Popular Mobile Applications for Crop Production

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Abstract. The level of implementation of information and communication technologies in agriculture changes the demand for information support for crop production management. The study showed that the main criteria for selecting mobile crop applications in Russia are recommendations from friends and colleagues, content and timeliness of data updates, cost of use, language, user reviews and ratings. According to the scope of application, the author has identified the following groups of mobile applications: management of technical means; control and measurement of technological parameters; production planning; management decision support, knowledge development, communication and consulting; sales and purchasing organization. The most popular applications for Russian crop production workers are applications for precision farming technologies, navigation, agro calculators, nitrogen management, process maps and reference books. The results obtained differ from the global ones and are explained, in our opinion, by cultural and geographical characteristics, the level of digitalization of the economy, education, and technology.

1. Introduction

The market of software products offers consumers more and more diverse software every year, and the range of gadgets is expanding. Mobile devices are now used by people not only to communicate and transmit messages, but also as an organizer, a means of rapid data collection and analysis, improving their knowledge, and managing mechanisms and equipment. Mobile apps are developed for platforms / operating systems installed on smartphones, tablets, and other mobile devices. For crop production, they can be separate programs, utilities of software complexes, or multi-platform applications. Their main purpose is to provide operational management of agricultural production, support management decision-making and improve user knowledge.

A large set of factors affects the formation of user preferences. C Costopoulou, M Ntaliani, S Karetsos noted that geographical and cultural factors determine the use of mobile applications [1]. E Peltonen, E Lagerspetz, J Hamberg, a Mehrotra, M Musolesi, P Nurmi, S Tarkoma described geographical and cultural factors [2]. S Nambisan, M Wright, M Feldman wrote about changes in the economy under the influence of digitalization [3]. I Pentina, L Zhang, H Bata, Y Chen emphasized cultural definitions when choosing mobile apps [4].

The level of digitalization of Russian crop production is still low, and the creation of digital ecosystems is only at the initial stage. Although there are already scientific developments, and most often they are related to IoT and Big Data analysis [5-9]. In our opinion, the level of crop production digitalization depends on the digitalization level of economy and education, digital culture, mentality, technology development, and others. User preferences differ not only in geography, but also in the

specifics of their activities. This explains the relevance of the research topic. The purpose of the study was to identify the most popular mobile applications for crop production in Russia.

2. Materials and methods

The author identifies the main factors that shape the demand for mobile applications for crop production, and the methods used in this study.

2.1. Features of crop production in Russia

The choice of mobile applications is influenced by the area of their use, in our case, the crop industry. Crop production is one of the main branches of agriculture, it includes field, meadow, vegetable, fruit, viticulture, floriculture, forestry. The following main crops are available for cultivation: wheat, oats, buckwheat, corn, millet, rye, barley, potatoes, peas, watermelon, carrots, feed beans, corn, clover, flax, and others.

Russia has a well-developed information and communication infrastructure. It supports the digitalization of crop production, but farmers do not yet have enough financial resources for new technologies. The Ministry of agriculture of Russia is implementing the Digital agriculture project, which is needed to create a digital ecosystem for managing production, supply and sales; obtaining loans, subsidies, insurance, hedging; improving skills and getting expert advice, recommendations; using electronic trading platforms and analytics; integration into the Internet space. It is obvious that with the digitalization of technological processes and management in crop production, the demand for information support will grow.

2.2. Factors that influence the choice of a mobile applications

Many scientists conduct research on the features of mobile apps. Most often, they focus on applications from large platforms. This is Android and iOS, because KaiOS and other operating systems are used by only 2.21% of users in the world. Thus, M Pandey, R Litoriya, P Pandey identified and studied mobile applications based on the following characteristics: reviews related to the requirement, user interface, design, testing, trust, maintenance and battery [1]. H W Kim, A Kankanhalli, H L Lee concluded that the decision to purchase a mobile app is influenced by five factors: word of mouth about the application, application usability, monetary value of the application, application trialability, and application enjoyment [10].

Based on the analysis of scientific publications and opinions of crop workers, we will highlight the main factors that determine the user's choice of a mobile app:

- recommendations from colleagues and friends;
- reviews in the Internet, magazines;
- cost of use [10, 11];
- category of placement in the app store;
- user reviews and ratings [12, 13, 14];
- interface (convenient or not) [15, 16];
- design [13, 15, 17];
- language;
- content and timely updating of data [11, 15, 18, 19].

In addition, the level of digitalization of crop production and the level of competence of crop workers will also affect the demand for mobile applications.

As noted by Russian crop workers, they prefer to use mobile apps for free. Most often they search for applications based on someone's recommendations by entering names, and free search is often carried out in the categories "Agriculture" and "Agro-industrial complex".

2.3. Steps of the research

The author analyzed scientific publications, supplemented them with the opinions of Russian crop production workers, and highlighted the factors that determine the user's choice of mobile applications. The respondents are specialists in crop production in Russia who have experience in using mobile applications, 24 people. Based on their ratings, the author assesses the importance of mobile app selection criteria. Respondents also gave ratings to mobile applications for crop production, which will help to identify the most popular. The grouping method was used by the author to classify popular applications by scope.

3. Results

There are results of two surveys for Russian crop production: an assessment of the criteria for selecting mobile applications for crop production and an analysis of groups of popular mobile applications.

3.1. Assessment of mobile app selection criteria

Respondents could choose any set of criteria that were important to them. There were 24 respondents, so the maximum set could consist of 24 criteria, and the minimum set could consist of 0. The results are shown in table 1.

Table 1. Evaluating the importance of mobile app selection criteria by respondents.

Selection criteria for mobile applications	Evaluating the importance of a criterion
Recommendations from colleagues and friends	24
Reviews in the Internet and magazines	4
The cost of using	20
Category of placement	1
User reviews and ratings	19
Convenient interface	6
Design	7
Language	19
Content and timely updating of data	23
The requirement of the technological process	24

Thus, respondents consider the most important recommendations of colleagues and friends (24), (they trust them more than reviews and advertising on the Internet) and the requirement of the technological process (24). However, it should be noted that the production of crop products does not require the mandatory use of mobile applications. And to make management decisions and improve the level of their competencies, they can be replaced by the use of other programs and software systems. The content and timely updating of data, the cost of use (this is expressed in the desire not to pay), the language (most respondents choose Russian), user reviews and ratings in the app store are also important criteria. The rating of the placement category was significantly underestimated (1). In our opinion, the significance of this criterion is higher and it is more related to the technical problem of placement. For example, the poultry statistics application is located in the "Food and drink" category. This makes it difficult for agricultural workers to find it.

3.2. The analysis of users ' preferences in the choice of mobile applications

An analysis of mobile apps for Russians on Android and iOS platforms conducted in 2020 showed that there are slightly more than 100 of them for crop production. According to the scope of their application, they can be divided into the management of technical means; control and measurement of technological parameters; production planning; support for management decision-making, increasing knowledge, communication and consulting; organization of sales and purchases. The author has identified groups of mobile applications that are most popular among Russian crop workers (based on expert assessments of respondents). These are navigation, agro calculator, nitrogen content management, process mapping, reference books, and an auxiliary platform for precision farming technologies. Compare this selection with the most popular apps in other countries (table 2).

Table 2. Popular mobile applications for crop production.

Application sphere	Popular applications in the world [20]	Popular applications in Russia
Management of technical means	Logistics of the machine and tractor fleet Drone flight control	Navigation
Control and measurement of technological parameters	Tester absorption of nitrogen by plants Field statistics	Nitrogen content management Agro calculator Auxiliary platform for precision farming technologies
Production planning	–	Process mapping
Management decision support, knowledge development, communication and consulting;	Reference books Sharing these fields for farmers to make collective decisions Detailed weather forecast and information support for your own weather stations Platform for getting advice from various specialists Pocket rain gauge Calculating areas on the map Chemical mixing system. Methodical recommendation Platform for interaction between consultants, specialists and farmers	Reference books
Sales and purchasing organization	Seed sales analytics	–

It should be noted that many English-language applications are not adapted for Russian crop production, climate, geography, cultivated crops, etc. This applies to a lesser extent to the management of technical means, control and measurement of technological parameters. Language is also a problem. And some technologies are not yet actively used, so there is a low demand for mobile apps to support them. This explains the lack of popularity in Russia of mobile applications for the logistics of the machine and tractor fleet. Navigation apps are more interesting. To control and measure the technological parameters of production, Russian respondents note a larger list of popular applications. This is nitrogen management, agro calculator, support for precision farming. For planning the

production of agricultural crops, Russians like the application for drawing up technological maps. Respondents did not identify many applications from the group for supporting management decision-making, improving knowledge, for communication and consulting. The exception is reference books. Platforms for interaction between consultants, specialists and farmers exist in Russia, and even have user ratings of 4.5 (with a maximum value of 5), but respondents did not identify them as popular. We can assume that the culture of online consulting and communication is still being formed. The situation is similar with applications for organizing sales, purchases, and their analytics. Such applications exist, but are not popular. Thus, we can see significant differences in the preferences of Russian crop workers and the global community of specialists.специалистов.

4. Conclusion

With the gradual introduction of information and communication technologies in crop production, there is a demand for mobile applications. The study showed that the most important criteria for choosing mobile apps according to respondents were recommendations from friends and colleagues, technological process requirements, content and timeliness of data updates, cost of use, language, user reviews and ratings. At this stage of development of information support for crop production, in our opinion, the "The requirement of the technological process" criterion can be removed to less significant ones, so the following criteria will remain for Russian users: recommendations from friends and colleagues, content and timeliness of data updates, cost of use, language, user reviews and ratings.

The study also showed that the set of popular Russian mobile applications for crop production differs from the "Top 21 List of Agriculture Mobile Apps for 2020" [20]. Russian respondents identified applications: navigation, nitrogen management, agro calculator, support for precision farming technologies, production of technological maps, reference books. The reasons for different preferences are the level of digitalization of crop production, economy and education; the development of technology, culture, in particular, digital; geographical features, etc.

5. References

[1] Costopoulou C, Ntaliani M and Karetsos S 2016 *IOSR J. Mob. Comput. Appl* **3** 44-49
[2] Peltonen, E, Lagerspetz E, Hamberg J, Mehrotra A, Musolesi M, Nurmi P and Tarkoma S 2018 *Proc. of the 20th Int. Conf. on Human-Computer Interaction with Mobile Devices and Services* (Spinger) pp 1-12
[3] Nambisan S, Wright M and Feldman M 2019 *Research Policy* **48(8)** 103773
[4] Pentina I, Zhang L, Bata H and Chen Y 2016 *Computers in Human Behavior* **65** 409-19
[5] Rajeswari S, Suthendran K and Rajakumar K 2017 *Int. Conf. on Intelligent Computing and Control (I2C2)* (IEEE) pp 1-5
[6] Muñoz M, Guzmán J L, Sánchez J A, Rodríguez F, Torres M and Berenguel M 2020 *IEEE Internet of Things Journal* https://ieeexplore.ieee.org/abstract/document/9097273/metrics#metrics
[7] Freebairn D M, Ghahramani A, Robinson J B, and McClymont D J 2018 *Environmental modelling & software* **104** 55-63
[8] Kamilaris A, Kartakoullis A and Prenafeta-Boldú F X 2017 *Computers and Electronics in Agriculture* **143** 23-37
[9] Huang Y, Chen Z X, Tao Y U, Huang X Z and Gu X F 2018 *Journal of Integrative Agriculture* **17(9)** 1915-31
[10] Kim H W, Kankanhalli A and Lee H L 2016 *Information & Management* **53(6)** 727-739
[11] Ickin S, Petersen K and Gonzalez-Huerta J 2017 *Int. Conf. of Software Business* (Springer, Cham) pp 186-191
[12] Lu M and Liang P 2017 *Proc. of the 21st International Conference on Evaluation and Assessment in Software Engineering* (Karlskrona: Association for Computing Machinery) pp 344-53
[13] Palomba F, Salza P, Ciurumelea A, Panichella S, Gall H, Ferrucci F and De Lucia A 2017

IEEE/ACM 39th International Conference on Software Engineering (IEEE) pp 106-117
[14] Malik H, Shakshuki E M and Yoo W S 2020 *Future Generation Computer Systems* **107** 659-69
[15] Pandey M, Litoriya R and Pandey P 2019 *Smart computational strategies: Theoretical and practical aspects* (Singapore: Springer) pp 121-133
[16] Tarute A, Nikou S and Gatautis R 2017 *Telematics and Informatics* **34(4)** 145-56
[17] Kumar D S, Purani K and Viswanathan S A 2018 *Journal of Retailing and Consumer Services* **45** 132-41
[18] Wisniewski H, Liu G, Henson P, Vaidyam A, Hajratalli N K, Onnela J P and Torous J 2019 *Evidence-based mental health* **22(1)** 4-9
[19] Thu E E and Nwe N 2017 *15th International Conference on Software Engineering Research, Management and Applications* (IEEE) pp 179-185
[20] Top 21 List of Agriculture Mobile Apps for 2020 https://www.agrotechnomarket.com/2017/09/list-of-agriculture-mobile-apps.html