SECTION 7. DIGITALISATION OF THE SYSTEM OF INTERNATIONAL ECONOMIC RELATIONS

DOI: https://doi.org/10.30525/978-9934-26-352-1-31

AGRI-FOOD SECTOR DIGITALIZATION AS AN INSTRUMENT OF STRENGTHENING FOOD SECURITY

Oleksandra Novak
PhD student in International Economic Relations,
Educational and Scientific Institute of International Relations
Taras Shevchenko National University of Kyiv
Kyiv, Ukraine

To begin with, the Global Food Security Index methodology relies on four food security dimensions, namely *availability, access, utilization, stability, agency and sustainability* (Fig. 1). However, there is no uniform reply to the question how to achieve food security. The post-Covid backdrop for agriculture is particularly challenging, and russia's war against Ukraine is further disrupting crucial food supply chains. In 2022, according to the Food and Agriculture Organization (FAO) nearly 735 million people in the world faced hunger [1].

To mitigate the negative impact of the current triple F (food, fuel, fertilizers) crisis, there is a need for radical changes of global agriculture and food production sector. In this context, the transformative power of digital technologies can become an effective instrument of strengthening food security. WEF 2023 Markets of Tomorrow report indicates that 29.7% respondents from 126 countries confirm that agriculture technologies rank first as the top technology of strategic importance [3]. Overall, the future of agriculture is 'connected' through three cross-cutting "accelerators" – technology, innovation, and data [4]. All these accelerators are closely linked with agri-food sector digitalization process.

The digitalization of agri-food sector is ongoing and it is often called interchangeably as digital agriculture [5], agriculture 4.0 [6], or the fourth agricultural revolution [7]. FAO explains digital agriculture as a process involving digital technologies that covers access, content and capabilities, which, if appropriately combined for the local context and needs within the existing food and agricultural practices, could deliver high agrifood value, and improve socioeconomic, and potentially environmental, impact. [8] Depending on the maturity of adoption of digital technologies, digital agriculture can be realized at the level of *basic conditions* (basic minimum for use of technology, including connectivity, cost, special programmes / e-strategies) and *enabling conditions* (capabilities that make possible or drive changes using digital technologies, digital skills, agripreneurial and innovation culture) [9].

Figure 1. Food security dimensions [2]

According to Silveira (Figure 2), there are 3 main levels under the "roof" of Agriculture 4.0 system. First, basic or fundamental elements include the fundamental concepts (pillars) that guide the development of agriculture 4.0, which the concept leans on (precision agriculture, smart farming, and digital farming) and without which it could not exist. Second, structuring elements cover key technologies that can revolutionize and influence the way commodities are produced, processed, traded, and consumed. Third, complementary elements encompass wider possibilities of action of agriculture 4.0. that address specific agricultural issues that require a certain degree of maturity with the structuring elements of agriculture 4.0.

Digitalization is already improving access to information, inputs and markets, increasing production and productivity, streamlining supply chains and reducing operational costs. Research shows that, globally, digitization will lead to higher productivity and wealth. Digitization and smart automation are expected to contribute as much as 14 percent to global GDP gains by 2030, equivalent to about US$15 trillion in today's value. As with all industries, technology plays a key role in the operation of the agri-food sector, a US$7.8 trillion industry, responsible for feeding the planet and employing over 40 percent of the global population [11].

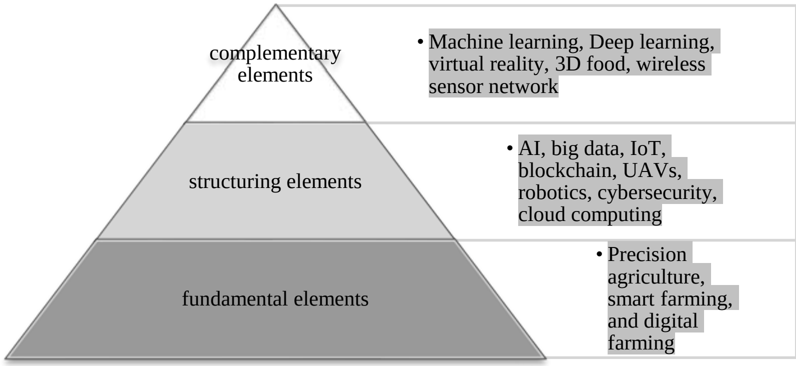

Figure 2. The “House of Agriculture 4.0” [10]

In general, it is expected that technical improvements in new agricultural technologies should: optimize production efficiency (efficient control of machines, cost reduction); optimize quality (timely detection of diseases in crops); minimize environmental impact (efficient use of inputs and pesticides); minimize production-associated risks (more excellent knowledge of cultivated areas). However, the technological advances that might help to bridge global agricultural productivity gap will differ between economies, and the category of “agricultural technologies” is broad. It includes basic techniques such as mechanization and irrigation – through to more recent AI-based developments, such as precision agriculture, use of agricultural drones or food crisis forecasting.

The management cycle as presented at Fig. 3 shows the mechanics of digital agriculture process: first, sensors monitor the crop to generate data captured by a platform; second, these data are processed by specific software (such as, artificial intelligence); third, intervention options are provided; and finally, the farmer decides how to act on the crop (directly with their own equipment or indirectly via automated equipment).

Figure 3. Information-based management cycle for advanced agriculture [12]

Overall, farmer–machine interaction is the cornerstone of agriculture 4.0 paradigm and is central to the running of the farm, with the farmer making decisions and operating interconnected equipment that operates autonomously on the information process.

However, there is a strong argument that the agriculture 4.0 may not reach its full potential because of the complexity of the agricultural ecosystem that undergoes transformation. FAO concludes that the lack of relevant research and development, education, information and communications technology infrastructure and digital skills among farmers and the rural population largely restraints the diffusion of innovative and digital technologies in food systems [13]. Moreover, there is the divide in the development of urban and rural areas, as well as divide between the small-scale and large enterprises in digital technologies adaptation.

Therefore, there is a strong demand for effective policies facilitating rural transformation globally, specifically targeting smallholders, the elderly and other vulnerable groups in the digital transformation. The recently reviewed EU Common Agricultural Policy (CAP) for 2023–2027 is one of illustrative examples of comprehensive approach towards digital agriculture development, aiming inter alia to bridge the digital divide among EU Member States. The CAP gives notice to using precision farming technologies, developing digital skills of farmers, establishing digital tools for knowledge exchange and increased data sharing [14].

In general, digitalization of agri-food sector enables farmers to make decisions that are more informed and as a result, it contributes to enhancing food security at local and national level. Key benefits of introducing digital technologies in agriculture include greater access to information and services (finance, links to markets, efficient resource management), productivity increase, and better informed policies.

However, there is a digital divide between the advanced and developing nations. The advanced economies were first to prioritize agri-food digitalization, as high agricultural output has compelled them to invest in innovation in agri-technology to sustain and grow their outputs. And these days the largest quantity of agritech startups are located in mostly in Australia, Canada, China, France, Germany, Israel, Japan, Netherlands, New Zealand, South Korea, United Kingdom, United States [15]. In parallel, these countries have very high food security level (as assessed in GFSI 2022). Therefore, innovative digital technologies in agri-food sector have proven themselves as an effective instrument that contribute to increasing food security. Now, the digitalization has become the mainstream trend and the developing countries are starting proactively pursuing digital agriculture agenda.

References:

1. FAO, IFAD, UNICEF, WFP and WHO. 2023. The State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural-urban continuum. Rome, FAO. DOI: https://doi.org/10.4060/cc3017en. DOI: https://doi.org/10.4060/cc3017en
2. Economist Impact Global Food Security Index 2022. URL: https://impact.economist.com/sustainability/project/food-security-index/reports/Economist_Impact_GFSI_2022_Global_Report_Sep_2022.pdf
3. Markets of Tomorrow Report 2023: Turning Technologies into New Sources of Global Growth. URL: https://www3.weforum.org/docs/WEF_Markets_of_Tomorrow_2023.pdf
4. FAO & ITU. 2023. Digital excellence in agriculture report – FAO-ITU regional contest on good practices advancing digital agriculture in Europe and Central Asia. Budapest, FAO. DOI: https://doi.org/10.4060/cc4764en
5. Elbehri, A. and Chestnov, R. (eds). 2021. Digital agriculture in action – Artificial intelligence for agriculture. Bangkok, FAO and ITU. DOI: https://doi.org/10.4060/cb7142en
6. da Silveira F et al (2021) An overview of agriculture 4.0 development: systematic review of descriptions, technologies, barriers, advantages, and disadvantages. Comput Electron Agric 189. DOI: https://doi.org/10.1016/j.compag.2021.106405
7. Rose DC et al (2021) Agriculture 4.0: making it work for people, production, and the planet. Land Use Policy 100. DOI: https://doi.org/10.1016/j.landusepol.2020.104933
8. FAO, IFAD, United Nations, UNDP, UNICEF, WFP, WHO Regional Office for Europe and WMO. 2023. Regional Overview of Food Security and Nutrition in Europe and Central Asia 2022. Repurposing policies and incentives to make healthy diets more affordable and agrifood systems more environmentally sustainable. Budapest. DOI: https://doi.org/10.4060/cc4196en
9. Trendov, N. M., Varas, S. & Zeng, M. 2019. Digital technologies in agriculture and rural areas – Status report. Rome.
10. Silveira, F. D., Agriculture 4.0 (Chapter). 2022. DOI: 10.1007/978-3-030-89123-7_207-1.
11. PwC. 2019. Global Digital Operations Study 2018: Digital Champions. London: Pricewaterhouse Coopers.
12. Sáiz-Rubio, V. & Rovira-Más, F. 2020. From smart farming towards agriculture 5.0: A review on crop data management. Agronomy, 10(2): 207

[online]. [Cited 21 July 2020]. DOI: https://doi.org/10.3390/agronomy 10020207.

13. FAO. 2022. The future of food systems in Europe and Central Asia 2022–2025 and beyond. Rome. DOI: https://doi.org/10.4060/cc1546en

14. CAP 2023-27 – 28 CAP Strategic Plans at a glance. URL: https://agriculture.ec.europa.eu/system/files/2022-12/csp-at-a-glance-eu-countries_en.pdf

15. Twelve Most Advanced Countries in Agriculture Technology 2022. URL: https://finance.yahoo.com/news/12-most-advanced-countries-agriculture-140128710.html, last accessed 2023/09/20