ONLINE IT-SERVICES LINKED TO CROP PRODUCTION IN UKRAINE

Abstract. Digitalization is the prime world trend in the contemporary economic development. Due to Information Technology (IT) innovative data are converted unto profitable assets and also determine the most effective way of utilizing material, financial, and labor resources. Ukrainian economy depends on outcomes of agriculture, especially its stronger industry of crop production. Thus, modern IT are significant to respond challenges of amplified competition and unstable harvests experienced by the national farmers involved in cereals and oilseeds growing.

This study took aim at a complex evaluation of online services on the Internet which foster crop industry at the different stages of a production cycle. A method of comparative analysis provided the most promising directions of applying IT to agricultural enterprises and enhancing total outcomes of their activity.

Firstly, the national farmers encounter high natural risks and market uncertainties which distort their initial forecasts and optimal plans. The research findings specified the most reliable insurance companies operating in Ukraine. The identified official websites of PrJSC "ASKA", "INGO", "Oranta-Sich", "PZU Ukraine", and "Universalna" contain transparent insurance offers focused at the agricultural issues.

Secondly, in general Ukrainian crop growers experience immense annual deviations of yields and harvests. It is largely explained by system mismanagement in utilizing seeds and farming technologies, as well as applying fertilizers and pesticide protection. To cope with these pressing issues it is advisable to consider Ukrainian data aggregator SuperAgronom. It illustrates available for purchase options distributed into seeds, fertilizers, weeds, and pesticides sections. Thirdly, approximately 30% of the grown grain harvest in Ukraine is lost owing to
inappropriate storing. Therefore, the obtained research findings described the major national IT-service linked to an interactive elevator map of Ukraine.

Overall, the above given made it possible to conclude that the online IT-services are invaluable driving means intended for innovative updating of the national crop industry.

**Keywords:** online service, website, insurance IT in agriculture, data aggregator, crop growing, harvest storing.

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**ОНЛАЙН ІТ-СЕРВІСИ, ПОВ’ЯЗАНІ З ГАЛУЗЬЮ РОСЛИННИЦТВА УКРАЇНИ**

**Анотація.** Цифровізація є провідним світовим трендом сучасного економічного розвитку. Завдяки Інформаційним Технологіям (ІТ) інноваційні дані перетворюються на прибуткові активи та визначають найбільш ефективні шляхи використання матеріальних, фінансових і трудових ресурсів. Українська економіка залежить від результатів сільського господарства, особливо його потужної галузі рослинництва. Відтак, сучасні ІТ є вкрай важливими засобами реагування на виклики стосовно посилення конкуренції та нестабільності урожаїв, що є типовим для вітчизняних фермерів, зайнятих у вирощуванні зернових та олійних культур.

Дане дослідження ставило за мету комплексну оцінку онлайн сервісів Інтернету на підтримку галузі рослинництва на різних етапах виробничого циклу. Метод порівняльного аналізу визначив найбільш перспективні напрями застосування ІТ в аграрних підприємствах для підвищення продуктивності їх діяльності.

По-перше, вітчизняні фермери стикаються з високими природними ризиками та ринковими невизначеностями, які викривають початкові прогнози та оптимальні плани. В ході дослідження встановлено найбільш надійні страхові компанії, що оперують в Україні. Проаналізовані офіційні сайти ПрАТ "ACKA", "INGO", "Оранта-Січ", "PZU Україна" та "Універсаль" містять прозорі страхові пропозиції, сфокусовані на проблемах сільського господарства.

По-друге, українське рослинництво демонструє суттєві річні коливання урожайністі та врожаїв. В основному, це пояснюється системними помилками у виборі насіння та агroteхнологій, використанні добрив і засобів захисту рослин. Для вирішення цих нагальних проблем доцільно розглянути вітчизняний агрегатор даних SuperAgronom. Він ілюструє доступні для
Problem statement. Information Technology (IT) is a solid background of the innovative digital economy spread across countries and industries. IT is responsible for searching, storing, retrieving, analyzing, and transmitting data converted into new knowledge. Digital communications connect the world and accelerate innovative progress. Under the Covid-19 restrictions, IT has provided an invaluable assistance to all industries in modifying supply chains and market channels. It also concerns Ukrainian agriculture which is the key sector in the national economy and one of the top contributors to the global food security by cereals and oilseed crops. Contemporary demands for high competitiveness, stable profitability, appropriate quality and diminished losses of grain harvests can be addressed by means of applying IT at every stage of crop production. Such an approach is an essential reserve for Ukrainian farmers. Consequently, it specifies an urgent topic for a separate research at the nexus of a computer science and agricultural economics.

A foreign experience of prosperous agriculture confirms that applications of IT transform information resources into tangible assets and accelerate economic growth. Unfortunately, the national agricultural producers frequently exploit obsolete and controversial data which inhibits a broad implementation and an effective utilization of agricultural IT [1].

Analysis of recent research and publications. However, there are some promising achievements. Namely, Samarets, N., Kharchenko, E. and Chorna, N. concluded that the most developed segment of Ukrainian agricultural IT was presented by statistical analysis [2]. It made possible to compare the impacts of operation conditions on quantity and quality of crop and animal products.

Dynamic progress of management IT was explored by Moroz, S. and Nuzhna, S. in [3]. They demonstrated advantages of setting integrated information systems in agricultural enterprises to combine automated accounting, electronic reporting, monitoring and controlling of material and labor resources which have a positive synergetic effect on adaptive decision-making.

Moroz, S. and Shramko, I. gave workable offers on increasing total effectiveness of the national agriculture through applying marketing IT which involve
optimal pricing and promoting the traded goods to the domestic and international clients [4].

Practice reveals that software and IT services provide better agricultural performance if they are specialized by industry and product [5]. Unfortunately, Ukrainian animal husbandry is concentrated in small farms and households which cannot afford to purchase full-fledged IT systems and mostly have to utilize freeware and mobile applications. In case of cash field crops this situation is quite opposite. Indeed, Shramko, I. and Solodovnykova, I. depicted essential increase in yields and improvement in management observed after strategic introduction of the latest IT into crop production [6]. But the current activity of agricultural enterprises implies that the raised issues of online IT assistance of Ukrainian crop production still need further exploration.

**Purpose of the article.** The aim of this study was focused on evaluating IT proposals to Ukrainian crop producers intended to enhance their commitment to innovative development of the national agriculture. Achieving the set goal was reduced to analyzing

- IT-services on an insurance of agricultural risks which are unavoidable at the stage of activity planning;
- online aggregators on seed varieties, fertilizers, and plant protectors which are important at the stage of crop growing;
- IT-services linked to silos which are invaluable at the stage of the harvest trade.

**Research Results.** As of 2020, Ukrainian crop producers were the first, second, fourth, fifth, fifth, sixth world exporters of sunflower oil, rapeseed, corn, wheat, barley, and soya beans [7]. Online IT services propose to support unstable yields of these crops through an agricultural insurance presented by almost 20 key actors.

Namely, the private joint stock company "ASKA" operates over 30 years in Ukrainian market and provides insurance of cereals, gardens, livestock, and agricultural machinery [8]. The insurance of cereals covers loss of harvest caused by critical unpredictable weather conditions, natural disasters or plant diseases and pests during the full agricultural production cycle or its certain period. The PrJSC "UJSIC ASKA" is a reliable partner as it paid the largest compensation of about €2 million for the loss of soybean yield in Bukovina in 2017. The present market share of the PrJSC "UJSIC ASKA" accounted for 15% of insured areas under agricultural crops.

The private joint stock company "INGO" insures crop, livestock and agricultural machinery [9]. Its products intended for crop farmers give a wide protection of winter crops, future or expected harvest, and perennial plantations against risks of fire, lightning strike, storm, hurricane, drought, landslide, avalanche, freezing, ice crust, earthquake, plant pests or diseases, and illegal actions of third parties. Over 25 years the JSC "IC "INGO"" leans toward contemporary ways of running business, presents itself on Facebook, Instagram, LinkedIn, Telegram,
YouTube, and practice online sales of insurance. The current market share of the JSC "IC "INGO" accounted for 20% of insured areas under agricultural crops.

Offers to agribusiness from the private joint stock insurance company "Oranta-Sich" include multi-risk protection of future crop yields [10]. The insurance rates are set from 0.5 to 8% of the insured sum depending on the crop type, risk degree, crop area and term of insurance. These tariffs are quite reasonable and go with further discounts and benefits. Other available insurance products provided by the PrJS "IC "Oranta-Sich"" focus on agricultural animals (such as cattle, pigs, goats, sheep, horses, poultry, rabbits, and fur animals) as well as farmers’ property (for example, buildings, vehicles, agricultural machinery, and raw materials).

The private joint stock insurance company "PZU Ukraine" belongs to the financial group "PZU" founded in Poland in 1803. At present it has over 22 million clients mostly from Poland, Lithuania, Latvia, Estonia, and Ukraine [11]. The total share of agricultural insurance provided by the PrJSIC "PZU Ukraine" rose from 35% in 2018 to 55% in 2020. The insurance contracts from the PJSIC "PZU Ukraine" make possible to solve risks of crop loss or damage in winter or spring-summer periods. The insured crops in the first case involve winter wheat, rye, triticale, barley, and rape. The covered crops in the second case are again wheat, rye, triticale, barley, rapeseed, and also corn, sunflower, sugar beet, soya beans, and oats. The mentioned insurance contracts are intended for agricultural enterprises, cooperatives, private farms, and peasant households. The share of crop insurance contracts signed by the PrJSIC "PZU Ukraine" amounted to 30% in Ukrainian market by 2020.

The private joint stock company "Universalna" proposes farmers to insure 50-75% of average yields of agricultural crops [12]. The alternative product addresses a voluntary insurance of farm animals and poultry. For the last 5 years the insurance premiums associated with agribusiness ranged between UAH 8 million and UAH 129.5 million. The paid coverage of agricultural insurance claims reached UAH 1.8 million for 2020. Now the PrJSC "Universalna" encompasses over 20% of agricultural areas involved in crop insurance.

To serve the purpose of navigating innovative crop production, the main site for Ukrainian agronomists [13] accumulated online IT-services dedicated to advanced seed, fertilizers, pesticide protection, and farming technologies. As of 2021 the seed section specifies 1416 hybrids of corn, 876, 485, 302, 248, 245, 244, 194 varieties of sunflower, winter wheat, winter rapeseed, barley, soybeans, sugar beet, potatoes and many other field crops and vegetables. The prime seed producers are National Academy of Agrarian Sciences of Ukraine, Syngenta, Evralis, Monsanto, Pioneer, KWS, MAS Seeds, LG Seeds, Caussade Semences, Saatbau Linz and so on. It is noteworthy that they offer regular promotions and discounts. The prevailing maturity groups of seeds are middle-early, medium ripe, early ripening, and mid-late. A distribution of seeds between recommended areas looks like 3521, 3027, and 2168 varieties designed, respectively, for Forest-steppe, Steppe, and Polissya. All seeds varieties are characterized by price and rating of views to facilitate agronomy decision-making.
The necessary sowing seed rate is defined by means of online IT-services of two Agronomic Calculators. Their input parameters are a recommended plant density per square meter, distance between the seeds in a row, a rotation length of a driving wheel of a seeder, sowing area in ha. The alternative way of calculations depends on an agricultural plant, seed quality, term of sowing, condition of soil, freezing percentage, parameters of tilling, and density of productive stems.

The fertilizers section aggregated complex, nitrogen, potassium, phosphorous, micronutrient fertilizers manufactured by Yara, Hermes Agrofirm LLC, Ecofol, Jiva, and etc. Every product has its description and is available for online sale. To clarify fertilizers application, there are interactive map to distinguish between 17 basic soil types across Ukrainian regions, in particular podzolic, regarded, black, brow, chestnut, meadow, sod, mountain, wetland, and salt marshes soils as well as their mixtures and combinations.

The necessary fertilizer rate is determined by means of online IT-services of two Agronomic Calculators. Firstly, the input data composed of a recommended fertilizer dose in kg per 1 ha, number of rows per 1 container of fertilizer, row spacing in cm as well as some technical parameters of a utilized seeder. Secondly, the performed calculations allow counting the necessary quantity of fertilizer application to meet the plant need for pure nitrogen.

The weeds section contains descriptions of 166 annual and perennial weeds presented by their names, pictures, biological features, areas of spread, affected cultures and workable control measures. Similarly, the section of crop diseases comprises data about 261 harmful mushrooms, viruses, and bacteria explaining symptoms, source of infection, and protection measures. The pests section identifies 341 kinds of insects which affect fruit crops, cereals, grain products, legumes, sugar beet, and vegetable crops. The supporting profiles reveal pest appearance, areas of location, harmfulness, signs of infestation, preventive and protection procedures.

The pesticides section illuminates 2574 available crop protection means including 1076 herbicides, 465 fungicides, 365 insecticides, 345 growth regulators, 247 disinfectants and other chemicals mostly among the classes of biological products, triazoles, sulfonylureas, neonicotinoids, triazines, synthetic pyrethroids, glycine derivatives. These pesticides represent famous brands of Ukravit, Syngenta, BASF, Bayer, Adam, Agrosphere, ALFA Smart Agro, DEFENSE, etc. Every product has description of its advantages, spectrum of action as well as instructions of utilization.

The major online IT-service linked to elevators facilities [14] considers processing, logistics, trading, equipment, and advanced practices. The created interactive elevator map illustrates locations of 1320 Ukrainian elevators with the total capacity of 55278022 thousand tons for storing grain crops including wheat, barley, triticale, rye, corn, millet, sorghum, oats, buckwheat; oilseeds such as sunflower, rape, soybeans; seed material; legumes and peas; organic cereals and oilseeds. The registered elevators can be filtered by region, drying option, laboratory.
checks, location type (for example, linear, port, connected with food or feed mills), and work policy (such as only grain, give-and-take raw, own and tolling grain). The largest certified elevators with capacities over 300 thousand tons are Stepanovsky Rise, TIS-Grain Terminal, Land&Freedom, Agro-Factory Rise, Vinnytsia Epicenter, SMI Nika-Tera, Evroveshtorg, and Zakupnyanskoe HPP.

The site SuperAgronom introduces top Ukrainian agronomists who are successful in their professional activity and achieve high outputs underpinned by the online IT-services. Evidently, their pattern is really encouraging and convincing for other Ukrainian farmers to enhance their agribusiness on the same innovative basis and provide a growth of the national food security [15].

Conclusions. Overall, IT allows improving performance of agricultural enterprises and is affordable for Ukrainian crop producers. To attain a maximal positive effect, the applied IT should cover all stages of the performed activity. Agricultural insurance, technologies of crop growing and logistics of harvest storing appeared to be the most elaborated directions among online IT services available to Ukrainian farmers via official sites and data aggregators on the Internet.

Further development of the discussed online IT-services can be directed by Nielsen usability heuristics for site interface design. Given the digital competence of Ukrainian farmers, these evaluation principles prompt to keep them informed about service status and progress, prevent errors, provide explanatory documentation, focus on relevant communication, minimize distracting design, follow convention standards, and tailor services to novices and experienced users. Besides, the online IT-service providers should be aware of the global agricultural innovations to trigger a fruitful fusion of Ukrainian crop production with the most effective findings in the world.

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