Cucumber	0.00	0.00
6	Potato	9.36	131 859 290.53
7	Trefoil	0.00	0.00
Jami:		**102.87**	**594 474 090.06**

Existing restrictions and their usage

Resources	Existing amount	Used amount
Total land area:	156.30	102.87
Amount of fuel and its consumption:	22 715.00	22 715.00
Amount of water and its consumption:	990 300.00	990 300.00
Number of permanent employees:	30.00	15.89

As can be seen from the data in Table 3, the expansion of crop selection increases the possibility of income optimization. In other words, the ability of farms to choose a wider range of products when using the program, taking into account the existing conditions, serves to optimize their income.

Based on the results analysis and the research, we can conclude that development of directions for efficient use of resources in the cultivation of agricultural products in our

country, creating opportunities for the use of modern information technologies serves to increase the amount of income received by more than 60 percent.

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