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## **ANALYTICAL REPORT**

WORK OF THE FUTURE. FORESIGHT: DEVELOPMENTS IN AGRICULTURE, FORESTRY AND FISHERIES IN UKRAINE AS A RESULT OF TECHNOLOGICAL CHANGE

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THE PROJECT «UKRAINE 4.0. FORESIGHT OF SOCIO-ECONOMIC CHANGES AND FORECAST OF THE NEED FOR PROFESSIONAL QUALIFICATIONS WITH DIGITAL SKILLS»

#### ISBN 978-617-7574-74-2

**Recommended** by the State Employment Service, Ministry of Agrarian Policy and Food, Ministry of Economy of Ukraine, Kyiv Regional Council of Trade Unions and Federation of Employers of Ukraine.

Analytical Report. Work of the Future. Foresight: Developments in Agriculture, Forestry and Fisheries in Ukraine as a Result of Technological Change. The project «Ukraine 4.0. Foresight of socio-economic changes and forecast of the need for professional qualifications with digital skills». Analytical report / O. Davlikanova, I. Osadchuk - Kyiv: National Agency of Qualifications, State Employment Service, Friedrich-Ebert-Stiftung Office in Ukraine. — Kyiv: LLC «VISTKA», 2022. — 120 p.

This analytical report summarizes the views of 825 enterprises operating in agriculture, forestry and fisheries in Ukraine concerning possible socio-economic changes caused by technological development, including the structure of employment, required professions and qualifications. The report provides an analysis of the expected impact of new technologies introduced by big, medium and small enterprises on business processes, planning, employment, qualifications, transformation of professions etc.

It will be of interest to enterprises in agriculture, forestry and fisheries in Ukraine, as well as the Ministry of Agrarian Policy and Food, the Ministry of Economy, the National Qualifications Agency, the State Employment Service, experts and anyone interested in the topic «Work 4.0».

**Responsible for the study**: National Qualifications Agency, State Employment Service, and Friedrich-Ebert-Stiftung Office in Ukraine.

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#### The report will be available on the following websites:

State Employment Service https://www.dcz.gov.ua

Ministry of Agrarian Policy and Food of Ukraine https://minagro.gov.ua

Ministry of Economy of Ukraine https://www.me.gov.ua

Federation of Employers of Ukraine https://fru.ua/ua

Kyiv Regional Council of Trade Unions http://www.korps.com.ua

Friedrich-Ebert-Stiftung Office in Ukraine http://www.fes.kiev.ua

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The project «Ukraine 4.0. Foresight of socio-economic changes and forecast of the need for professional qualifications with digital skills» was launched in January 2021. The report was planned to be presented at the end of February 2022, but these plans were interrupted by the war.

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We hesitated for some time, discussing the relevance and expediency of issuing the report in the new reality – in other words, whether the material would be interesting, based on data collected when we lived in peace, tilled mine-free fields, did not have to haul tanks away with tractors, thought about developments in a 10-year perspective and implemented the latest technologies at enterprises? Today, part of the territory is temporarily occupied and the invaders are stealing equipment, illegally exporting grain and other agricultural products from Ukraine, destroying farms, mining forests and agricultural land, killing and kidnaping farmers and the local population.

Nevertheless, after the Victory this report will be invaluable in setting benchmarks for the development of agriculture, fisheries and forestry in a free and independent Ukraine. And although certain calculations presented here require updating on the basis of yet-to-be-collected data on human and economic losses due to the war, we consider this document a kind of «memory» of what prospects domestic agriculture had and what it will become again. Thus, this publication may be considered an incentive for restoring a country that feeds a large part of the world.

The project team

In our new reality, the issues of sowing, repairing equipment, fattening up cattle or milking have temporarily given way to other tasks, such as obtaining equipment for territorial defence, finding fuel for our armed forces, providing loaders to build checkpoints, evacuating a colleague from Bucha, paying salaries a week earlier and many other things. At first, it was strange to talk about all of that with our agronomists or engineers, but the war has quickly transformed our daily lives, adding new challenges. Problems that would have brought me out in a cold sweat a month ago have become routine.

Is it ethical to hold back tractor drivers, who we desperately need in the fields, but who are willing to join the army? Sowing is about to start... The worst thing for us is that no one can be sure that enemy tanks will not trample the land where our tractors are now working. We don't know whether there if we manage to harvest in the fall.

Even more worrying is the situation on animal farms, which are extremely sensitive to logistical changes. Feed, medicine and consumables are needed every day. Milk must be shipped daily. Workers have to be at their workplaces every day. Agriculture is a long game. It's about investing effort and money, with faith in your land and the skills of agronomists to get results over many months. Our production cycle lasts for twelve months, so we usually plan carefully a year in advance. At least we used to...until February 24th. Now our planning horizon has shrunk to only one day. But we are still going to sow! Only three employees, out of nearly 1,500, have fled the country. Several more have relocated to Ukraine's western regions. So 99 per cent of people have stayed put. This is neither bad nor good. It is just a fact. We are about to sow! As long as we have this opportunity, we will work on farms and in the fields. We love it and we know how to do it. The heads of our enterprises have scarcely slept for over a month. But everyone is angry (in a constructive way) and ready to do everything to ensure that Ukraine is well-fed, strong and free!

Darya Dranovska, HR director at Eridon Agro

<sup>100+</sup> Stories of Women and Girls from Russia's War against Ukraine (Volume I). Buchunska O., Davlikanova O., Lylyk I., Yashkina O. (2022). FES-Ukraine. Available at: https://www.researchgate.net/publication/360931069\_100\_Stories\_of\_Women\_and\_Girls\_from\_Russia's\_War\_ against\_Ukraine\_Volume\_I

# INTRODUCTION

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## INTRODUCTION BY THE AUTHORS OF THE REPORT

#### Above all, the forecaster's task is to map uncertainty, for in a world where our actions in the present influence the future, uncertainty is opportunity.<sup>2</sup>

#### Paul Saffo

At the World Economic Forum in 2016, German economist Klaus Schwab described the scale of change due to the development of innovative technologies as unprecedented in human history. Since then, the concept of the Fourth Industrial Revolution has rapidly entered political discourse. This is because the expected changes will not only affect production processes, but also radically change human relations and perception of oneself and the world.

In Ukraine, the discussion of this topic is focused mainly on technology implementation, seeking investment and solutions to accelerate the pace of development of Industry 4.0. However, insufficient attention is being paid to issues such as changes in the structure of employment, the functionality of existing professions/positions and qualification requirements, in particular, digital skills. Although economists and scientists are already making forecasts at the global level, it is national contexts that will determine how individual economies will react to the technological revolution. Thus, we did not aim to present the full variety of technologies available in the world or implemented in Ukraine, or to advertise individual solutions and brands, but sought to look into the fate of a human in the world of work 4.0.

Thus, the project "Ukraine 4.0. The Foresight of socio-economic change and the development of methods for predicting professional qualifications with digital skills" is designed to help Ukraine «look into its future», as technology development is expected to have the potential not only to improve living standards but also to catalyse socio-economic change. The state must anticipate its negative consequences, however, and develop appropriate strategies and policies in advance. These policy decisions must be based on the consensus of stakeholders, and when it comes to predicting the future, foresight is one of the most effective ways of achieving it. Foresight involves the creation of a broad platform for discussion and presentation of different positions, which allows us not only to develop forecasts, scenarios and policies and thus to contribute to the study of the future, but also to reach a consensus through dialogue between business, politicians, experts and the public. Dr Olena Davlikanova, researcher, project coordinator Friedrich-Ebert-Stiftung Office in Ukraine

Inna Osadchuk, member of the National Qualifications Agency



Saffo, Paul (2007, July–August): Six Rules for Effective Forecasting, in: *Harvard Business Review*; available at: https://hbr.org/2007/07/six-rules-for-effective-forecasting#

This report outlines the views, assumptions and ideas of 825 large, medium, small and micro enterprises operating in agriculture, forestry and fisheries in Ukraine, which took part in the survey, as well as analysts, experts, government officials and educational institutions, which joined the regional discussions on the expected impact of new technologies on employment, strategies for enterprise development and retraining, expectations of qualifications and skills, disappearance of obsolete professions and positions (jobs), the transformation of existing and the emergence of new ones.

On one hand, digitalization and automation of production processes are important drivers of national economic growth, increasing productivity and enterprise competitiveness; on the other, for the labour market it is a window of opportunity and its challenges are currently being explored by scientists, business, trade unions, policymakers, national governments and local authorities, all those who are already thinking about the issues of Work 4.0 and the relevance of qualifications over the coming 10–15 years.<sup>3</sup>

A number of international studies show the inevitability of changes in the structure of the labour market, the growing share of atypical forms of employment, automation and polarization of jobs, and thus the deepening of social inequality due to the growing gap in digital skills. According to OECD estimates, almost 14 per cent of workers face a high risk of losing their jobs in the next ten years due to automation. Another 32 per cent will be forced to adapt to significant changes in the nature of their work and the introduction of tasks that will require other skills and, consequently, additional training.<sup>4</sup> Policymakers and governments are working to anticipate such changes in order to make informed decisions in advance, which will enhance the positive and mitigate the negative socio-economic consequences of these transformations.

The main driver of progress is knowledge, concentrated in human capital, as a factor in increasing productivity and growth. According to estimates by experts from the World Economic Forum, 65 per cent of current school first-graders will work in positions or perform types of work that do not yet exist.<sup>5</sup> A World Bank report entitled «The Changing Nature of Work» states that the value of workers with higher levels of human capital in the market will only increase, as a highly automated global economy will reward those whose skills enable them to perform tasks that are impossible or difficult to automate.<sup>6</sup> According to W. Taichler, «some professions that did not previously require higher education have undergone some transformation, so now they mostly require it».<sup>7</sup>

A number of studies predict significant changes in the structure of employment not only for developed but even more for countries with economies in transition. This is characterized as «the transition from simple and productive to knowledge-based activities and other consumer services».<sup>8910</sup> This so-called routine-biased technological change is so profound that jobs that have hitherto been low or even lacking in skills are becoming increasingly complex and technology-intensive.<sup>1112</sup> This leads to a kind

<sup>&</sup>lt;sup>3</sup> OECD (2019): Preparing for the changing nature of work in the digital era, in: OECD Going Digital Policy Note, OECD, Paris; available at: www.oecd.org/going-digital/changing-nature-of-work-in-the-digital-era.pdf

<sup>&</sup>lt;sup>4</sup> L. Nedelkoska/G. Quintini (2018): Automation, skills use and training, OECD Social, Employment and Migration Working Papers, No. 202, OECD Publishing, Paris; available at: http://dx.doi.org/10.1787/2e2f4eea-en

<sup>&</sup>lt;sup>5</sup> World Economic Forum (2020): Global Competitiveness Report. World Economic Forum. Geneva Switzerland; available at: http://www3.weforum.org/docs/WEF\_Future\_of\_Jobs\_2020.pdf

<sup>&</sup>lt;sup>6</sup> World Bank (2019): World Development Report (WDR) 2019: The Changing Nature of Work. Washington, DC. Doi: 10.1596/978-1-4648-1328-3.

<sup>&</sup>lt;sup>7</sup> U. Teichler (2005): Research on Higher Education in Europe, in: European Journal of Education, 40(4), 447–469; available at: http://www.jstor.org/stable/3496957

<sup>&</sup>lt;sup>8</sup> B. Dachs (2013): The impact of new technologies on the Labor market and the social economy, European Parliamentary Research Services; available at: https://www.europarl.europa.eu/RegData/etudes/STUD/2018/614539/EPRS\_STU(2018)614539\_EN.pdf

<sup>&</sup>lt;sup>9</sup> CEDEFOP (2013): Roads to recovery: three skill and labor market scenarios for 2025. Briefing Note. European Centre for the Development of Vocational Training; available at: https://www.cedefop.europa.eu/files/9081\_en.pdf

<sup>&</sup>lt;sup>10</sup> H. Bakhshi/J. Downing/M. Osborne/P. Schneider (2017): The Future of Skills: Employment in 2030. London: Pearson and Nesta; available at: https://futureskills.pearson.com/research/assets/pdfs/technical-report.pdf

<sup>&</sup>lt;sup>11</sup> CEDEFOP (2013): Roads to recovery: three skill and Labor market scenarios for 2025. Briefing Note. European Centre for the Development of Vocational Training; available at: https://www.cedefop.europa.eu/files/9081\_en.pdf

<sup>&</sup>lt;sup>12</sup> D. Card/J.E. DiNard (2002): Skill-Biased Technological Change And Rising Wage Inequality: Some Problems And Puzzles, in: *Journal of Labor Economics*, 20 (4), 733-783; available at: https://davidcard.berkeley.edu/papers/skill-tech-change.pdf

of digital divide, when, due to a lack of digital skills, workers are at risk of unemployment, poverty and social exclusion in the future.

Some forecasts emphasize that labour market polarization will continue until 2030 and beyond. Thus, the number of jobs requiring a high level of qualifications will increase significantly, and the number of jobs for low-skilled workers will increase in part, and opportunities for middle-skilled people will decrease, with the prospect of their complete disappearance.<sup>13</sup>,<sup>14</sup> It should be noted that increasing the number of jobs for low-skilled workers who fall below the lowest level of the wage scale raises the problem of increasing poverty and lack of career opportunities in this group of workers, which significantly reduces their chances of ensuring their own well-being.

The most vulnerable groups are young people and low-skilled workers.<sup>15</sup> Young people continue to be overrepresented among the unemployed, while most young people work in low-quality jobs, characterized by unstable working conditions, lack of adequate legal and social protection, limited opportunities for training and promotion (or even their absence), and low wages. Although young people see new opportunities in the changes brought about by *the Fourth Industrial Revolution*, this group is concerned about the likelihood of losing current or potential jobs, as they may be replaced in the near future by other jobs or artificial intelligence.<sup>16</sup>

Technological progress has always led to the obsolescence of professional skills, defined as «the degree to which professionals lack the modern skills needed to maintain the effectiveness of results within their current or future job».<sup>17</sup> However, Industry 4.0 and the changes in the labour market described above raise the question of the dependence of economic development on young people's education and vocational training and retraining.<sup>18</sup> That is why the governments of developed countries are drafting programmes to increase digital literacy of the population, and educational institutions are reviewing the content of education and more actively use digital technologies in the education process.

Anticipating changes in the labour market and skills / qualifications is supposed to help young people and adults make informed choices about education and careers, and lifelong learning pathways, and to mitigate the impact of change on the economy in general and on certain groups of the population in particular by increasing the efficiency of investment in education and science.

Digitalization can create the conditions for improving work–life balance through greater flexibility in work schedules and a new range of tools for tasks. This will contribute to the increasing inclusion of technological innovations in both production and services through the use of artificial intelligence and automated systems. Automation makes it possible to refuse to involve people in physically difficult, «dirty» or monotonous work, increasing the share of jobs that require creativity, finding non-standard solutions, ingenuity, empathy and so on.

So, while we are all operating in a state of uncertainty, and the future will be determined by trillions of decisions, today nevertheless we can make an effort to reduce socio-economic inequality and the balance of human–machine relations in the World of Work 4.0.

<sup>&</sup>lt;sup>3</sup> CEDEFOP (2013): Roads to recovery: three skill and Labor market scenarios for 2025. Briefing Note. European Centre for the Development of Vocational Training; available at: https://www.cedefop.europa.eu/files/9081\_en.pdf

<sup>&</sup>lt;sup>14</sup> CEDEFOP, Eurofound (2018): Skills forecast: trends and challenges to 2030. Luxembourg: Publications Office. Cedefop reference series; No 108I; available at: http://data.europa.eu/doi/10.2801/4492

<sup>&</sup>lt;sup>15</sup> Organization for Economic Cooperation and Development (OECD) (2019): Finland should do more to improve job prospects of low-skilled youth; available at: https://www.oecd.org/finland/finland-should-do-more-to-improve-job-prospects-of-low-skilled-youth.htm

<sup>&</sup>lt;sup>16</sup> ILO (2017): Global Employment Trends for Youth 2017: Paths to a better working future. Geneva: International Labor Office; available at: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms\_598669.pdf

<sup>&</sup>lt;sup>17</sup> H. Kaufman (1974): Obsolescence & Professional Career Development. American Management Association, New York, p.193

<sup>&</sup>lt;sup>18</sup> CEDEFOP (2012): Preventing skill obsolescence - Rapid Labor market changes leave too many workers at risk of losing their skills. Briefing Note. European Centre for the Development of Vocational Training; available at: https://www.cedefop.europa.eu/files/9070\_en.pdf

## INTRODUCTION BY THE MINISTRY OF AGRARIAN POLICY AND FOOD OF UKRAINE

Agriculture is the basis of the primary sector of Ukraine's economy. It is important not only in terms of food security, but also as one of the key elements of GDP, of which it has made up a stable 9–10 per cent since 2016. The development of agriculture, forestry and fisheries in recent years shows a stable positive dynamic and is one of the main drivers of sustainable economic growth.

The rural population makes up 31 per cent of the Ukrainian population (14 million people). Furthermore, 22 per cent of all those in official employment work in agriculture – about 3 million people – while another 1.5 million work in it unofficially.

To stimulate the growth of agricultural products with high added value, the state budget for 2021 provides for expenditures of the General Fund in the amount of UAH 4,500 million under the programme EPCC 2801580 "Financial support for agricultural producers". This will expand rural employment and ensure sustainable economic growth in rural communities through the development of agricultural entrepreneurship.

At the state level, measures are being taken to improve the investment attractiveness of the sector, for example, through its technical and technological modernization, which will encourage an increase in the share of reconstruction and construction of new production facilities and increase the number of jobs that require appropriate skills.

Therefore, it is important to conduct research to improve forecasting of changes in the labour market for the agricultural sector.

## INTRODUCTION BY THE MINISTRY OF ECONOMY OF UKRAINE

The introduction of new production technologies, including the automation/digitalization of production, has brought to the fore the problem of bringing job seekers' knowledge, skills and digital skills/competencies in line with the requirements of the labour market.

Issues of the development of digital skills and digital competencies are reflected in strategic documents at the national level.

The National Economic Strategy for the period up to 2030, approved by Resolution of the Cabinet of Ministers of Ukraine of 3 March 2021, № 179 on strategic goal 4 "Creating new opportunities for human capital, development of innovative, creative and digital industries and businesses" identifies ways of improving the situation, including improving people's digital skills, and raising the level of professional and specialized digital skills. Among the main tasks are the creation of a quality system for learning digital competencies for all groups with relatively low digital skills and educational programmes of varying difficulty to enable adults to master digital competencies.

In the government's priority action plan for 2021, approved by order of the Cabinet of Ministers of Ukraine of 24 March 2021, № 276-r, improving the literacy rate is defined as a priority task. In this context, one of the main steps is to improve digital skills, the ability to use digital gadgets and the internet for different categories of people.

The development of digital skills and digital competencies is also one of the main tasks of the Concept for the Development of Digital Competences, approved by order of the Cabinet of Ministers of Ukraine of 3 March 2021 № 167-r.

When analysing the provisions and priorities of strategic documents we should note the crosscutting nature of digital competencies and their importance for various sectors and industries, as well as the importance of training in accordance with modern labour market requirements, improving digital literacy.

Implementation of the project "Ukraine 4.0. Foresight of socioeconomic changes in the agricultural sector" will contribute to:

- the creation of indicators for monitoring the state of development of digital skills and digital competencies;
- the formation and development of digital skills and digital competences in society and, as a consequence, the development of the digital economy and society, as well as the development of human capital;
- ensuring legal regulation of the formation of state policy in the field of digital skills and digital competencies;
- comprehensive changes in the legislation on digital education, digital skills and digital competencies in various spheres of public life;
- defining the system and description of the components of digital competence (digital competence framework), as well as requirements for the level of digital skills and competencies of different categories of workers, in particular in professional standards.

### INTRODUCTION BY THE STATE EMPLOYMENT SERVICE

One of the important conditions for ensuring the development of the national economy is to reduce the imbalance between supply and demand in national and regional labour markets, and to meet employers' needs for workers with relevant competencies, as well as productive employment.

The State Employment Service ensures the implementation of state policy in the fields of employment and labour migration, provides professional selection/selection of personnel for employers, promotes job search, employment and adaptation of the unemployed to labour market requirements, and increases their competitiveness by developing skills and qualifications.

These tasks are especially relevant today. Thus, the development of digital technologies has led to changes in job functions in many areas of activity and, as a consequence, the requirements for applicants seeking to fill vacant positions.

Under such conditions, the development of human capital is the basis for ensuring the functioning of the national economy. Introduction of pre-emptive training of workers and organization of professional training for jobseekers and the unemployed in short-term training programmes in relevant areas (partial qualifications), including the acquisition of digital competencies, will help ensure employment, reduce occupational imbalances in the labour market, and foster uninterrupted production and competitiveness among Ukrainian businesses. It is also a measure likely to prevent mass layoffs and promote labour mobility.

In order to meet employers' need for workers with appropriate skills and provide people with work, the State Employment Service organizes vocational training at the request of employers in vocational education institutions, including vocational training centres, in the workplace or in services. These efforts are aimed at assisting job-seekers to obtain relevant qualifications or bring existing qualifications into line with the requirements of the modern labour market.

In the context of the digital economy, the actualization of short-term educational programmes on partial qualifications and advanced training of the adult population in the acquisition of digital competencies is of particular importance.

The main steps required to bridge the current gap between existing and demanded competencies are analysis, study of employers' requirements for a certain level of employee competencies, including digital, and also expanding the list and updating the content of educational programmes to develop digital skills. Anticipating labour market needs for digital skills/qualifications in different sectors of the economy will help to address the imbalance between labour supply and demand by supplying the market with skilled workers, which in turn will help combat unemployment.

Currently, the work of the State Employment Service is aimed at implementing these steps and ensuring a customer-oriented approach to service delivery.

## INTRODUCTION BY THE NATIONAL QUALIFICATIONS AGENCY

The National Qualifications Agency is a permanent collegial body authorized to implement the state policy of Ukraine in the field of qualifications. One of the agency's tasks is the forecasting of labour market needs in relation to qualifications.

Forecasting future skills needs in the labour market is important in order to address the imbalance between supply and demand, as well as to support the government in making strategic decisions on human capital development policy in Ukraine. The project "Ukraine 4.0. Foresight of socioeconomic changes in the agricultural sector" aims to study the trajectory of the Ukrainian labour market under the influence of global trends, such as digitalization, job automation, the threat of unemployment due to mismatch of qualifications, as well as the development of methods for forecasting labour market needs in digital skills, competencies and qualifications.

In Ukraine's agricultural sector, the research area of this project, there is already increased demand for new digital skills: agro-ecologists, agro-technologists, engineers of precision farming systems, operators of robotic machines/complexes and more. The project will provide an opportunity to develop a list of the professional qualifications and skills that agricultural workers will require.

Based on the data collected, it is possible to develop recommendations for government agencies in order to form an effective state policy in Ukraine in the field of digital education of employees based on EU experience, and to develop guidelines and a research methodology on the application and development of digital skills and competences.

### ACKNOWLEDGEMENTS

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S. Chuprikov	Member of the Supervisory Board of APPAU and head of the Systems Development Department of the Metinvest Digital Expertise Centre;
T. Ishchenko	director of the Educational and Methodological Center for Professional Higher Education;
l. Lylyk	President of the Ukrainian Marketing Association, Ph.D., Associate Professor of Marketing;
D. Dranovska	HR Director of the Agricultural Production Department of the Head Office of ERIDON FIRM LLC;
V. Khvostikov	chairman of the Kyiv regional council of trade unions;
O. Dadus	Deputy Director of the Department of Agrarian Policy, Head of the Department of Animal Husbandry and Breeding of the Ministry of Agrarian Policy and Food, Ukraine;



E. Lanchenko	Doctor of Economics, Associate Professor of Economics, National University of Life and Environmental Sciences;					
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O. Azeeva	Head of the Vocational Training Department of the Personnel Management Department of the Agro-Industrial Holding MHP;					
S. Mozgova	Director of Human Resources, Corporate Partnership and Communications, Astarta-Kyiv;					
E. Kovnir	Head of the Operational Efficiency Management Office, Head Office, Astarta-Kyiv;					
Yu. Utkin	Ph.D., Associate Professor, Head of the Department of Information Systems and Technologies, Poltava State Agrarian University.					

Together we are creating Ukraine 4.0!

## ABBREVIATIONS

AI	Artificial intelligence				
APPAU	Association of Industrial Automation Enterprises of Ukraine				
CEDEFOP	European Centre for the Development of Vocational Training				
DIH	Digital innovation hub				
EBRD	European Bank for Reconstruction and Development				
EDMS	Electronic document management system				
EIF	Export, internationalization, fundraising				
EPCC	Expenditure programme classification code				
ERP	enterprise resource planning				
EU	European Union				
GIS	Geographic information system				
GHG	Greenhouse gas				
GMO	Genetically modified organisms				
ICT	Information and communications technology				
IFC	International Finance Corporation				
ILO	International Labour Organization				
ΙοΤ	Internet of things				
IPOs	Initial public offerings				
GDP	Gross domestic product				
HQCE	Handbook of qualification characteristics of employees				
KPI	Key performance indicators				
KSAU	Kherson State Agricultural University				



Ltd	Limited liability company				
LuhNAU	Luhansk National Agrarian University				
МНР	Myronivsky iliboproduct (bread product)				
NACE	Nomenclature of Economic Activities (European statistical classification of economic activities)				
NDVI	Normalized Difference Vegetation Index				
NSFE	Non-standard forms of employment				
NULES	National University of Life and Environmental Sciences of Ukraine				
OECD	Organization for Economic Co-operation and Development				
RFID	Radio-frequency identification				
SMM	Social media marketing				
SNAU	Sumy National Agrarian University				
SSSU	State Statistics Service of Ukraine				
TSATU	Dmytro Motornyi Tavria State Agrotechnological University				
UAH	Ukrainian hryvnia (currency)				
UAV	Unmanned aerial vehicle				
USREOU	Ukrainian state registry legal entity identifier				
VNAU	Vinnytsia National Agrarian University				

### **HOW TO READ THIS REPORT**

At the beginning of the report, the rationale for the choice of industry for research, the research methodology and a brief overview of the current situation in agriculture, fisheries and forestry in Ukraine (section «Desk research») are presented.

The results are presented in three blocks, as the topic «Work 4.0» should be considered from several angles:

- driver technologies of Industry 4.0;
- · past and future professions and changes in the structure of employment;
- level of education and skills in the world of work 4.0.

Block 1 is dedicated to reviewing existing technologies that are considered to be drivers of Industry 4.0 and the basis for technological solutions used for agriculture, fisheries and forestry. Examples of finished products are given. Some of them are already being implemented in Ukraine, while others are unknown or little known to a wide range of domestic enterprises. Based on the results of the survey, a brief overview is given of the expected consequences of the introduction of innovations and potential obstacles that slow down this process.

Block 2 covers the analysis of current and expected changes in the content of functional responsibilities by groups of staff and individual professions / positions. There is also a list of anticipated professions.

Block 3 outlines the work of the future in terms of the required level of education, necessary skills and strategies needed to bridge the skills gap.



Subdivisions in each block are divided into two parts:

- the first is an explanation of the issues addressed in the section, their relevance to the global and national agenda, reviews of research and existing innovations;
- the second contains the foresight results and expert assessments. For easy orientation in the text, all such subblocks are marked with an icon:



To illustrate the identified trends, we have included quotations from respondents representing large, medium and small enterprises, opinions of experts, case studies on the work of innovative enterprises, as well as excerpts from international reports and documents that help take into account aspects such as climate change, development of organic production, cooperation with the EU, gender equality, and innovation in education.

At the end of this report there are conclusions and recommendations for accelerating the introduction of new technologies and overcoming possible negative socio-economic effects in terms of employment.

## RATIONALE FOR CHOOSING THE TYPE OF ECONOMIC ACTIVITY

(Note. This study is based on statistical information from the State Statistics Service of Ukraine, in accordance with the "Calendar of disclosure of information for 2021". Thus the data are for 2019 or 2020.)

Agriculture, forestry and fisheries are an important component of the real sector of the economy, which is one of the five most important types of economic activity making up GDP;<sup>10</sup> in other words, it is strategically important for the development of Ukraine's economy. Thus, in 2020 the GDP shares of agriculture, forestry and fisheries (in current prices) amounted to UAH 338.726 billion, second only to "Wholesale and retail trade, repair of motor vehicles and motorcycles" and the processing industry (Figure 1).

According to the SSSU, in 2019 agriculture, forestry and fisheries were among the top ten economic activities with the largest number of business entities. In 2019, 75,450 legal entities and private entrepreneurs registered for this type of economic activity. As SSSU, in compliance with the requirements of the Law on Personal Data Protection (Vidomosti Verkhovnoi Rady, 2010, № 34), did not provide contact details of private individuals, they had to be excluded when forming a sample for the study. The sample thus covers 50,239 companies, registered in the USREOU, information on which was provided by SSSU (Figure 2).



Figure 1 Gross domestic product for 2020 (current prices), UAH million

**Source:** State Statistics Service of Ukraine (SSSU) for 2020. Excluding the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and parts of the temporarily occupied territories in Donetsk and Luhansk oblasts.



#### Figure 2 Business entities by type of economic activity<sup>20</sup>

**Source:** State Statistics Service for 2019. Excluding the temporarily occupied territory of the Autonomous Republic of Crimea, the city of Sevastopol and parts of the temporarily occupied territories in Donetsk and Luhansk oblasts.

 State Statistics Service of Ukraine (2019): Number of business entities by type of economic activity; available at: http://www.ukrstat.gov.ua/operativ/operativ2012/fin/osp/ksg/ksg\_u/arch\_ksg\_u.htm



Figure 3 Number of employees ('000)

Note: \* According to a sample survey of economic activity of the population.<sup>21</sup>

According to SSSU statistics, the number of full-time employees in enterprises in the studied economic activity was 610,100, but according to the Labour Force Survey, state statistical surveys of enterprises and administrative reporting in 2020, the total number of employees in rural, forestry and fisheries, in particular taking into account seasonal workers, amounted to 2.72 million people aged 15–70. This means that these activities have the second largest share of employment in the economy (Figure 3).<sup>22</sup>

In addition to the officially registered business entities pursuing the economic activities under study, according to a sample survey of household living conditions in 2019, performed using the extrapolation method, there are almost 4.8 million rural households in Ukraine.<sup>23</sup> They are the main source of labour market formation in agriculture, forestry and fisheries, and therefore changes in the employment structure due to the introduction of new technologies will certainly affect this category, which was not included in the sample. As it is incredibly difficult to organize a large-scale survey of households, the project focuses on the study of agricultural, forestry and fisheries enterprises, which are most focused on technological change and have the appropriate resources to implement innovation.

<sup>&</sup>lt;sup>21</sup> State Statistics Service of Ukraine (2020): Employed population by type of economic activity in 2000–2020; available at: http://www.ukrstat.gov.ua/operativ/operativ2014/rp/zn\_ed/zn\_ed\_2013\_u.htm

<sup>&</sup>lt;sup>22</sup> State Statistics Service of Ukraine: Employed population by type of economic activity in 2000–2020; available at: http://www.ukrstat.gov.ua/operativ/0perativ2014/rp/zn\_ed/zn\_ed\_u/zn\_ed\_2013\_u.htm

<sup>&</sup>lt;sup>23</sup> State Statistics Service of Ukraine (2019): Household expenditures and resources in Ukraine in 2019 (according to a sample survey of household living conditions in Ukraine). Statistical collection; available at: http://ukrstat.gov.ua/druk/publicat/kat\_u/2020/zb/06/zb\_vrd\_19\_ue.pdf

According to NACE (2010), activities in agriculture, fisheries and forestry are divided into the following sections:

- Section A «Agriculture, forestry and fisheries» includes the use of plant and animal natural resources, including activities for growing crops, growing and breeding of farm animals, timber, forest and other plants, animals and products of animal origin on farms or in the natural environment;
- Section C «Processing industry» is focused on the processes of physical or chemical processing of materials, substances or components in order to produce new products. Agriculture, forestry and fisheries in this section are allocated to 13 groups and an additional seven classes of economic activity. The study of professional qualifications in them is certainly important, but would have a different focus and require a separate research.

Based on the above and taking into account the results of the study «Future of Work 2030: how to prepare for change in Ukraine», which defines the hierarchy of the most promising sectors in Ukraine's economy up to 2030 (based on performance indicators, export potential and future trends), agriculture and the food industry, as a single cluster of high-tech food production, was identified as a priority area of further economic development. Some experts believe that by 2030 Ukraine will be positioned as a country focused on the production and processing of agricultural products. This will usher in new technologies and a transition from extensive to intensive agriculture.<sup>24</sup>

That is why the project examines NACE (2010) Section A «Agriculture, Forestry and Fisheries» as one of the most important drivers of economic growth in Ukraine because of the innovative changes already under way or planned for implementation. However, due to the wide range of issues to be considered, the sample size and the limited scope of the project, this study does not cover the processing industry.

<sup>24</sup> Career Hub (2021): National Study »Future of work 2030: how to prepare for change in Ukraine«; available at: https://careerhub.in.ua/future-of-work-in-ukraine-2030/

## RESEARCH METHODOLOGY

#### **RESEARCH METHODOLOGY**

The study was conducted among large, medium and small enterprises in agriculture, forestry and fisheries.

The foresight methodology was developed more than 30 years ago and is actively used in business and public administration to design future or anti-crisis forecasting.

Strategic foresight is a systematic, participatory, forward-looking and policy-oriented process that (supported by various methods of scanning environments or horizons) aims to actively involve key stakeholders in a wider range of activities to predict the future, prepare recommendations and implement them in the technological, economic, environmental, political, social and ethical spheres.

The foresight methodology always involves intensive mutual discussions among many experts from fields right across the board, related at least to some extent to the subject of a particular foresight project, as well as surveys of certain groups of the population with an interest in solutions to the problems under study.

#### **STAGES OF RESEARCH**

#### 1. Preparatory stage. "Desk research": February-March 2021

Conducting a desk study of the state of development of agriculture, forestry and fisheries in Ukraine and the global experience of strategic foresight in relation to the topic «Work 4.0» (a list of relevant international studies is given in Annex 1). Development of a guide for in-depth interviews.

#### 2. Data collection: April-November 2021

#### The first wave of foresight "In-depth interviews": May-June 2021.

Interviews were conducted with representatives of 27 large (market leaders) and medium-sized enterprises. Data collection was carried out in order to form hypotheses and compile questions for quantitative research.

#### The second wave of the foresight "The quantitative research": June–July 2021.

Creating an online questionnaire to collect and consolidate survey data from 727 companies. Formation of preliminary lists of professional qualifications with digital skills, conclusions and recommendations. Preparation of materials for discussion within the framework of focus groups.

#### The third wave of the foresight "Focus groups": October-November 2021.

Conducting nine focus groups with 205 representatives of enterprises in hybrid (online + offline) format in Dnipropetrovsk, Zaporizhia, Kirovohrad, Mykolaiv, Poltava, Rivne, Vinnytsia, Kharkiv and Sumy oblasts to discuss, finalize and agree on a previously developed list of professional qualifications with digital skills, conclusions and recommendations. Representatives of 71 companies that did not participate in the previous two waves of the project took part in the focus groups.

Thus, a total of 825 enterprises took part in the study (Figure 4).



### Figure 4 Respondents in the study of agriculture, fisheries and forestry

The in-depth interview guide contained 14, and the quantitative questionnaire contained 17 main and 8 additional closed-ended and open-ended questions, grouped into blocks:

- the current status of the introduction of technologies in the Ukrainian economy;
- · changes in enterprise employment structures;
- changes in the functionality of employees under the influence of technologies implemented at enterprises;
- changes in the list of required skills;
- · portraits of new and transformed professions;
- education and ways to overcome a skill gap.

#### 3. Data analysis and report preparation: August-November 2021

Data analysis was carried out in three stages:

1) after the first wave of the foresight, the completion of in-depth interviews, which allowed us to form research hypotheses and compile a questionnaire for quantitative research;

2) after the second wave of the foresight, the completion of a quantitative survey, which allowed us to formulate a preliminary list of professional qualifications with digital skills, conclusions and recommendations, as well as to prepare materials for discussion in focus group format;

**3)** after the third wave of the foresight, based on the results of discussions in nine focus groups with representatives of enterprises from different regions, the list of professional qualifications with digital skills was finalized and agreed upon, and final conclusions and recommendations were formed.

#### Sampling for qualitative research

In order to form a sample of respondents for qualitative research, the project team asked professional associations to provide a list and contacts of companies that are setting development trends being the industry leaders (Section A, NACE-2010), in particular with regard to the introduction of new technologies. Thus, 27 enterprises were selected.

#### Sampling for quantitative research

The report examines the visions of enterprises belonging to Section «A» «Agriculture, forestry, fisheries» of NACE–2010, which considers agriculture, forestry and fisheries separately (Table 1).

Table 1 Ex	Table 1 Extract from the NACE (2010), Section A			

Section	Name of economic activities and description		
А	Agriculture, forestry and fisheries		
	<i>This section</i> includes the use of plant and animal natural resources, including activities for growing crops, growing and breeding farm animals, obtaining timber, forest and other plants, animals and products of animal origin on farms or in the natural environment.		
contains the following sub-sections			
01	Agriculture, hunting and related services		
02	Forestry and logging		
03	Fisheries		

	Enterprise size			la total
Economic activity subgroups	Big	Medium	Small	in total
1 (plant farming)	21	1 510 / <b>144</b>	42 716 / <b>327</b>	44 247 / <b>492</b>
2 (animal farming)	10	323 / <b>12</b>	2 049 / <b>23</b>	2 382 / <b>45</b>
3 (mixed agriculture, support activities)	7	120 / <b>45</b>	1 132 / <b>45</b>	1 259 / <b>97</b>
4 (hunting)	0	3 / <b>1</b>	429 / <b>4</b>	432 / <b>5</b>
5 (forestry)	5	301 / <b>34</b>	693 / <b>20</b>	999 / <b>59</b>
6 (fisheries)	0	16 / <b>4</b>	904 / <b>25</b>	920 / <b>29</b>
Total	43 / <b>43</b>	2 273 / <b>240</b>	47 923 / <b>444</b>	50 239 / <b>727</b>

#### Table 2 Sample (overall in the strata / number of enterprises in a sample)

24 regions of Ukraine and the city of Kyiv are divided into four consolidated regions:

**Western:** Zakarpattia, Chernivtsi, Lviv, Ivano-Frankivsk, Ternopil, Volyn, Rivne, Khmelnytsky regions.

Central: Kyiv and Kyiv, Zhytomyr, Chernihiv, Vinnytsia, Kirovohrad, Poltava, Cherkasy regions.

Eastern: Sumy, Kharkiv, Donetsk, Luhansk, Dnipropetrovsk, Zaporizhia regions.

Southern: Mykolaiv, Odesa, Kherson regions.

To form a sample in each of the four enlarged regions of Ukraine, enterprises were selected based on their performance (it should be noted that the criterion of enterprise resources for the introduction of new and expensive technologies was taken into account):

- large enterprises: a continuous sample, because these enterprises, according to expert
  estimates, have the most resources for the introduction of new technologies; because the
  sample was continuous the error was zero for the results of the analysis of the answers of the
  respondents in this group;
- medium-sized enterprises: random selection of 10.5 per cent of the overall number of enterprises in this category, as they are also innovative and active, although they have fewer resources than the enterprises of the previous group; the sample covered 240 medium-sized enterprises; for the results of the analysis of the respondents' answers in the group of medium-sized enterprises, the error was 6.1 per cent (with a reliability level of 95.45 per cent and without taking into account the design effect);
- small and micro enterprises: a random selection of 0.93 per cent of the overall number of enterprises in this category, as this group has the most limited access to expensive technologies due to lack of resources. The sample comprised 444 small businesses. For the results of the analysis of the respondents' answers in the context of the group of small enterprises, the error was 4.7 per cent (with a reliability level of 95.45 per cent and without taking into account the design effect).



#### **Statistical Sampling Error**

Statistical sampling error (with a probability of 0.9545 excluding the design effect) does not exceed:

- 3.68% for results close to 50%;
- 3.2% for results close to 25% and 75%;

- 1.5% for results close to 5% and 95%;
- 0.7% for results close to 1% and 99%.

## FORESIGHT RESULTS

## **BLOCK 1**

Scope of implementation of Industry 4.0 technologies in Ukraine

*The future is not created; the future is co-created.* 

Nilofer Merchant

Ukraine is a fairly prominent global producer of agricultural products, although the pace of introduction of high technology in the agricultural sector employees under. According to the Network Readiness Index 2020, which assesses the ability of 134 countries to digitally transform, Ukraine ranks sixty-fourth. At the same time, Ukraine ranked fifty-fourth in terms of readiness for new technologies, behind Armenia, Kazakhstan, Russia and most central and eastern European countries, according to the Digital Competitiveness Rating 2020, which covers 64 countries. Experts who participated in the preparation of this rating identified Ukraine's weakest points as its state of readiness for digital transformation, especially the level of IT integration in the economy and the conditions for the development of digital technologies. Assessing the overall level of innovation activity, it should be noted that Ukraine lags far behind the European average, and over the past ten years the country has failed to improve its position. The level of ICT use in the country is estimated at only 25 per cent of the European average.

The list of Industry 4.0 technologies covered in the study is based on an analysis of a wide range of classifications presented in reports and other materials related to forecasting the future. Thus, the authors' classification is based on international research and reports, including «The Future of the Labour Market» by the International Economic Forum, «Agriculture 4.0: The Future of Farming Technologies» following the World Government Summit, the McKinsey Global Institute's report "Future of Work: Turkey's Talent Transformation in the Digital Era" and K. Schwab book's The Fourth Industrial Revolution.

The grouping of technologies for the survey took into account such factors as, first, the projected prevalence of technology use, and second, the ability to separately explore the main technologies that are often combined to create a specific solution or product. For example, the grouping of unmanned vehicles with additive technologies (3D printing) would not reflect the prevalence of the former in Ukraine, on one hand, and the almost complete absence of the latter, on the other. In addition, the integrated solutions currently being offered to enterprises are based on a combination of a number of technologies: for example, GIS is a combination of the internet of things, big data, AI and cloud technologies. Therefore, the distribution is rather conditional and serves rather to identify trends in the transformation of tasks within individual professions / positions and the replacement of human labour due to the introduction of these technologies. For example, smart farms operate through a combination of robotics, big data collection and analysis technologies, cloud technologies, the internet of things, geographic information systems and, in some cases, AI, which is now changing more than just business process on farms, but also the number of staff required.



Additive technologies / 3D printing /

New materials

1.6

Genetic

engineering

1.4

Blockchain 0.4

40

30

20

10

56

Digital

twin

0.4

Solutions based on technologies that are considered to be drivers of Industry 4.0 are being implemented unevenly by Ukrainian agricultural, forestry and fisheries enterprises, given the specialization and size of these entities. It is difficult to assess the real level of digitalization and automation, given the unwillingness of some companies to speak openly on this topic, as well as because the consumer does not always know which technology the solution in use is based on.

Technologies that are being or have been implemented, % of responses

«Not all companies keep up with the times. Of course, few people use horsepower, but in order to innovate, you need to think differently. A modern farmer works with Big Data, not with material resources, he treats agriculture more analytically and creatively.»

Green technologies /

New biomaterials

9.5

Unmanned vehicles (incl. drones)

18.2

«Some farmers, when they hear about technology, say, 'Stop telling us fairy tales' [ed. - success stories from developed countries with major resources not applicable to the national contextl.»

«We were very impressed by the story of changes in labour processes due to the introduction of new technologies at a large enterprise [ed. – Ukrainian case shared at one of the focus groups]. We have heard about such approaches before. Of course, we are very far from that [ed. - a small enterprise].»

«Of course, technology is extremely necessary and interesting, but we now have completely different problems – the human factor. For example, today a tractor driver may come to work, but tomorrow may refuse to do so.»

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«An electronic platform for monitoring animals is not needed, animals are dynamic. To account for the number of animals we still use Excel, which generates any statistical reporting. We plan to add a hotel and a fishing base to the farm, then there will be a need to form a client base and we'll need to create an electronic platform.»

«Experience cannot be robotized. An algorithm will never be able to learn some things, sometimes only human creativity is needed.»

Large and medium-sized enterprises are most open to technological change, as they have access to loans, necessary resources, and managers with appropriate qualifications who are able to facilitate the process of technology implementation (from choosing a specific solution to putting it into operation). The technological gap between large and small enterprises is particularly noticeable. This is not only due to lack of resources but also lack of development strategies, low level of awareness of a wide range of existing technological solutions, as well as conservative approach when it comes to innovations and believe that some things should be done in the «old-fashioned way», even though such type of work has already been automated at other enterprises.

It is in plant and animal farming and on mixed farms that innovation is most widespread. In fishing, forestry and hunting, technological changes are the least noticeable.

The most common technology in Ukrainian farms is unmanned aerial vehicles, especially drones, which are used autonomously for data collection and as part of integrated AI-based systems, cloud technologies and big data. Unmanned agricultural machinery makes it possible to cultivate fields using satellite navigation data. Autonomous farms and precision farming are already a reality in Ukraine. In addition, there is a demand for the use of biomaterials and green technologies. Respondents particularly emphasized the potential for increasing revenues from the re-use of waste from enterprises' own activities. The capabilities of technology such as blockchain, 3D printing and the so-called «digital twin» are not yet fully exploited.

«We are a state-owned enterprise, so we are funded accordingly [ed. – in other words, underfunded]. We are looking at changes in the world and in our country under the influence of digitalization, but we must note the inertia of our industry's response. But in the medium term, the company is considering using drones and artificial intelligence. Drones make it possible to transmit the coordinates of poaching gear, make video recordings and identify violators, and most importantly they help to identify fishing vessels and collect data on their location. This is important during the spawning period ban on fishing. The unmanned complex can also be used for search and rescue operations.»

«We plan to use in particular the industrial internet of things, robotic complexes using underwater drones with AI to monitor aquatic bio-resources in order to preserve it.»

Most innovative solutions are purchased and implemented by domestic companies with the involvement of third-party organizations, often foreign ones, as there is no Ukrainian research base. Research can be financed mostly only by large enterprises. The latter have their own AI development and may, for example, develop blockchain-based solutions. Small and medium-sized enterprises use ready-made solutions, most often buying them abroad: the most popular brands are John Deere, Hollander, Fendt, Valtra, Väderstad, Manitou, Geringhoff, Mitas and Trelleborg.

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«Unfortunately, some of our companies' behaviour is unethical. They promise certain functionality for an item, and so we acquire it, but then, if problems occur, they just do not get in touch. In addition, they rarely offer product use training.»

#### BLOCK 1

#### Note

Researchers do not aim to promote individual brands or solutions, but there are a few examples of domestic developers:

- MaaS electronic visualization service for monitoring and control of land use, deforestation;
- AgroYard marketplace with the option of concluding e-contracts;
- G.MIAN system of automatic samplers for the analysis of quality of grain mixes;
- Profeed a program for feeding management on cattle farms;
- CleverAgri supermarket of agricultural innovations.<sup>25</sup>

Given the prospect of transition from fragmentary automation (individual processes and tasks) to fully automated digital production, which is controlled by intelligent systems in real-time, small businesses will lose their competitiveness and will be forced to seek a niche or leave the market. Currently, such niches include organic production and green tourism, but advances in genetic engineering, robotics and the spread of green technology will allow large enterprises to gradually make all their production «green» and destroy this niche, so small businesses should consider other options.

#### Note

### The state of the market for organic products in Ukraine<sup>26</sup>

The organic products market in Ukraine has enjoyed a fairly high growth rate. Thus, while in 2010 market volume was about 2.4 million euros, by 2020 it had reached 38 million euros. Compared with 2019, growth was 5 per cent. The main types of organic products consumed in Ukraine are dairy, as well as cereals and grains, flour and seeds.

However, the vast majority of domestic products are exported to markets in about 40 countries, primarily the EU and the United States. The main export products are corn, soybeans and wheat. Total exports of organic products in 2020 amounted to almost 180 million euros.

The development of organic production is ensured by the growth of the number of organic agricultural enterprises, which in 2019 amounted to 470 units, as well as the expansion of the area of agricultural land with organic status and the transition period. During the period 2016– 2019, it increased by 22 per cent and reached 467,980 hectares, which is 1.1 per cent of the total area of agricultural land in Ukraine.

Another option to ensure the survival of small businesses and individual farms is to create cooperatives that would help accumulate resources to innovate, but currently this strategy is barely being implemented.

<sup>&</sup>lt;sup>25</sup> Agrarian Innovation Supermarket (2021): CleverAgri; available at: https://cleveragri669287081.wordpress.com/

<sup>&</sup>lt;sup>26</sup> Domestic organic market of Ukraine (2020); available at: https://organicinfo.ua/news/organic-domestic-market-2020/; Export of Ukraine's organic products (2020); available at: https://organicinfo.ua/infographics/ua-organic-export-2020/, OrganicInfo (2020). http://organic.com.ua/organic-v-ukraini/

BLOCK 1



The developed by Industry 4.0 Strategy has not been adopted at the state level yet, although at present there are some relevant projects, such as «Development of Industry 4.0 Centres», ClusteRise, DIH (network of digital innovation hubs), BOWI (project Boosting Digital Innovation Hubs), APPAU EIF (Association of Industrial Automation Enterprises of Ukraine - Export, Internationalization, Fundraising), EU4Digital-I4MS etc. Some of them are being implemented within the framework of public policy, such as industrial high-tech, and at the level of regional policies.

The Industry 4.0 Strategy contains six areas: integration into public policies, innovation ecosystem, digitalization by industry, security and defence, export programmes, and international cooperation.

Industry 4.0 Strategy intersects with other strategies that are also, unfortunately, lacking (industrial, digital, innovative, regional). In addition, no state agency has been established to coordinate the development of Industry 4.0.

The Fourth Industrial Revolution includes the digitalization of processes covering all spheres of life and all sectors of the economy, including agriculture. The digitalization of agricultural and agro-processing enterprises in the Ukrainian regions is accelerating due, among other things, to the creation of «Industry 4.0 Centres» at institutions of higher education. According to Resolution of the Cabinet of Ministers of 21 July 2021, №750 on promoting the implementation Industry 4.0 in Ukraine, the main functions of such centres are coordination of the implementation and development of advanced technologies, training of relevant specialists, developing modern technologies etc.

With the help of the Center in Poltava, the digitalization of agricultural and agroprocessing enterprises of Poltava region is being accelerated by strengthening the role of clusters.

Alexander Yurchak, APPAU




#### CONSEQUENCES OF TECHNOLOGICAL CHANGE

The advantages of implementing technologies for companies that can afford them are undeniable (Figure 6). Thus, based on respondents' answers, all the consequences of technological and digital transformations that have already been felt can be summarized in three categories (Table 3):

- productivity and income;
- costs;
- employees.

#### Table 3. Consequences of technological and digital transformations

<ul> <li>sales growth and revenue growth;</li> <li>increased productivity;</li> <li>ensuring constant control over technological operations and costs;</li> <li>simplification of business processes and the emergence of new business models;</li> <li>increased efficiency of both the enterprise in general and employees in particular;</li> <li>reduction of financial and tax burden by reducing the number of employees;</li> <li>reduction of negative impact on the environment.</li> <li>significant costs for the purchase of technological solutions and payment of interest on loans;</li> <li>rising cybersecurity costs;</li> <li>costs of additional staff training.</li> <li>facilitation of manual labour;</li> <li>change in the functionality of employees;</li> <li>reduction of financial and tax burden by reducing the number of employees;</li> <li>reduction of negative impact on the environment.</li> </ul>	Productivity and revenue	Costs	Employees
	<ul> <li>sales growth and revenue growth;</li> <li>increased productivity;</li> <li>ensuring constant control over technological operations and costs;</li> <li>simplification of business processes and the emergence of new business models;</li> <li>increased efficiency of both the enterprise in general and employees in particular;</li> <li>reduction of financial and tax burden by reducing the number of employees;</li> <li>reduction of negative impact on the environment.</li> </ul>	<ul> <li>significant costs for the purchase of technological solutions and payment of interest on loans;</li> <li>rising cybersecurity costs;</li> <li>costs of additional staff training.</li> </ul>	<ul> <li>reduction of the impact of the human factor on production processes and decision-making processes;</li> <li>facilitation of manual labour until the complete replacement of human labour;</li> <li>change in the functionality of employees;</li> <li>change in the list of required qualifications and the need for employees / specialists with digital skills;</li> <li>disappearance, transformation or emergence of professions / qualifications / positions.</li> </ul>

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«Material costs are insane, but productivity is growing, the human factor is levelling off, and the workforce is declining.»

«These technologies minimize human impact, increase control over production.»

«There is a decrease in the load on workers and equipment and an increase in productivity.»

«Several farms that use our biologization technology apply green biofertilizers that improve soil quality.»

The majority of respondents confirm that the most important economic effect of the introduction of technologies is the increase of the efficiency of enterprises and sales.

#### Note

International experts point to the negative effects of technology, including the likelihood of increasing labour market polarization and income inequality; an increasing share of informal employment; and rising «technological» unemployment, which may particularly affect developing countries. The existing differentiation of countries / regions in terms of demographic potential, access to broadband, and levels of workforce skills affect the formation of «gaps» in the speed of technological progress in the country or region, as well as the quality of human capital. There is a growing risk that people will not be able to get quality work with adequate social security, so they will have to work several jobs at once. This can lead to growing anxiety and uncertainty about the future, exacerbating populism, which can undermine economic and democratic institutions, global balance and peace.<sup>27</sup>

Emphasis should be put on the role of technology in mitigating the negative effects of the humanbased climate change on agriculture, forestry and fisheries. Although the majority of respondents were not concerned about such changes or had no interest in this topic, discussing the prospects of future professions, such as agroecologist, showed a gradually increasing demand for prioritizing environmental performance and reducing the anthropogenic impact on the environment. Even though small businesses do not currently pay much attention to this because they are focused on surviving, they will be more affected by climate change than large enterprises because of the gap in levels of innovation, and access to human and financial capital.

#### Note

Climate change is a serious and growing threat to global food security. Expected effects include rising temperatures, increasingly extreme weather events, water scarcity, rising sea levels, ocean acidification, land degradation, ecosystem destruction and biodiversity loss. All this could seriously undermine the ability of agriculture to feed the most vulnerable and to eradicate hunger, malnutrition and poverty...

Rising temperatures increase the vulnerability of animals to disease, thus reducing their reproductive capacity and cutting meat and milk production. In areas in which rainfall will increase, the growth of pathogens and, consequently, the incidence of livestock diseases is expected. Climate change also threatens to reduce the potential capacity of natural and cultural pastures, as well as feed production.

Fisheries and aquaculture, which provide at least 50 per cent of animal protein in the diets of millions of low-income people, are already experiencing various types of stress...

That is why urgent measures are needed to ensure that crop and livestock products, fisheries and forestry are ready for rapid environmental change and to reduce agriculture's contribution to total global warming (GHG emissions). Therefore, the agricultural sectors are unique in terms of potential contributions to stabilizing the global climate, as they can improve the management of crop, land and livestock, reduce emissions and increase carbon sequestration in soils and plant biomass.<sup>28</sup>

<sup>&</sup>lt;sup>27</sup> OECD (2019); available at: https://data.oecd.org/

<sup>&</sup>lt;sup>28</sup> Situation in the field of food and agriculture (2016): FAO; available at: https://www.fao.org/3/i6030r/i6030r.pdf

#### Figure 6. Effects of technological change on argo-enterprises





#### FACTORS HINDERING THE INTRODUCTION OF NEW TECHNOLOGIES IN ENTERPRISES

All the factors mentioned by the company representatives can be divided into external (which do not depend on company policies and strategies), and internal, due to management decisions.

#### Table 4. Factors hindering the introduction of new technologies in enterprises

	External	Internal
Strategies and infrastructure	Lack of systematic government policy and support for Industry 4.0 development. In particular, the Industry 4.0 Development Strategy drafted in 2018 was not approved. Lack of high-quality uninterrupted internet access complicates reliable data transmission.	Lack of long-term and medium-term strategic planning for small and partially medium-sized enterprises.
Finances	Adverse economic situation exacerbated by the pandemic, including rising gas prices, which make fertilizers more expensive; high cost of technology; lack of access to «long cheap money» and investment.	Rising cybersecurity costs. Small and micro enterprises do not have enough financial resources to purchase expensive technological solutions / equipment.
People	Low general level of education and awareness as regards digital technologies. Shortage of skilled and motivated workforce, partly due to significant labour migration, underdeveloped non-formal and informal education, insufficiently practice-oriented and outdated educational content.	Bureaucracy at the management level due to reluctance or lack of awareness of new technologies (according to R&D experts, this is sometimes due to the age of business leaders). Lack of managers and/or specialists in small enterprises who could understand technology, and develop and implement it. Rejection of technologies by employees for fear of losing their jobs. At the same time, the demotivation of some employees to develop their own potential, to master new skills.

#### STRATEGIES AND INFRASTRUCTURE

Not all companies have long-term development strategies, being satisfied with annual planning or an intuitive vision. Sometimes, existing long-term strategies are revised in light of changes in legislation and new government programmes (Figure 7).

Only 10 per cent of respondents carry out long-term planning, mostly large and medium-sized enterprises, as well as forestry enterprises, which make plans for ten years. Small businesses focus on survival rather than development. Strategic planning is easier to implement on a sectoral, cluster or regional basis.

Among all respondents who have short-, medium- or long-term strategies, only 60 per cent include the introduction of new technologies (39 per cent of total sample).

Other relevant tasks include:

- · creation of multi-vector profitability;
- · increasing operational efficiency and maximizing profits;
- improving product quality;
- searching for investments, in particular opportunities to attract «long money» at low interest rates;
- improving customer relationships;
- promoting sustainable development, especially with regard to the environment.

Further strategies include automation/robotics and digitization, investing in technology and innovation (strengthening R&D, implementing developments, in particular for precision farming).

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«We do not have a development strategy. We have a vision of how to make money.»

«There is no strategic planning in Ukraine's agriculture, because the risks to the land are high, so it is difficult to plan something long-term, two-three year planning is more widespread.»

«This is one of the sector's main problems: when there is no strategy, things are being done in the old way. When we ask, 'How do you keep records?', we mostly hear, 'In the paper notebook.' For some owners, not only IT, but even an Excel table are considered to be as hi-tech as a space trip.»

The introduction of technology is treated as a component of profitability and a tool to reduce risks by reducing the impact of the human factor on production processes. According to experts, this approach will lead to the partial dismissal of employees, in particular in enterprises that aim at full automation.





Does a company have a development strategy?

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Does the strategy include introduction of new technologies\automation of processes?





Does a company have a development strategy?

Does the strategy include introduction of new technologies\automation of processes?



Given the infrastructure, the spread of the 5G mobile standard is one of the drivers of digitization in agriculture, forestry and fisheries. Currently, the lack of stable data transfer from remote areas is considered a factor in slowing down the implementation of innovations.

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«The use of modern digital technologies in rural areas without quality infrastructure, including the internet, is questionable.»

«There are solutions in agricultural work that make it possible to see current information about the state of fields, the harvest and performance in mobile applications. This is a great opportunity, but without a stable data channel, they lose their meaning. Mobile internet does not cover the entire territory of Ukraine, a stable signal cannot be found everywhere. Of course, telecommunications companies are not interested in installing a tower in the middle of a field, so an agronomist in a field a few kilometres from the village cannot properly use application.»



#### FINANCES

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All the small enterprises surveyed noted that a lack of funds is the main obstacle to the introduction of technologies. Medium-sized enterprises stressed the importance of correctly calculating profitability to decide on the feasibility of innovation.

The share of equity in the long-term capital structure of small agricultural enterprises is almost 90 per cent, and the main source of investment is their own income due to the high cost of long-term financing (on average 15 per cent). Borrowed capital was usually used to pre-finance the harvest. The average term of bank loans in agriculture is 1–3 years. This indicates an unfavourable situation as regards access to long-term financing.

Unlike small businesses, large agricultural businesses have access to foreign bank loans; it is much easier for them to obtain funds from international institutions such as the EBRD or IFC, and the interest rate on long-term liabilities can be as low as 12 per cent. It is cheaper than attracting short-term financing, so large companies can finance part of their current needs through long-term liabilities. In addition, agricultural holdings raise additional capital through IPOs and international stock exchanges.<sup>29</sup>

«Not everything is expensive. Sensors for precision farming cost pennies. For farms over 10,000 hectares, the cost will be only \$ 10 per hectare. The cost of software and support is up to \$2 per year per hectare. The internet of things helps to save a lot of resources, spend less fertilizer, water, and most importantly – prevent theft.»

«Precise agriculture is already in the process of implementation, but it requires funds. It pays for itself, however, if you cultivate more than 500 hectares.»

«We are a small agricultural enterprise, so we can't take any risks. Raw 'untested' automation does not pay off. We are implementing everything that is being rolled out and we will gradually increase the pace thanks to new approaches in agriculture, control, monitoring, such as GPS navigation and unmanned equipment, solutions for mapping yields, etc.»

«The use of digital technology is certainly costly, but we are doing it to save investment. Profits from the introduction of digitalization have not yet been seen.» (hunting)

«You don't have to buy drones, because you can rent them.»

«Given the nature of our business and its affiliation with the public sector, the digital transformation does not affect our income, but it will inevitably increase the income of private fisheries companies.»

Undoubtedly, the pandemic has affected not only the economic situation in the country, but also the pace of introduction of new technologies. Thus, investment in re-equipment has been suspended, as quarantine restrictions, which have significantly affected international logistics, have provoked difficulties in the supply of equipment and components. Enterprises that started to automate before quarantine and already fully automated enterprises have been particularly affected, as they depend on the timely supply of components and spare parts. As a result, these companies are not working at full capacity or are even suspending some production processes.

<sup>&</sup>lt;sup>9</sup> Müller, W.M. (2020): Analysis of agricultural financing. in Ukraine. Agropolitical report; available at: https://www.apd-ukraine.de/images/2020/ APD\_Berichte\_2020/11\_Landwirtschaftsfinanzierungen/Bericht\_Mueller\_Landwirtschaftsfinanz\_APD\_UKR.pdf

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«There are some problems with obtaining sensors from abroad due to Covid-19. We have even had to change the architecture of the sensor itself to match the components that can be found in Ukraine. Production has been suffering for six months now.»

#### Note

The total amount of capital investments in agriculture (crops, livestock and hunting) in 2020 amounted to UAH 50.189 billion, while investments in forestry did not exceed UAH 460.1 million, and in fisheries UAH 30.2 million.

Every year the Ministry of Economy makes a list of domestic agricultural machinery and equipment that can be paid for from the state budget support program. According to the Ministry, this inventory has been expanded by 6.3 times in two years. The number of factories or manufacturers of agricultural machinery with the appropriate level of localization has increased by 4.5 times. This has created at least 5,000 jobs.

As of July 31, 2020, the total amount of payments under the budget programme «Financial support for agricultural producers» is UAH 716 million, of which UAH 47.4 million was allocated to agricultural producers who purchased machinery and equipment of domestic manufacture in June 2020.<sup>30</sup>



#### PEOPLE

The most discussed topic is the human factor, whose impact can be traced from considering a decision to introducing new technologies to building "man-machine relationships" at all levels of the personnel structure.

Large enterprises and agricultural holdings have sufficient resources to set up separate departments to monitor innovation and organize the introduction of new technologies, including research departments (R&D). By contrast, due to lack of resources, small businesses prefer to study the experience of their colleagues directly in order to implement available solutions already proven as profitable in the national context, as they often do not have highly qualified managers/ specialists well-versed in modern technologies to facilitate the introduction of an innovation, from decision-making to launch.

Low-skilled and unmotivated workers regard technology as a threat to their jobs or heralding their displacement by more skilled workers with advanced digital skills. In addition, they see new technologies as a tool to control their activities, from monitoring the efficiency of each individual employee to detecting theft. Data collection provides a basis for making operational management and personnel decisions.

> «Sometimes technology is rejected at the level of human (sub)consciousness. But changing people's mentality is a matter of time. For example, five or seven years ago, agronomists resisted the introduction of drones, perceiving them as 'spies' that gather information not only about the state of the fields, but also about the work of specialists, as well as 'taking away' part of their work. Nowadays, they no longer go out into the fields without drones – they have accepted the technology.»

> «First of all, our digital products are aimed at management to help managers do their jobs faster and better. If decision-making is based on larger amounts of data and a minimized human factor, the result is better.»

> «A technologist or director can control operational processes from a mobile phone. The tractor driver used to report about the work done 'on paper' and it was difficult to assess the volume and quality of the tasks accomplished. Currently, the entire business process is digitalized, so theft is no longer a problem, it is now possible to properly plan the procurement and control the distribution of seeds. We can see the real picture online, for example, where the tractor driver is, what he is doing and with what effect.»

> «In hunting, the community is quite small, very grudging, not open to change. Take, for example, the profile law on hunting - it has not changed since Soviet times.»

In addition, many companies face an acute staffing problem. On one hand, especially before the pandemic, there was an outflow of young professionals to work abroad, and on the other hand, educational institutions' outdated material and technical base does not allow training specialists for hi-tech enterprises, so employers prefer people who are ready to quickly learn new technologies. Companies do not see the age of employees as an obstacle to acquiring new knowledge and learning new skills, emphasizing that personal qualities are crucial for maintaining competitiveness in the labour market. Particular attention is paid to soft skills, such as the desire to learn and work, responsibility and analytical thinking, which are basic for the formation of relevant professional competencies.

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«Young people are happy to work in automated production, but the most important thing is to find these young people! Our small enterprise (up to 30 employees) is not just experiencing a general labour shortage, but an acute shortage of young workers. Unfortunately, the borders with the EU opened after quarantine, which created favourable conditions for labour migration of the most qualified and promising Ukrainian men and women.»

«During the quarantine period, there were no problems with the labour force, as the borders with Poland were closed. This year the labour force has risen in price again, and there is a lack of qualified personnel. Good specialists left the country. Those who remain do not always have the necessary qualifications to perform even the most basic work.»

«At first, it was difficult for older workers to work with smartphones, tablets, platforms, but after a week they tend to have acquired skills alongside those of young people. Those who want to, learn very quickly.»

«It takes at least six months of field work for a person to become a game warden, but there is no guarantee that they will stay in the job. We do not have a queue seeking employment.»

«There is a problem with obtaining permits to work on modern technology; there is no place to obtain formal documents proving qualifications.»



A number of factors hinder the introduction of technology, depending on the type of economic activity. Thus, for enterprises engaged in crop production, the topical issue during the survey was the adoption of the Law «On Amendments to Certain Legislative Acts of Ukraine on the Conditions of Circulation of Agricultural Land.» The prospect of opening up the land market has led to a reduction in the costs of enterprises, including the introduction of technology, in order to accumulate resources to respond to changes (opportunities) caused by the new regulations.

#### Note

Another prerequisite for attracting investment in agriculture is the opening of the land market in Ukraine. In the first two and a half years, there will be restrictions on the purchase of land - no more than 100 hectares in one hand. From 2024, the limit will be 10,000 hectares in one hand.

At present, foreigners and foreign companies cannot officially own land, and only after an all-Ukrainian referendum will they decide whether to sell land to foreigners, but the very fact of opening a land market is a big step towards further agrobusiness development in Ukraine.<sup>31</sup>

Enterprises in hunting note that access to resources for innovation is deteriorating due to public opinion. Ukrainians are increasingly seeing hunting as a crime, killing living beings, rather than as a way to spring-clean nature, protect forests, promote reproduction and more.

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«We are a state-owned enterprise, so we are subject to state budgeting. We follow technological change in the world and in our country under the influence of digitalization, but the response has been slow. In the medium term, the company is considering the use of drones and artificial intelligence. Drones will allow us, first of all, to transmit the coordinates of poaching gear, the location of vessels, including video recording of the number of people and, most importantly, to identify fishing vessels. This is important during the spawning period ban on fishing. The unmanned complex can also be used for search and rescue operations.»

«We plan to use, in particular, the industrial internet of things, robotic complexes, underwater drones with AI to monitor aquatic bioresources in order to preserve and increase aquatic bioresources in the natural environment.»

«Given the public sector and the nature of the enterprise, the digital transformation does not affect our revenues, but it will inevitably increase the profitability of private fisheries enterprises.»

Professions of the past and the future. Changes in the structure of employment

# DISAPPEARANCE OR SIGNIFICANT TRANSFORMATION OF EXISTING OCCUPATIONS AND EMPLOYEES' FUNCTIONS

Technology has always been a factor in changing the nature of work – both the content of tasks and their implementation – as well as its professional structure, because it may result in a loss of relevance or the transformation of old professions and the emergence of new ones.

Today, not everyone can remember the exact nature of long «dead» professions, such as «spitter»,<sup>32</sup> coachman,<sup>33</sup> or log-shipper.<sup>34</sup> You will not find haymakers on large farms, shepherds are disappearing and milkmen or women no longer milk cows by hand. Many jobs and professions that have been passed down from generation to generation for centuries are in their last days.

On one hand, technology has been changing the nature of labour throughout history, against the protests of Luddites<sup>35</sup> but with humanity in general benefitting from the change. On the other hand, society has never witnessed changes of this magnitude and intensity. Half a century ago, a career tended to be linear: choosing a profession in one's youth and obtaining a specialized education could guarantee work in the chosen field until retirement. Today, the picture is completely different: a person has to constantly learn new, usually narrow, related specialties, acquire additional skills and more. For example, 47 per cent of the workforce in the United States today does work that computers and algorithms are likely to do in 10 to 20 years (Frey and Osborne 2017)<sup>36</sup>; in developing countries, the proportion is about 60–70 per cent (World Bank 2016).<sup>37</sup> With regard to agriculture, forestry and fisheries, in the long run the demand for sector specific occupations will decrease (CEDEFOP 2018).<sup>38</sup>

Another feature of the current technological revolution is a significant reduction in the spectrum of sectors and tasks in which a human could be more productive than a machine, while changes in the nature of jobs that have lasted for centuries are now taking place over several years. Digitalization has changed the tools of work, and as a result, the professions themselves are being modernized, and the requirements for specialists are supplemented by digital skills. Full or partial automation of the processes of fertilization, irrigation, water collection, container turnover or berry picking already require redistribution of functionality, upgrading existing professions.

<sup>&</sup>lt;sup>32</sup> Long ago, very small turnip seeds were not scattered by hand, but spat out (more than a million seeds per 1 kg). Experienced »spitters« were respected because their work was not easy.

<sup>&</sup>lt;sup>33</sup> Engaged in ploughing fields and transporting anything by horse.

<sup>&</sup>lt;sup>34</sup> Rafting logs by river.

<sup>&</sup>lt;sup>35</sup> Participants in spontaneous workers' demonstrations in England in the second half of the eighteenth/early nineteenth centuries against the introduction of machines in industry, which were displacing manual labor and increasing the number of unemployed. The name probably comes from the artisan Ned Ludd, who destroyed his knitting machine in protest against the tyranny of the owner. [Dictionary of Foreign Words: http://slovopedia.org.ua/36/53403/243113.html]

<sup>&</sup>lt;sup>36</sup> Carl Benedikt Frey and Michael Osborne (2017): The Future of Employment. Working Paper; available at: https://www.oxfordmartin.ox.ac.uk/downloads/academic/future-of-employment.pdf

<sup>&</sup>lt;sup>37</sup> International Bank for Reconstruction and Development/World Bank (2016): Digital Dividends; available at: https://www.worldbank.org/en/publication/wdr2016

<sup>&</sup>lt;sup>38</sup> CEDEFOP (2018): 2018 European Skills Index. Luxembourg: Publications Office of the European Union; available at: https://www.cedefop.europa.eu/files/3080\_en.pdf

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«Although a person can still control some of the equipment, the tools change the nature of the tasks. Everything is getting to the point at which machines, being more productive, will gradually significantly displace human labour. And in a decade or so, machine operators will do most of the job managing 4–5 units (drones or tractors) to conduct a range of operations on the fields from ploughing the field to harvesting. Of course, people will not disappear in agriculture, but their participation in production processes will be greatly reduced.»

K. Khmelnytsky, Deputy General Director for Agricultural Production, NIBULON<sup>39</sup>



<sup>&</sup>lt;sup>39</sup> Konstantin Khmelnytsky: »We were at the origins of creating a powerful Ukrainian agro-industrial complex - the flagship of the domestic economy« (2021). Agropro; available at: http://www.agroprofi.com.ua/statti/1990-kostyantyn-khmelnytskyy-my-stoyaly-u-vytokivstvorennya-potuzhnoho-ukrayinskoho-apk-flahmana-vitchyznyanoyi-ekonomik



#### CHANGING THE CONTENT OF FUNCTIONAL RESPONSIBILITIES BY PERSONNEL GROUPS AND INDIVIDUAL PROFESSIONS / POSITIONS<sup>40</sup>

This so-called «routine-biased technological change» is so profound that jobs that were usually low-skilled or even no-skilled are becoming more complex and technologically intensive.

A number of studies predict significant changes in the employment structure, not only for developed countries, but even more so for countries with economies in transition. This has been characterized as a «transition from simple and productive to knowledge-based activities.»

According to analysts, the polarization of the labour market will become more pronounced and increase until 2030 and later, when there will be a significant increase in the number of jobs requiring high skills and a certain increase in jobs for low-skilled workers, while labour market opportunities for persons with intermediate qualifications will be reduced, with the prospect of their complete disappearance.<sup>41, 42</sup>

According to the results of the study (Table 5), it is obvious that the technologies that are implemented will have different effects on changes in the functionality of all professional groups in the industry.

Category of employees	No change	Slight change	Significant change	Hard to tell
Management (of projects, processes, people)	19.4	21.5	37.1	22
Profile specialists	16.3	21.7	35.7	26.3
Engineering (excluding IT sector)	17.1	20.8	35.9	26.2
Service employees (accountants, inventory clerks)	17.7	24.9	42.6	14.8
Employees with working professions	25.4	30.8	30.2	13.6

# Table 5. Views of Ukrainian enterprises on changes in functionality by categories of employees (% of responses)

<sup>40</sup> The list of functional responsibilities of employees in the studied professions/positions, determined in accordance with the provisions of the HQCE or standard job descriptions (instructions for work). Due to the research focus on responsibilities that have already changed and will change under the influence of technology, the project team combined some functional positions to optimize presentation.

<sup>&</sup>lt;sup>41</sup> CEDEFOP (2013): Roads to Recovery: Three Skill and Labor Market Scenarios for 2025. Briefing Note; available at: https://www.cedefop.europa.eu/files/9081\_en.pdf

<sup>&</sup>lt;sup>42</sup> CEDEFOP (2018): *Skills Forecast: Trends and Challenges to 2030.* Eurofound. Luxembourg: Publications Office of the European Union; available at: http://data.europa.eu/doi/10.2801/4492

#### MANAGEMENT (MANAGEMENT OF PROCESSES, PROJECTS, PEOPLE)

The introduction of technology and work automation will have the least effect on top managers, who are more likely to acquire tools for data collection and analysis to make more informed decisions. The development of artificial intelligence, «machine learning», statistical methods / tools and approaches already greatly facilitates the work of management.

The most vulnerable part of this group will be middle managers, whose functions, such as monitoring productivity, maintaining appropriate reporting, performing organizational and administrative operations, have partially been modified because of algorithms and will be redistributed between senior managers and profile specialists.

#### Not

According to experts from the consulting company Gartner Inc., in the future the need for middle managers will decrease. The reasons for this are that data collection, monitoring the work of others and following procedures will be implemented using algorithms and «robosses» (robot/boss). Al-based systems can perform a significant amount of work traditionally performed by middle managers, namely communication between executors and senior management and the distribution of tasks among employees. However, the emphasis in people management will shift to activities that require intuition, empathy and interpersonal communication.<sup>43</sup>

This idea is supported by executive director of Future Forum Brian Elliott, who believes that digital technologies provide a more transparent and democratic flow of information. On the other hand, the active development of a distributed (remote) format of work requires the creation of teams and the need to bring people together, including around corporate goals and principles.<sup>44</sup>

«A mechanic is a person who repairs things. And when we sit these specialists in front of a computer and give them access to all available information about any piece of equipment or spare part, their availability, the number and place of repairs, or replacement periods mechanics will come up with more informed decisions about what needs to be repaired and when; in other words, they will partly perform functions that managers used to be responsible for.»

Because small and medium-sized enterprises already operate in conditions of insufficient resources, the concentration of the functionality of middle managers was taking place at the level of top management even before the Fourth Industrial Revolution. Therefore, even partial implementation of innovative solutions facilitates the functions of monitoring and control.

<sup>&</sup>lt;sup>43</sup> »The boss machine is here – AI is all set to eliminate middle management in 8 years« (2020): Business Insider, available at: https://www.businessinsider.in/careers/news/the-boss-machine-is-here-ai-is-all-set-to-eliminate-middle-managers-in-8-years/ articleshow/73474729.cms

<sup>&</sup>lt;sup>44</sup> Brian Elliott (2021): It's Time to Free the Middle Manager, in: *Harvard Business Review*; available at: https://hbr.org/2021/05/its-time-to-free-the-middle-manager

#### Working time accounting in an agricultural company



We introduced automated accounting of working time in our company in 2021.

The software was developed by specialists in our IT department. The locations of the production divisions of our company are quite extensive and scattered territorially, and the staff in the agricultural divisions works according to different work schedules. All these nuances must be taken into account in order to keep proper records of hours worked and to calculate wages correctly. All this was previously done by staff among seasonal workers, assistant field managers, data accountants (people responsible for making records regarding the time and scope of work done), and planning technicians.

The company's managers were tasked with digitizing this business process (tracking and recording the time and scope of work done). A very simple solution was found: QR codes that are generated for each employee as soon as their data is entered into the company's accounting system. A code is printed and handed to each employee, or they can take a picture of it using their phones. The code serves as a pass.

An employee only needs to scan a QR code, which is done with a smartphone installed at the entrance to our facilities or buses that transport workers through the fields. They need to «check-in» at the beginning and in the end of the working day. A photo of the employee is made every time to confirm their identity.

The testing period was March-April, the beginning of active field work. We tested the program and kept time sheets on the ground in parallel. Then we compared the data, and made sure the margin for error is correct (15 min). And now, according to the annual results, we see that the program was worth the investment. This solution allows elimination the of the human factor, takes into account the impact of weather conditions and reflects the actual working hours of each employee.

The change of the time tracking system stimulated innovations. Now all our tractor drivers receive tasks in messages sent to their smartphones. They have to press a kind of a «start button» when they start working on it and later another button to confirm they have finished the assigned task.

In addition, the program also allows tracking of a flexible work schedule, with several starts during the day: for example, in the summer heat, workers take a break during the hottest hours. We also took into account the lack of internet coverage in some fields located far away from the telecommunication towers. The device records the time the button was pressed and transfers data immediately.

Thus, by automating the time tracking process, we reduced the number of people employed in the accounting of working time, and cut payments for working hours by 12 per cent. This made it possible to increase the salaries of productive staff by 26 per cent.

> Olga Doroshenko, Head of Human Resources, Agrofusion Group of Companies

#### Note

**Kernel** has developed a system called #DigitalAgriBusiness, which digitizes all key stages of production and enables managerial functionality using big data and algorithms:

- production and budget planning for the season is now based on big data analysis done by algorithms that can answer questions such as what the crop rotation for the next five years will be, and what the production strategy should look like, how to plan fertilizers or what the best plant protection schemes are;
- operational management distribution of tasks, monitoring of equipment in field and freight, oversight over logistics and storage, work in fields and on elevators, GPS tracking and precision farming, etc.;
- analytical portal of production management;
- mobile application Land Asset Management Manager (MUZA).

The main task of the system is to ensure a continuous process of operational improvement through the use of reliable historical and operational data for algorithms and business rules that:

- analyse the maximum possible number of factors that affect the productivity and profits of the company in the planning and implementation of the production program, and
- provide recommendations for making rational decisions.

All employees receive an effective tool to increase the efficiency of their work, including by reducing the amount of paperwork and speeding up the transfer of information. Automation minimizes the human factor and improves productivity.



Thus, under the influence of digital technologies, the transformation of the functional work of managerial staff has been accelerated.

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«Today, technology is evolving so fast that we have decided to create a separate new position at the company, digital technology manager.»

#### Table 6. Change of functional responsibilities of managerial personnel

Profession / position	Functional responsibilities that might be changed by the Industry 4.0 technologies
HR manager	Personnel manager as a separate profession will gradually disappear as their functional responsibilities will be performed by AI.
	Technology allows not only to collect detailed data and evaluate results in accordance with the KPI, but also to assess staff psychological state, motivation and abilities / inclinations.
	On the basis of such data, profile managers will be able to make decisions on employment, financial incentives and individual career development trajectories, including advanced training.
	The learning process will also be largely digitized.
	That is, these functions can be redistributed between immediate supervisors, as well as team architects / career development consultants and psychologists (possibly outsourced).
Foreman of a complex brigade	The foreman's functional responsibilities are performed / transmitted / digitized and automated through AI or algorithms. Currently special mobile applications allow digitalize some of the tasks (such as «Foreman»):
	creation of operational tasks;
	placement of employees;
	monitoring of crew members' work in real time;
	<ul> <li>formation of a daily report on work performed;</li> </ul>
	<ul> <li>daily control of the use of consumables, fuel, feed, etc.;</li> </ul>
	<ul> <li>monitoring of the state of the workforce, production, executive discipline;</li> </ul>
	<ul> <li>approval of orders, reports, other primary accounting production documents;</li> </ul>
	<ul> <li>daily timely, high-quality accounting and measurements of work performed.</li> </ul>
	The fate of the foreman's position will be decided depending on the vision of each individual company. After all, an «Agronomist» app (conditional name) may include all the functionality of the «Foreman» app, so the functional responsibilities of the foreman can be transferred to the agronomist-manager (field / line agronomist).
	The functional responsibilities of a foreman that cannot be performed by an algorithm, can be redistributed among other employees, including profile specialists, or fully transferred to the appropriate middle manager.

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«Most of the functionality of HR managers should become the daily work of managers at all levels, starting from foremen. After all, each leader must select staff to create an effective team, create conditions and participate in adaptation activities for beginners, train successors, be able to provide feedback, motivate subordinates to achieve good results and more. That leads to human-oriented management, on one hand, and a reduction in the number of HR employees on the other.»

### Recruitment – what work has already been transferred to robots?

Al performs routine and uniform work in the selection of personnel:

- search and analysis of resumés of specialists from the internet;
- screening to create a «short list»;
- distribution of information about the vacancy;
- processing of inquiries, answers to standard questions from candidates: what is the work schedule? Is there a dress code? Where can information be found about the probationary period?;

- scheduling interviews;
- gathering candidates' feedback after interview;
- help for new employees to adapt.
- In this way, AI expands the search for talent. However, some shortcomings in the work of such algorithms have been identified so far, which leads to the elimination of good enough candidates and discrimination on certain grounds, as AI learns on the basis of analysis of humans' decisions, previous actions and their outcomes.

#### **PROFILE SPECIALISTS**

It is forecast that technology will have a significant impact on the functionality of narrow-profile specialists, in particular, agronomists, veterinarians, zootechnicians, hunting experts and fish farmers, among others. To a great extent, large and medium-sized enterprises are already observing changes in the nature of work through digitalization and automation. They believe that tangible changes may be expected by 2030. On the other hand, due to the slower pace of innovation, small enterprises are not monitoring the current impact of technology and do not have enough information to anticipate significant changes in the functional responsibilities of farm workers. In addition, as the general lack of strategic planning found in the study showed, it is in principle difficult for small businesses to predict changes in a 10-year perspective.

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«An agronomist will no longer have to go to the field every day. Thanks to drones, sensors and AI, they will be able to make control trips two or three times a month.» «Of course, for a vet, drug administration is still a manual process, but taking into account the condition of animals and current treatment, analytics can be automated by means of creating a «file» for each cow («electronic passports» or chips). In this way constant and reliable veterinary control may be provided. This is likely in two or three years.»

This category of employees, thanks to digitalization, will also be given the opportunity to perform some of their duties remotely. The remote format of problem-solving will increase the share of managerial functions within the scope of specialists' profile tasks. Even the emergence of a new professional qualification «field manager» is expected.

A common trend is a widening of the scope of functionality of various professions (universalization of specialists). This includes a combination of the functions of agronomist and cybernetician / engineer / economist / analyst, etc. However, the universalization of narrow-profile specialists will go hand in hand with the deepening of specialization. For example, an agronomist who may already have several professional qualifications (agronomist-researcher, agronomist for plant protection, etc.) may need additional specializations, such as agronomist-GIS, agronomist-mechanic, which ultimately deepen profile knowledge and expand the range of skills.

#### Note

In the future, when all fields are mapped (field passports are drawn up), the need for GIS-agronomists as a separate qualification will disappear, and there will be a demand for precision farming agronomists working with geographic information systems as part of their tasks.



«An example of the synergy of professions is the «agronomist-economist». In addition to the functional responsibilities of an agronomist, such a specialist would make decisions and calculate the economic feasibility of growing specific crops, depending on weather forecasts and market conditions, taking into account economic risks.»

#### Table 7. Change of functional responsibilities of profile specialists

Profession / position	Functional responsibilities that might be changed by the Industry 4.0 technologies
Agronomist	Agronomist is an old profession. Modern agronomists must have the skills needed to use the
Seed agronomist	most advanced technologies, organize agricultural work taking into account changes in climatic conditions, ensure the collection of the biggest possible harvest, while adhering to the principles
Agronomist for plant protection	<ul> <li>controlis, ensure the conection of the biggest possible narvest, while adhering to the principles of sustainability and environmental friendliness. Such a specialist must have not only analytical and managerial skills, but also know the architecture of production processes and GIS, manage unmanned vehicles and more.</li> <li>Functions not subject to automation: <ul> <li>introduces a scientifically sound system of agriculture;</li> <li>rationally uses labour, agricultural machinery, organic and mineral fertilizers, pesticides, plant growth regulators;</li> <li>controls all processes of the cycle of growing crops and makes final decisions based on big data or algorithm conclusions;</li> <li>works with precision farming systems, robotics, unmanned agricultural machinery;</li> <li>participates in certification and rationalization of jobs;</li> <li>monitors workers' compliance with the rules of environmental protection, labour discipline, rules and regulations of labour protection;</li> <li>monitors team's psychological state;</li> <li>organizes training to improve specialist skills;</li> <li>participates in the organization of sales of crop products.</li> </ul> </li> <li>Different potential qualifications: <ul> <li>Agronomist-economist</li> <li>Agronomist-manager / Field agronomist (linear)</li> <li>Agronomist-operator</li> <li>Agronomist-operator</li> </ul> </li> </ul>
Tractor driver/ driver of agricultural machinery	<ul> <li>Agronomist-GMO</li> <li>In a ten-year perspective, manual control of agricultural machinery will remain an in-demand skill, but the proportion of machines that are completely autonomous or operated remotely will increase</li> </ul>
machinery	This will lead to a gradual evolutionary change in functional responsibilities and, accordingly, qualification requirements.
	At the first stage tractor drivers must:
	manage complex high-tech equipment,
	enter variable settings,
	<ul> <li>read and interpret data from the screens of digital devices, monitor the correctness of variable tasks within specified parameters,</li> </ul>
	<ul> <li>diagnose problems and make decisions about troubleshooting on their own or the need to turn to specialists or inform the company's managers;</li> </ul>
	<ul> <li>perform minor repairs of equipment, and / or make changes to software settings (not programming).</li> </ul>
	In the second stage, the functionality of the tractor driver will change so much that the profession will be transformed into something like an «operator of agricultural machinery» (see professional passports).

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«The agronomist has a special application on his tablet, the program «Agronomist», which accumulates and analyses satellite NDVI indices, data from field survey reports, etc. and already has a forecast yield in this field. They only need to go out into the field three times a month.»

Profession / position	Functional responsibilities that might be changed by the Industry 4.0 technologies
Hunting expert	None of the functional responsibilities of a hunting expert will disappear. Their implementation is changing due to the use of new technologies, in particular, improvements in the quality of decision-making based on big data analysis.
	Functional responsibilities to be added:
	drone control;
	<ul> <li>work with «e-traps» and e-feeders;</li> </ul>
	<ul> <li>evaluation of information from simple visual reports (data collected by drones, sensors, thermal imagers, and interpreted by AI).</li> </ul>
Pisciculturist	The profession will be gradually transformed into a professional qualification «operator of a smart fish farm» within the profession «operator of robotic complexes (robotics)», which includes:
	control and maintenance of unmanned vehicles and robotic farms;
	<ul> <li>minor repairs and changes to software settings (not programming);</li> </ul>
	<ul> <li>• evaluation of information from visual reports (data collected by sensors and interpreted by AI);</li> </ul>
	• work with specialized programs and applications for the calculation of norms and composition of feed, management of lighting parameters, feeding, all water parameters, monitoring the condition and development of fish throughout the life cycle.

#### The Case of Myronivsky Hliboproduct (MHP)

In 2019, the private company Myronivsky Hliboproduct (MHP), one of the largest agroindustrial companies in Ukraine, developed its own agribusiness management system Digital Agro Tech MHP (DAT).

The system is aimed at the maximum automation of business processes related to agricultural production, and, consequently, integrates various software products into a single system, including:

- 1. a land use management system contains information about the entire land bank, including current contours of crops;
- a vehicle monitoring system provides information on the location of equipment, what operations it performs, which driver is currently working on the equipment, the amount of work performed, etc.;
- 3. an accounting system contains all the necessary regulatory information, accounting for goods and materials, payroll and more;
- 4. meteorological data;
- 5. an agronomist's app, which includes the following:

• Crops – detailed information on crop rotation for the last known years, field agrochemical passport, technical and economic planning, surveys performed by agronomists during the period of cultivation. It is possible to view weather data from nearby weather stations.

• Measurements – when changing the sowing contour, the agronomist can measure the required area with the help of a tablet and send the measurement data to the appropriate GIS analyst for prompt changes in the sowing contour.

• Surveys – collecting information in the form of photographs and videos, recording information on the state of crops during the entire period of cultivation.

• Materials – tools for agronomists and storekeepers to move materials and goods. All actions take place in real time and are displayed in the «Agronomist app» and in the enterprise accounting system.

- 6. The application enables the management of the composition of goods and materials.
- 7. Reporting system analysis of accumulated information, displayed in graphs and dashboards.

The introduction of the system will change the agronomist's functionality. A new feature is the creation of operational tasks directly in the mobile app: you need to select a field from the list, specify which operation you want to perform, add performers, vehicles and goods in the appropriate amount.

The system provides maximum information and consulting support to agronomists in choosing parameters; for example, it automatically pulls up the equipment assigned to the unit, mechanics working on this equipment, filters the tools needed to perform this operation. Upon completion of the work, the agronomist confirms their implementation.

#### WORKERS' PROFESSIONS

Global research shows that this group of workers is at risk and will be most affected by the introduction of technology, as it is easiest to automate routine / repetitive processes. Only a quarter of Ukrainian agricultural, fisheries and forestry enterprises do not envisage changes in the functionality of this group. Mostly these are small enterprises where the pace of automation of production processes is the slowest. More than 60 per cent of respondents expect changes, significant or insignificant.

Technology will eradicate hard physical labour and dirty work, turning most workers into operators working in tandem with complex systems and machines. Although some handicrafts will remain, the demands on digital and machine-to-machine skills will increase.

Table 8 Change of functional	responsibilities in	working profession	۱C
Table 6. Change of functional	responsionnes in	working profession	13

Profession / position	Expected impact of Industry 4.0 technologies on functional responsibilities	
Milkmaid	<ul> <li>Maintenance of the robotic animal/milking complex:</li> <li>monitoring the correct operation of the equipment when performing the functions of feed distribution and watering, cleaning of animals and livestock boxes, washing and disinfection of devices (eg, milking), control of weight gain;</li> </ul>	
Swineherd Stockbreeder	<ul> <li>identification of animals (ear tag, responder [collar], rescounter [collar, leg mount]);</li> <li>entering information about the animal into the database;</li> <li>interpretation of data on the condition of animals collected in the mobile application using video surveillance cameras and sensors that are analysed by Al/algorithm, which transforms the monitoring of livestock;</li> <li>based on Al data, making decision to call a vet or initiate the «Electronic Vet» (separate robotic complex or integrated into the overall farm system) to implement treatment regimens and veterinary manipulations planned or assigned in accordance with the condition of the animal;</li> <li>granting permission for milking (optional).</li> </ul>	
Farm worker <sup>45</sup>	<ul> <li>Respondents note that the farm will always need manpower (significantly less). But in the era of the Fourth Industrial Revolution, low-skilled workers still need to understand at least at a basic level the principles of production processes and implemented technologies.</li> <li>For example: <ul> <li>to evaluate information from simple visual reports, in particular in mobile apps;</li> <li>to understand the functionality of installed sensors, mobile applications, barcodes, etc.</li> <li>requirements for soft skills of workers in this professional group are also increasing (for more details, see the section «Required skills»).</li> </ul> </li> </ul>	

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«In fact, workers do not need any additional special skills, now or in the future, to work with mobile apps. All modern developments are as intuitive as possible, so that even at the age of 60, after 20 minutes of training, employees become confident users, although before that they had just an analogue phone. A person who has worked on the farm for at least a month will easily understand the app without help, training and instructions. The same situation applies to tractor drivers engaged in loading feed. They have one button in the application that starts the process, and there everything is gradual – unloadingloading, moving, hilling. Using technological innovations should be like playing a game: it's simple, it's fast and it's interesting.»

<sup>&</sup>lt;sup>45</sup> As part of the research, the functional duties of farm workers were studied within the scope of work in small, medium-sized and large enterprises, not households.

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«No exorbitant demands are made on workers. All that a tractor worker has to do is to use the phone (smartphone) confidently and have the minimum ability to understand the information the program provides about the operation of the equipment and make decisions according to the data obtained: fix minor violations or call for technical assistance.»

Profession / position	Expected impact of Industry 4.0 technologies on functional responsibilities
Forester	A forester will be expected to be able to use new technologies:
	<ul> <li>conducting precise forestry on the basis of advanced analytics (including with the use of genetic engineering);</li> </ul>
	<ul> <li>controlling the functioning of closed automated nurseries;</li> </ul>
	<ul> <li>forecasting and monitoring of the state of fire danger, application of fire extinguishing measures (UAVs, satellite schemes);</li> </ul>
	<ul> <li>monitoring conditions and taking measures to control pests and diseases;</li> </ul>
	<ul> <li>conducting a digital inventory of forest plantations (UAVs, remote sensing, RFID-tags);</li> </ul>
	<ul> <li>control of field support tools (mobile devices / sensors located in the forest).</li> </ul>
Fisherman	The functionality of this profession has already been changed significantly by the technologies of Industry 3.0.
	Industry 4.0 technologies will help in the collection and interpretation of data, as well as change the system of monitoring the work of fishermen of the State Fisheries Agency.



# Case. Industrial fishing monitoring system in Ukraine

Monitoring system for commercial fishing in Ukraine

Aquatic bioresource users are required to install a GPS module on board their craft, which allows online monitoring of the movement of all commercial fishing vessels.

«Remote monitoring system for fishing vessels will help minimize illegal fishing by users. After all, immediately after the vessel enters a prohibited area for commercial activities, the fishery patrol will receive an audible signal and the raiding group will arrive quickly. It is currently a pilot project; later, such practices will be introduced throughout Ukraine», said Acting Head of the State Fisheries Agency Oleg Bazduganov

#### NON-CORE EMPLOYEES (SERVICING)

Servicing covers professions/positions that provide/serve the profile area, such as accountants, financiers, economists, marketers, warehouse workers and so on.

It is expected that the introduction of technology will have the most significant impact on the nature of work and employment of this group of workers. There are even predictions that some professions and positions will disappear and that functions that algorithms will not be able to perform will be redistributed among other farm employees or outsourced. Currently, the insufficient development of electronic document management at the state level and the requirements for reporting in paper format protects full-time accountants from mass layoffs, although the entire accounting process can be fully digitalized and automated.

«Even with the transition to software for the financial component of the holding, a reduction in the number of accountants is not expected. This is the result of habit and the age of the employees of regional government agencies who control the submission of financial, statistical and accounting reports. As long as these institutions, together with electronic forms, require paper analogues and additional reporting documents, we will not be able to reduce the number of accountants.»

«The responsibilities and professional tasks of accountants are fully covered and systematized in the software we use.»

«The number of staff required for accounting and controlling financial data will decrease. Previously, it took two or three days for specialists keeping records regarding feed use due to file transfers at the end of the month. Zootechnicians and accountants were also involved. It now takes five minutes per person in the central office. Therefore, a reduction in the number of employees in the implementation of relevant applications is projected, but it will depend entirely on the decision of the relevant managers. You can redistribute these people to other processes.»

«The number of service function performers, of course, will decrease - storekeepers, warehouse workers.»

«After the introduction of the Enterprise Resource Planning (ERP) system, the number of documents and the number of accountants decreased. We are considering reducing the working day for them.»

«Accounting has been significantly simplified and we have already reduced the working day for accountants, but have not reduced salaries.»

«Life has become easier for accountants: data is entered directly from trackers and sensors. That's why there has been a reduction: from the previous seven accountants there will in future be only two or three, at most.»

«Labourer, storekeeper, warehouse manager – maybe these occupations will be combined into one.»

Agro-businesses do not need to hire PR, SMS or advertising specialists (for example, traders fight for the attention of crop producing companies, they do not need to invest much time and effort into looking for buyers), but hunting and fishery that provide leisure services are forced to look for customers/end consumers. Enterprises engaged in berrying, hunting and fishing are developing a stable demand for marketers, social media marketing and public relations specialists.

Hunting farms also consider it necessary to develop a positive image because the public's generally negative attitude to this activity. It is important for berry growers, in turn, to ensure rapid sales of their products, so professional promotion online is an effective tool to increase sales.



«We already outsource services such as website support, social media marketing targeting and public relations.»

Farmers sell their products through video content platforms. The most famous successful example today is the Chinese farmer Jin Guowei, who created the Brother Pomegranate account. In a few years, the number of subscribers increased to 7.3 million, and revenue in 2020 amounted to more than 45 million US dollars. Sales are made during interactive video broadcasts in which the farmer advertises and demonstrates the product, emphasizing the organic nature of production. Delivery is provided by transport companies in e-commerce.<sup>46</sup>

But regardless of the service performed, all the above mentioned specialists are expected to have skills such as in-depth knowledge of specialized programs and the ability to work effectively remotely.

The study did not cover the work of IT specialists, but respondents emphasized the growing demand for them.

<sup>16</sup> Livestreaming Farmers Earn Millions From Fruit on China's TikTok (2021). Bloomberg Wealth. URL: https://www.bloomberg.com/news/articles/2021-07-07/livestreaming-farmers-earn-millions-from-fruit-on-china-s-tiktok

# Table 9. Change of functional responsibilities of non-core employees (service function, with the exception of IT specialists)

Profession / position	Functional responsibilities that might be changed by the Industry 4.0 technologies
Checker/ Record-keeper	70 respondents indicated the position of a record keeper as one that has already lost its relevance (5 of them are large enterprises, 29 medium, 36 small).
	Most of the functional responsibilities have been digitalized and automated through special programs and AI.
	But even now some functions still require human participation in certain tasks. But these tasks are already being redistributed among working accountants, agronomists, repairmen, storekeepers and so on. People running small businesses do a lot of these things, too:
	<ul> <li>control of reception, shipment and weighing of goods and cargoes;</li> </ul>
	<ul> <li>receipt, accounting, storage and issue of tools, spare parts, etc;</li> </ul>
	<ul> <li>support, storage of agricultural goods;</li> </ul>
	<ul> <li>compilation of defective information, repairs, write-offs, shortages and damage of agricultural products and materials;</li> </ul>
	participation in inventories.
Logistics specialist	Changing the nature of logisticians' work under the influence of electronic platforms/software and AI will lead, first of all, to a need to learn to work with Big Data. Logistics processes are increasingly automated and digitized, with minimal use of human labour and paper documents.
	But, despite the significant share of responsibilities that are already performed and will soon be performed by machines, there are still aspects of logistics work that require purely human qualities, such as creativity, professional intuition, and an ability to work effectively with others, namely:
	<ul> <li>determination of enterprise logistics strategy;</li> </ul>
	<ul> <li>making proposals for development of new product markets, choice of supply and marketing channels;</li> </ul>
	<ul> <li>organization of relations with business partners, establishment of economic relations with suppliers, conducting negotiations, concluding contracts;</li> </ul>
	conflict resolution;
	<ul> <li>coordination of interests of various parts of the logistics system;</li> </ul>
	making decisions on the use of cost reduction methods without compromising quality.
	It should be noted that this profession is relevant mainly to large enterprises. But even such companies should keep in mind that thanks to machine learning, the working day of a logistics specialist will be increasingly «curtailed» and will raise questions about the number of such employees in a company.

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«Currently, the Electronic Document Management System (EDMS) is functioning, which automates the process of record-keeping at enterprises with various activities, forms of ownership, size and so on. This resource streamlines the processes of archiving documents, work on business correspondence, citizens' appeals, and internal document management, taking into account the specifics of each form of production, enterprise and organization.»

#### ENGINEERING AND TECHNICAL STAFF

The functionality of this group of staff will not change significantly. The priority will shift from direct repairs to the prevention of breakages and quality diagnosis of possible faults. At present, the company entrusts the repair and maintenance of expensive equipment to service specialists or hires relevant specialists on a short-term basis.

The same respondents who note the expected change in functionality rather mean an increase in the requirements for the knowledge and skills of engineering and technical personnel, rather than any significant changes in their tasks and responsibilities.

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«Conceptually, the functionality of such employees will not change. The equipment we use now is so complex and diverse that within the farm we can perform only current maintenance and eliminate some minor faults, and to repair, for example, drones, they must be transported to servicing.»

«In the near future, the operator will control the process of the combine, more likely remotely, and in some cases will be able to change the appropriate software parameters and perform simple repairs. I think that in order to promptly eliminate equipment malfunctions, the farm will create an operational team or enter into contract with specialists to perform such work.»

«Example. We rent combines, usually together with those who work with them. We do not repair machines and do not employ combine-drivers, so we bear no responsibility for contracted staff. Thus, we rent almost 30 per cent of combines and up to 50 per cent of vehicles. As production increases, the share of outsourcing will increase.»

«Perhaps we will additionally hire one specialist who will maintain all that digital equipment. Companies like ours can afford to hire such a specialist, but small businesses are likely to outsource it.»

#### THE EMERGENCE OF NEW PROFESSIONS47

With technological development, the labour market is changing significantly. The possibilities of «partnership» between people and machines are expanding. Technology is creating new business models, ways of working and experience for employees performing new tasks.

The list of new tasks in the agriculture, fisheries and forestry of the future already includes:

- · automation and digitalization of farms;
- · operation of complex robotic equipment;
- · design and management of complex automated processes of the agricultural complex;
- · development of competitive seed production and selection and breeding work;
- · use of alternative energy sources in agricultural production processes;
- conducting research and development in the fields of biotechnology, computer science and robotics;
- environmental monitoring.

With the emergence of new tasks transformations will occur in the occupational structure of industry:

- the boundaries between working professions and professions that require higher education will blur. For example, in farms equipped with the latest modern complex technology, managers prefer to employ a combine operator-mechanic who has a higher education;
- new specializations are appearing in existing occupations, along with new occupational qualifications. For example, in the profession of agronomist there is already a need for professional qualifications such as «Agronomist-GIS», which in addition to specialized knowledge and skills in agronomy entails some engineering skills (specialty 8.08010105 «Geographic Information Systems and Technologies»);
- some occupations are being combined into one or completely new occupations are emerging, for example, agro-ecologist, urban farmer, precision farming engineer, or 3D food printing engineer.



«In general, all agricultural occupations need new skills. For example, some operations performed by a mechanic or even a handyman require skills in using digital devices, entering certain data into applications, and so on.»

<sup>&</sup>lt;sup>47</sup> One occupation may have several full or partial occupational qualifications. Currently, methodical approaches to distinguishing occupational qualifications (full, partial) within occupations are being worked out and will be formalized in the rollout of activities for obtaining/confirming occupational qualifications. Some occupational passports may lack specific occupational qualifications.





#### **PASSPORTS OF PROFESSIONS**

#### NOTE

As a result of discussions, several occupational passports have been developed to take account of changes in the National Classifier of Professions and include only those skills and knowledge that must be obtained because of the introduction of new technologies. The English version only contains the list of occupations/ professions as professional passports with a detailed description of required knowledge and qualifications emerge in the wake of national sectoral consensus:

- Agrobioenergetician
- Agroecologist
- Agroengeneer
- Agronomist-GIS
- Bioengineer
- City farmer
- Climatic agro-engineer
- · Operator of agricultural autonomous vehicles
- Operator of robotic complexes
- Precision farming engineer



«The task of agro-engineers is to introduce new technologies, and provide efficient and profitable informatization/automation of production. Ukrainian farmers are now waiting for IT projects and innovative technological solutions that will make production processes more efficient and easy to control.»<sup>48</sup>

«Agro-ecologists work on waste disposal, namely the development of principles for the disposal of agricultural waste, as well as soil remediation.»

«The main task of a climatologist is to study the climate of the area, determine the causes of its transformation, predict the effects of climate change. A climate agroengineer must have knowledge at the intersection of climatology, ecology, geophysics, hydrodynamics, geography, astronomy, biogeochemistry, of course agronomy, and research skills and be able to use appropriate professional equipment.»

«City farmer is a person who organizes and maintains agro-industrial farms on the roofs and skyscrapers of large cities. Vertical farms are autonomous ecological constructions that allow you to grow plants and breed animals within the city - the top specialty of the near future.»

«Agro-drone operators must have knowledge of the agrosphere and understand chemistry. I think that in 15-20 years in Ukraine about 90 per cent of fields will be cultivated with agro-drones, because it saves money for farmers.»

«Operators of robotic complexes are already needed. This will eventually include a large number of occupational qualifications that we cannot even predict at the moment. The main task of the operator: monitoring the correct operation of the complex, making sure that the algorithms are followed. Operators make sure that checklists are followed.»

<sup>&</sup>lt;sup>48</sup> Agronomist-geneticist, biohacker or agrocybernetic: which agricultural professions should be mastered now (2021). Contemporary Education Magazine. https://s-osvita.com.ua/magazine/stati-iz-zhurnala/znakomtes-professiya/1522-agrariy





#### **CHANGES IN EMPLOYMENT STRUCTURE**

Opinions of Ukrainian business people on possible staff redundancies were divided. Some believe that only functions and sets of required skills will change, not so much the number of employees; others are already seeing a reduction in the need for workers.

Large and medium-sized enterprises are currently partially offset by expanding production, such as a fourfold increase in the number of animals on automated farms supervised by operators (formerly livestock farmers). In addition, large enterprises have more resources for training and retraining of employees, which allows them to transfer to new jobs.



#### Figure 8. Impact of technologies on staff reduction



In your opinion, will the introduction of technology lead to job cuts?


BLOCK 2

In small businesses, redundancies are not expected for two main reasons. First, with a small staff, workers often already combine the functions of several positions (accountant/lawyer, manager/ agronomist, mechanical engineer/tractor driver and so on); and second, their rate of adopting innovation tends to be slow, which also leads to lower productivity and loss of competitiveness. In addition, small business leaders often live in the same community as their employees, which increases the impact of interpersonal factors on their decision-making.

### Do not foresee job cuts

«It is very difficult to find young workers in a village. We do not have enough staff, so we are modernizing and introducing new technologies and not reducing staff. Every employee undergoes retraining.»

«Software helps to speed up work, and how processes are designed, requiring this or that number of people, depends on management, this is where changes in approach are needed.»

«Well, the camera is watching the animals, but someone has to wipe it every day.»

«We are not planning to cut staff. It is difficult for village manufacturers to compete for young people and high level specialists. We are constantly introducing new technologies and modernizing production and not reducing staff. We try to re-profile each employee.»

«Our company has not yet started implementing high-tech robotic production processes, so redundancies due to automation are not expected.»

«A farmer performs a social function. As long as there is a farmer there will be a village. We have 23 farmers and we provide 50–60 jobs, including seasonal workers.»

«We have introduced new technologies, but we do not make people redundant because we are socially responsible, although it is a bit expensive. But you can always find a task for them to do.»

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### Foresee job cuts

«Let's be honest. I do not need so many people to perform low-skilled work. I don't want to fire them, but there are just not enough tasks for them.»

«The number of employees will definitely decrease, but the requirements on them will increase, their responsibilities will increase. When a person can do the work of 4-5 people it is useful and profitable for the company, but people need to be more responsible.»

«Dismissals will primarily affect manual workers who work in difficult conditions (get up at 3-4 in the morning, work in the mud) and accountants, the need for whom will be reduced from 7 to 2-3 people.»

«Thanks to automation, first of all, the need for seasonal workers will be reduced, but full-time workers are not threatened at all.»

«Workers who performed routine tasks will become unnecessary. But there will be a need for people to perform new operations and processes that emerge as a result of the introduction of technology.»

«Until 2011, when the climate system and new technologies for growing plants on mineral wool were introduced, 10–12 vegetable growers worked per 1 ha; after the introduction, the number was 8 people per 1 ha. The European trend is a maximum of 5 people per 1 hectare. There were also operators of automated systems. The number of tractor and vehicle drivers has decreased, and accountants have well nigh disappeared, while qualification requirements for employees have increased. Out of the former 700 people, 500 are still employed.»

The fastest rate of replacement of human labour is expected in animal husbandry, in which the introduction of technological solutions has been intensive, in contrast to fishing and hunting, which are activities with the lowest rates of digitalization and automation. In hunting, however, technology is more likely to help with staff shortages: currently the majority of working hunters are «young retirees». «There is a lack of staff, so there is no one to fire.» A significant share of enterprises in fisheries are state-owned and lack funds for the implementation of costly technological solutions.

# Em Nev

### Employee of the future in agro. New farm: will humans disappear?



The new farm is a large robotic and automated complex / set of complexes filled with all kinds of robots and sensors, where the processes of feeding, cleaning and milking take place almost without human intervention. The milkman controls the robot – in fact this person is a computer operator. Automation of the milking process provides better sterility when collecting milk than manual milking.

Creating such a farm is a big investment project. Robotic farms allow fewer people to serve more cows. The old farm was a home for 180 cows, and the new (automated) farm we are currently building will house 750 dairy cows taken care of by about 30 employees. In this case, the number of people employed on the farm remains almost unchanged, but the volume of milk produced increases 10 times.

Robotics and automation define the future of farming. However, in my opinion, people will still be needed, at least for equipment monitoring and decision-making in case of malfunctioning or animal sickness. However, the number of staff will decrease and qualification requirements will increase.

Daria Dranovska, HR Director, Department of Agricultural Production Head office of ERIDON LLC Among the different categories of staff, the following predictions can be made:

- Seasonal workers will be the first to suffer from the introduction of technology, as most of them are involved in low-skilled manual labour. Fruit picking robots are already used in Ukraine (picking fruit is a task that requires fine motor skills), as well as sorting robots. Because most seasonal workers are residents of rural communities, job cuts can also significantly affect the well-being of residents of villages and settlements, and rising unemployment can have significant negative social consequences. These include higher crime rates, increasing social tensions, increases in physical and mental illness, reduction of labour activities and the devaluation of education.
- 2. The next category of staff whose jobs are threatened by digitalization and automation are low-skilled workers, including livestock workers, who are being replaced by robotics operators and handymen, some of whom are, for example, gradually being replaced by cleaner-robots.
- 3. The most protected are top managers who determine the company's development strategies. The number of middle managers will be reduced. To remain compatible on the labor market they are expected to have some understanding of technological innovations, including the whole process of implementing a new technological solution and to be able to address relevant staffing issues, including staff qualifications, working with new equipment or new software. Cutting such personnel will occur because monitoring and analytical tasks can be done by AI and algorithms. At large and medium-sized enterprises, management functions will also be redistributed among narrow-profile specialists, including agronomists and zoo engineers. In small enterprises, most managerial tasks are already performed by the manager and middle management is absent as such.
- 4. For narrow-profile specialists, the introduction of technologies will have ambiguous consequences. A slight increase in the number of this category of staff will be due solely to increasing production and expanding the range of production processes. This will significantly increase the level of skills required, especially motivation and the ability to learn continuously. In other cases, there will be a tendency to reduce the number of staff in this category by increasing the size of land plots or number of animals that one specialist is responsible for, aided by technological solutions or outsourcing.
- 5. Big business will expand its IT staff mostly to increase digital security and ensure correct operation of the complex systems, as well as invest in R&D to develop individual digital solutions based on its own AI or blockchain technology. Small businesses, on the other hand, will rather hire such specialists through outsourcing and only to service the purchased ready-made solutions.
- 6. An increase in the number of engineering and technical personnel is not expected, as the equipment is so expensive and complex that it requires maintenance in specialized service centres, and increases the qualification requirements for mechanics capable of troubleshooting or resetting some software parameters directly in the field. At present, machine operators prefer to transport agricultural machinery to service centres because of their unwillingness to take responsibility for expensive equipment.
- 7 Digital technologies pose the least risk to full-time creative professionals (marketing, design, advertising, etc.), who will need to be able to analyse Big Data for detailed study of target groups and ultra-precise targeting. However, the main reason for the lack of expected changes in the number of workers in this category is that there are as yet few of them in large

enterprises of agriculture, fisheries and forestry and virtually none in small enterprises. These tasks are in most cases outsourced or do not feature at all.

Specialists in services departments (accounting, HR, lawyers and so on) will feel the impact of digitalization and automation in different ways. Thus, most companies need one accountant after the transition from paperwork to using software, but generally the need for accountants is disappearing. However, the transition to even 1C for small businesses is often difficult and perceived as a significant achievement, raising questions about the level of digital skills development in rural communities. In addition, in small enterprises, the function of ensuring compliance with current legislation is often performed by an accountant, not a lawyer, because small businesses cannot afford to have one in staff permanently. In addition, for the foreseeable future the procedures for current primary documentation processing and reporting to regulatory authorities are required]. The low pace of digitalization of documents processing (implementation of the state program of a «state in a smartphone» for businesses) in reality means that specialists must spend at least a day filing reports [traveling to district or regional centres and waiting in line], which is especially problematic for companies located in remote areas.

Large and medium-sized enterprises point to the possibility of reducing the number of finance specialists and economists, whose functions will be transferred either to agronomists-economists or analysts able to develop appropriate business strategies based on digital data. In addition, small and medium-sized enterprises point to the possibility of completely shedding staff with such functions and the sharing of one such specialist by several enterprises through outsourcing/ employee sharing, which will of course lead to job cuts.

As for HR, they are not currently threatened with mass layoffs, especially given the difficulty of finding qualified staff and the imperfections of artificial intelligence-based recruitment programs. However, international studies have indicated the threat to such positions or their significant transformation by way of the transfer of recruitment to AI or production managers.

In general, companies are aware of their social responsibility and impact on the lives of communities as employers, so they do not view the optimization of staffing and reduction of the cost of wages and social benefits as a benefit of innovation. However, they naturally prioritize increased profits and are not prepared to retain unneeded labour. The main advantage of digitalization and automation to companies is the reduction of human influence on production processes, and representatives of enterprises emphasize that they do everything possible to preserve existing jobs and create new ones.

#### Not

Many companies that mentioned they might make 20–50 per cent cuts have only a few employees in the relevant groups. For example they might say, we will cut 50 per cent of service workers, which in reality may mean that they will need only one accountant instead of two (small business). Thus, when we forecast employment reductions of 50 per cent it does not signify mass unemployment.

# Scenario I

**Scenario I** was developed taking into account the slow pace of digitalization and automation of production processes in agriculture, forestry and fisheries.

According to this scenario, by 2030, large enterprises will remain the flagships of the introduction of Industry 4.0 technologies. According to data from the Main Department of Statistics such enterprises employ 5.6 per cent of all employees in this sector. Staff cuts by 2030, according to experts, can be estimated at 10–30 per cent of the current number of full-time employees of large enterprises.

Medium-sized enterprises will also invest in technology, albeit more modestly than big business. According to the Main Department of Statistics 55.7 per cent of all employees in the industry are employed at medium-sized enterprises. Roughly 5–15 per cent of the staff may be made redundant in the future.

Small businesses will lag behind large and medium-sized enterprises in terms of technology adoption due to lack of resources and development strategies. Under such a trend, it is predicted that 5–10 per cent of staff will be cut by small enterprises. Currently, 38.7 per cent of all employees in the industry are employed in small enterprises.

Separately, it should be noted that a significant reduction of seasonal workers is predicted. Today there are 2.11 million of them (out of 2.72 million employed in agriculture, forestry and fisheries, of whom only 610,000 are full-time employees). In this scenario the reduction of seasonal workers is predicted at a rate of 50–60 per cent.

Considering the relative share of employees in large, medium and small enterprises, we can estimate the predicted percentage of dismissals according to the first scenario (Table 1).

	Share of employees in the total number employed in the industry	Minimal expected shedding of employees	Maximum expected shedding of employees	
Large	5.6%	10%	30%	
Medium	55.7%	5%	15%	
Small	38.6%	5%	10%	
Minimum percentage of workers shed according to the first scenario: 0.056*10% + 0.557*5% + 0.386*5% = 5.27%				
Maximum percentage of employees shed according to the first scenario 0.056*30% + 0.557*15% + 0.386*10% = 13.9%				

# Table 1. Scenario I (slow pace of digitalization and automation of production processes in agriculture, forestry and fisheries)

In absolute numbers, the number of full-time employees will decrease: From  $610,000 \times 5.27\% = 32,000$  to  $610,000 \times 13.9\% = 85,000$  workers by 2030.

The number of seasonal workers will decrease:

from 2.11 million x 50% = 1.055 million to 2.11 million x 60% = 1.13 million workers by 2030.





**Scenario II** (was developed taking into account an accelerated pace of digitalization and automation of production processes in agriculture, forestry and fisheries.

It is assumed that medium and small enterprises will reorient themselves to the technologies of Industry 4.0 and will be able to actively implement them, which will lead to a 30–55 per cent reduction of staff for medium enterprises and 30–50 per cent at small ones.

According to the accelerated scenario, a 60-80 per cent reduction of seasonal workers is predicted.

	Share of employees in the total number employed in the industry	Minimal expected shedding of employees	Maximum expected shedding of employees		
Large	5.6%	30%	50%		
Medium	55.7%	30%	55%		
Small	38.6%	30%	50%		
Minimum percentage of employees shed according to the second scenario 0.056*30% + 0.557*30% + 0.386*30% = 30%					
Maximum pe	rcentage of employees s 0.056*50% + 0.557*55%	hed according to the sec 6 + 0.386*50% = 52.74%	cond scenario		

# Table 2. **Scenario II** (accelerated pace of digitalization and automation of production processes in agriculture, forestry and fisheries)

In absolute numbers, the number of full-time employees will decrease from  $610,000 \times 30\% = 183,000$  to  $610,000 \times 52.74\% = 321,700$  workers by 2030.

The number of seasonal workers will decrease from 2.11 million x 60% = 1.13 million to 2.11 million x 80% = 1.69 million workers by 2030.

Nevertheless, it should be remembered that some specialists will remain in demand, only the form of employment will change. For example, the share of outsourcing will increase.

In addition, demographic changes should be taken into account. According to the research done by the Institute of Industrial Economics of the National Academy of Sciences of Ukraine, the reduction in labour supply in agriculture, forestry and fisheries calculated based on the methodology of a shift in age-related life expectancy coefficients amounts to -26 per cent (-789,000 people) from 2019 to 2030. [Methodological approaches to impact assessment of digitalization on the demand and supply of jobs. Scientific report note. Institute of Industrial Economics of the National Academy of Sciences of Ukraine. 13 p.].<sup>49</sup>

O. Yashkina, Doctor of Economics, professor, Odesa Polytechnic National University

<sup>&</sup>lt;sup>49</sup> After the end of the war, the results of the genocide policy conducted in Ukraine by Russia since the beginning of the invasion on 24 February 2022, as well as mass migration should also be taken into account.

## CHANGING FORMS OF EMPLOYMENT

Today, automation and digitalization are clearly factors in the significant increase in the share of atypical forms of employment, as well as the emergence of new forms.

BLOCK 2

The International Labour Organization (ILO) does not yet provide a clear definition of atypical employment. The transformation of standard formats of labour relations and permanent employment into non-standard and unstable forms, accompanied by a weakening of the protection of workers' social and labour rights generally comes under the heading of «precarious» (dubious, dangerous, risky, unguaranteed, unstable) employment.<sup>50</sup>

There is no official definition of non-standard forms of employment (NSFE). Typically, this status is considered to cover work arrangements that fall outside the realm of the standard employment relationship, understood as work that is full time and indefinite, as well as part of a subordinate, but bilateral, employment relationship. The ILO considers the following employment arrangements to be non-standard: (i) temporary employment; (ii) contractual arrangements involving multiple parties, including temporary agency work; (iii) ambiguous employment relationships, including dependent self-employment and disguised employment relationships; and (iv) part-time employment (ILO, 2015a, 2015b).<sup>51</sup>

Of course, not all atypical forms of employment are inherently adverse for workers. For example, part-time work is seen as a means of integrating young people, the elderly and the disabled into the world of work, as well as those who need to combine work with unpaid care work (taking care of family members), which is still largely performed by women. It is important to note that in countries in which mechanisms are in place to prevent permanent precarious employment, temporary work is not perceived as an intrinsically vulnerable situation.<sup>52</sup> Recent research also shows that under certain conditions (self-discipline, availability of resources, tools and opportunities for a normal workplace) remote/distant working allows people to achieve a better work–life balance without loss of productivity and ensures better performance of family responsibilities (unpaid care work).<sup>53</sup> In total, in the wake of the pandemic, two-thirds of the world's workers want to be able to work from home, aided by technology; another third would be ready to change workplace if their employer does not show flexibility and forces them to return to the office for a full working week.<sup>54</sup>

However, most atypical forms of employment pose a threat to both individual workers and the state. Workers may be deprived of paid annual leave, paid weekends and holidays, paid sick leave, health insurance, overtime pay, the right to join a union and employment contract coverage, bonuses, and more. Often, such workers receive much lower wages; work in the worst conditions without compliance with labour protection standards, which increases the risks to health and safety; and lack pension provision.

<sup>&</sup>lt;sup>50</sup> FES-Ukraine (2011): Non-standard employment in Ukraine: social risks and counter-strategies of trade unions; available at: http://www.fes.kiev.ua/new/wb/media/publikationen/2-finalnij%20maket%20Nestandartna%20zanyatist.pdf

<sup>&</sup>lt;sup>51</sup> ILO (2015): World Employment and Social Outlook: The changing nature of jobs; available at: https://www.spcr.cz/images/MO/wcms\_368626.pdf

<sup>&</sup>lt;sup>52</sup> Dudin, V./Popovich, Z. (eds) (2017): Atypical employment and precarization of labor in Ukraine. Kyiv: Center for Social and Labor Studies: 69; available at: https://rev.org.ua/wp-content/uploads/2017/12/Atypical-Employment\_Brochure.pdf

<sup>&</sup>lt;sup>53</sup> McKinsey & Company (2021): Getting hybrid work right: What employees are saying; available at:

https://www.mckinsey.com/about-us/covid-response-center/mckinsey-live/webinars/getting-hybrid-work-right-what-employees-are-saying <sup>54</sup> World Economic Forum (2021): Home or office? Survey shows opinions about work after COVID-19; available at:

https://www.weforum.org/agenda/2021/07/back-to-office-or-work-from-home-survey/

In addition, employers are reluctant to invest in the occupational development of temporary staff, which limits career opportunities. Forced underemployment or informal employment are also usually associated with low income, as well as increasing poverty, social inequality and anxiety in the face of high labour market volatility due to feelings of instability and insecurity, the constant threat of unemployment or underemployment. Other problems include alcoholism and other addictions, deterioration of the nation's health, and hence a growing burden on the medical system, increasing crime, rising state expenditure on social benefits, reducing productivity; as well as insufficient investment in human capital, leading to a loss of global competitiveness.

Therefore, poor quality employment and a failure to ensure decent work hamper a country's socioeconomic development.<sup>55</sup> That is why most researchers interested in the effects of the Fourth Industrial Revolution on labour markets occupy themselves with this question.

Non-standard forms of employment include, in particular, employment as a temporary worker; secondary employment; employment on the basis of a civil law contract; remote employment; agency work (staff leasing, outstaffing, outsourcing); informal employment and others.

Although atypical forms of employment are not expected to explode in the near future, with most workers switching to fixed-term, part-time, day or intermediated work, there has been a rapid spread of such forms of employment in a number of industries and occupations in which they did not previously exist.<sup>56</sup>

According to the surveyed enterprises, the same tendencies characterized by a falling share of standard employment and an expansion of the range of forms of non-standard employment will be observed in Ukrainian agriculture, fisheries and forestry.

<sup>55</sup> FES-Ukraine (2011): Non-standard employment in Ukraine: social risks and counter-strategies of trade unions; available at: http://www.fes.kiev.ua/new/wb/media/publikationen/2-finalnij%20maket%20Nestandartna%20zanyatist.pdf

<sup>&</sup>lt;sup>56</sup> International Labour Office (2017): Non-standard forms of employment. Analysis of problems and prospects for solutions in different countries. Overview version. Geneva; available at: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms\_554952.pdf

	2011-2020	2021	2021-2030	Тренд
Permanent contract (standard employment)				¥
Short-term contract				$\mathbf{\Psi}$
Job sharing				1
Employee-sharing				¥
Out-staffing and staff leasing				1
Remote working				1
Outsourcing				1

### Figure 9. Prevalence of some forms of standard and non-standard employment, %

From 10% to 30% From 30% to 50% Over 50%







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### PERMANENT CONTRACTS (STANDARD EMPLOYMENT)

Hitherto, this has been the most common employment format in agriculture, fisheries and forestry in Ukraine. For all categories of staff, except seasonal workers, companies use the standard practice of permanent employment after a probationary period.

Regardless of size of enterprise and economic activity, the surveyed business people did not openly declare their intention to abandon standard employment, although they foresaw a possible reduction of workers working on permanent contracts. This is partly due not so much to the reduction of jobs through automation, but to the economically justified desire to optimize enterprise costs, in particular to reduce taxes and social benefit contributions.

«Labour relations will become more flexible.»

«Already, there are pig farms that have switched to shift work. From 7.00 to 19.00 people work for two weeks, two weeks off.»

«A 40-hour work week is our headache, just like an 8-hour work day. My tractor driver doesn't sow for 40 hours. It may be that he sows for three days from dawn till dusk. If the rain starts pouring, he has to wait for better weather, sometimes for a long time and then finish sowing before the cold. We don't have a drone yet to do this job.»

«I want a person to come and work, to pay their wages by online transfer [not cash], fill out the form  $\mathbb{N}^{\mathbb{P}}$  1DF (ed. a tax category), and then let the state deal with the rest. This is how non-residents work in Poland. All by agreement. If I follow official procedures, I have to wait for two weeks for the employee, then I do the certification, then it's hard to fire them when the work has been completed.»

Experts warn against too wide deregulation («liberalization») of labour legislation in view of the socio-economic consequences for the state described above.

One of the factors in this context that will determine the intensity of the decline in sustainable employment will be the result of the political debate on changes to Ukraine's Labour Code.

Currently, Ukraine is deregulating («liberalizing») labour relations with a loss of social guarantees for workers in the guise of labour reform. Draft Law № 5371 provides for the division of workers into several categories according to the level of protection of their rights by labour legislation. The proposed simplification of the regulation of labour relations in the field of small and medium-sized enterprises contravenes the Ukrainian Constitution (Articles 22, 36, 43, 92), as well as international acts ratified by Ukraine: the EU–Ukraine Association Agreement (Articles 296, 419, 420), the European Social Charter (revised) (Article 24), ILO Convention No. 135 on the Protection of the Rights of Workers' Representatives and Opportunities (Articles 1, 2),

Note

ILO Convention No. 58 on Termination of Employment at the Initiative of the Employer (Articles 1, 4, 13) and Council Directives No. 98/59/EC on the approximation of the laws of the Member States relating to collective redundancies; No. 2003/88/EU on certain aspects of the organization of working time; No. 2019/1152 on transparent and predictable working conditions in the European Union; and ILO Recommendations No. 166 on termination of employment at the initiative of the employer and No. 189 on job creation in small and mediumsized enterprises.

Standpoint of Ukrainian trade unions

### SHORT-TERM CONTRACTS

Temporary employment has always been common in those sectors of the economy that are characterized by seasonal fluctuations in labour demand, especially agriculture. This form of labour relations is not typical of hunting, fisheries and forestry; most temporary workers are engaged in crop production in seasonal jobs.

BLOCK 2

Most often, fixed-term contracts are offered to low-skilled workers, and there is a sufficient supply due to limited opportunities to find permanent work in particular areas. Preference is given to hiring the same seasonal workers every year, because they are guaranteed to have the necessary skills and are familiar with the company.

In future, it is expected that the demand for seasonal workers will decrease due to partial or full automation of production processes (at some enterprises), and therefore the share of this labour relations format will decrease. The effects of job losses will be mitigated by another trend that will only intensify, the migration of rural people to cities, which will also lead to an outflow of young labour.

It should be noted that accelerating the pace of automation in developed countries will reduce the demand for Ukrainian labour for seasonal work abroad, which will narrow the economic opportunities of some households.

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«Generally, I might need different number of employees per season, from around 5% of the number of permanent employees to additionally 100-300 people to perform field work. If I am lucky, I am able to hire about 30 per cent of seasonal workers who worked for me in previous years.»

### **OUTSOURCING AND EMPLOYEE SHARING**

The introduction of technology makes outsourcing inevitable, especially for small and mediumsized enterprises, which cannot afford to retain all the necessary narrow-profile specialists.

In addition to the transfer of service functions, such as accounting, cleaning, catering, PR, carrier and logistics services, marketing, design and other services, there is a growing demand for highly qualified professionals to solve specialized IT problems, create customized products and solutions, and ensure maintenance of complex systems, equipment and mechanisms. For example, outsourced specialists provide maintenance of drones, electronic feeders, photo traps on hunting farms, and electronic hunting and forestry maps are being developed.

«There are already consultant-zootechnicians who serve several farms: they check the situation, give their recommendations, for example, on the calculation of feed and the composition of nutrients, as well as animal care. I think that in future everything related to zootechnics will be outsourced. Retaining a high-quality specialist with experience will be economically inefficient. In addition, for zootechnicians it is an opportunity to constantly improve their skills, because working with 20 farms they are constantly learning, getting acquainted with new technological solutions, and farmers will benefit from this. The same can be said about veterinary medicine. It's like developing a business consulting segment.»

 ${\it «If}$  necessary, we hire organizations that provide drones and their management services.»

One interesting trend is the interest of small and medium-sized enterprises in creating a database or register of narrow-profile specialists needed by agriculture, forestry and fisheries on a regional basis. Thus, several individual companies can agree to hire one specialist, so the specialist is provided with sufficient work and income, and companies are able, on one hand, to avoid overpaying for specialist work, attracting them only for the time needed to perform the tasks. On the other hand, retaining an experienced specialist who is fully acquainted with the enterprise removes the problem of finding a person with appropriate qualifications to perform complex specific tasks. Currently, accountants work in a similar way, providing services for several companies or organizations. Respondents feel the urgent need to cooperate in such a way with narrow-profile specialists. Such a register could be maintained by the State Employment Service. By the way, the term "employee sharing" describes when such employees are registered as part-time at several enterprises.

### **OUTSTAFFING AND LEASING OF PERSONNEL**

**Outstaffing** is the replacing of employees from one company with the legal registration of employees of another company for further use of their work, changing only the number of jobs, not the nature of work. Such a scheme can be used to reduce employees' social package and bonuses, to change the wage scheme or transfer employees from permanent to fixed-term contracts.

**Leasing** involves a company giving other companies the opportunity to hire their employees (often highly qualified specialists) for a certain period of time to perform specific tasks. However, the term also includes the activities of intermediary companies (private employment agencies, recruitment

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Figure 10. Share of interviewed enterprises that outsource staff, %

Figure 11. Share of tasks that have been or will be outsourced, %



agencies), which formally hire employees and then provide their services to customer companies. Thus, the latter are not in an employment relationship with such employees, significantly limiting the range of their responsibilities. This labour relations format differs from outstaffing in that when the relationship between the customer company and the employee is terminated, the employment relationship with the lending company is terminated.

As according to the current legislation a person may not be the subject of a leasing relationship, instead of the term «staff leasing» the term «staff representation» is used. In fact, leasing companies of this type are practically non-existent.

The spread of such forms of employment in the future by firms in agriculture, forestry and fisheries in Ukraine is not expected. This is a positive trend. Outstaffing almost always worsens the situation of employees, and such agencies do not invest in training/retraining, shifting such costs onto the workers themselves.

«Leasing» of workers is a normal practice at «peak» periods, whether harvesting or sowing, when an agricultural enterprise seeks help. In Ukraine, this is generally associated with cooperatives.

Outstaffing is mainly used during the implementation of a project. Having said that, if the project goes well, an employee may be transferred to the staff. Use of such schemes is to some extent due to the bureaucratic processes involved. A project contract is only rarely concluded for 1-1.5 years, when outstaffing is resorted to in order to complete a project. In such cases, contracts are traditionally fixed-term, but may be extended.

### **JOB SHARING**

This approach is not currently in demand among Ukrainian employers in agriculture, forestry and fisheries, and no significant development of this format is expected in the future.

**66** |

«We are not in Neatherlands.»

### DISTANCE WORKING

The Covid-19 pandemic has accelerated the spread of this form of employment and the development of new skills by workers, such as digital-based teamwork, where everyone works remotely, albeit together. In this case, employees' employment status (full-time, part-time) does not change due to changes in working methods.

This form of work has already become the new norm in IT and may in future also change the work of managers, accountants and analysts. It is expected that distance employment will remain the prerogative of highly skilled intellectual workers. Respondents believe that agriculture, by contrast, does not offer significant opportunities for remote working. Even agronomists and business owners, who can at any time read data on the progress of work or data collected by GIS in special applications, do not consider the remote format as relevant.

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«I get up in the morning and immediately check all the data from the fields and the status of work in the app.»

The International Labour Organization emphasizes that it is important not to limit diversification of labour relations formats and forms of employment, but to ensure that all work corresponds to the concept of «decent work.»

«Governments and social partners must work together to ensure decent work, support the effective transition from non-standard to standard forms of employment, promote equality and non-discrimination, provide social security guarantees for all workers, secure jobs and freedom of expression. Unification and realization of the rights to conduct collective bargaining, increase the efficiency of labour inspections, solve the problems of unstable forms of employment and protect fundamental rights in the field of labour.»

International Labour Organization<sup>57</sup>

<sup>57</sup> International Labour Office (2017): Non-standard forms of employment. Analysis of problems and prospects for solutions in different countries. Overview version. Geneva; available at: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms\_554952.pdf

# BLOCK 3

Level of education and skills in the world of work 4.0

### **EDUCATION**

How should we educate and train children and young people for occupations and positions that do not yet exist? Interest in Industry 4.0 at the global level has put the issue of the dependence of economic development on the results of education and training of young people at the top of the agenda.<sup>58</sup>

Globally, the development of technology is increasing the demand for higher education, which is designed not only to provide deeper knowledge, but also to develop analytical thinking and expand people's worldview, enabling them to navigate in a rapidly changing world. For some time now, the proportion of job vacancies that require higher education has been growing.

#### Note

The European Commission expects that by 2025 almost half of all vacancies in the EU will require specialists with higher education, and recommends that higher education institutions adopt innovative approaches to remain relevant in the knowledge-based economy. Some recommendations to Member States emphasize the need to strengthen the correspondence between the content of higher education and the skill requirements of the workforce in today's economy. One of the ways to achieve this goal is the continuous renewal of educational programmes and the integration of vocational education and training into higher education.<sup>59</sup>

However, in Ukraine, where the level of higher education coverage is one of the highest – over 80 percent<sup>60</sup> – employers' level of dissatisfaction with graduate training is also high. There is little obvious relationship between higher education and increasing worker competitiveness (or quality of life). Thus, according to some studies, almost two-thirds of Ukrainian employers are dissatisfied with graduates' lack of practical skills.<sup>61</sup>

<sup>38</sup> CEDEFOP (2012): Preventing skill obsolescence - Rapid Labor market changes leave too many workers at risk of losing their skills. Briefing note; available at: https://www.cedefop.europa.eu/files/9070\_en.pdf

<sup>59</sup> European Commission (2016): European Semester: Country Reports and Communication; available at: https://ec.europa.eu/info/publications/2016-european-semester-country-reports\_en

<sup>60</sup> Strategy for the development of higher education in Ukraine for 2021–2031 (2020); available at: https://mon.gov.ua/storage/app/media/rizne/2020/09/25/rozvitku-vishchoi-osviti-v-ukraini-02-10-2020.pdf;

<sup>61</sup> Buchynska, O.V./Davlikanova, O.B./Lylyk I.V., Chaikovska A.B. Kyiv: Friedrich-Ebert-Stiftung in Ukraine (2020): https://mon.gov.ua/storage/app/media/rizne/2020/11/10/Dualna\_2\_2%20edit%206-11.pdf

	Workers	Employees in other departments	Engineer and technical personnel	Agricultural specialists	Management
Higher education			0.71	0.63	0.82
Pre-tertiary education (college)		0.54	0.43	0.42	
Vocational education and training	6	0.48			
Educational level is not important, experience is a decisive factor	0.92				

# Figure 12. Education level and level of qualifications expected in the perspective till 2030 by personnel groups, share

#### lote

The level of higher education coverage in Ukraine is high, at 82.7 per cent. In the Global Innovation Index 2020 Ukraine was ranked fourteenth out of 131 countries, well ahead of Germany (70.2 per cent, 28th place) and the United Kingdom (60 per cent, 46th place), well above the OECD average and many others.

At the same time, according to the Skills component of the Global Competitiveness Report 2019 (estimates the level of training of the current workforce in the country), Ukraine ranks 44th in the world with an index of 69.9; furthermore, as regards the proportion of graduates in Ukraine with the skills needed for the contemporary labour market to work the country ranks 54th with an index of 54.5, significantly behind Germany (13th place, 68.4) and the United Kingdom (29th place, 62.3).<sup>62</sup>

According to the statistics of the Ukrainian State Employment Service, in the first half of 2019, 49 per cent of the registered unemployed had higher education. The unemployment rate in the past five years among people who have completed higher or basic higher education, or who had entered by failed to complete it, was in the range of 7–8 per cent, 13.7–16.3 per cent and 7–9 per cent, respectively.<sup>63</sup>

Some 34.51 per cent of young people work in jobs that require a lower level of education and qualifications than they have.<sup>64</sup>

<sup>&</sup>lt;sup>62</sup> Strategy for the development of higher education in Ukraine for 2021–2031 (2020); available at:

https://mon.gov.ua/storage/app/media/rizne/2020/09/25/rozvitku-vishchoi-osviti-v-ukraini-02-10-2020.pdf

<sup>&</sup>lt;sup>63</sup> Mismatch between higher education supply and the labour market demand in Ukraine: analytical note (2020). Analytical note. »Social Policy« series, No. 14/2020; available at: https://niss.gov.ua/sites/default/files/2020-02/analit-yatsenko-social-policy-14-2020.pdf

<sup>&</sup>lt;sup>64</sup> Government Institute of Family and Youth Policy (2019): Youth on the labour market: 21st century skills and career building. Annual report to the President of Ukraine, the Verkhovna Rada of Ukraine, the Cabinet of Ministers of Ukraine on the situation of youth in Ukraine. Kyiv; available at: https://mms.gov.ua/storage/app/sites/16/Mizhnarodna\_dijalnist/shorichni\_dopovidi/shorichna-dopovid-pro-stanovishe-molodi.pdf

Ukrainian employers in agriculture, forestry and fisheries will in future expect higher education from managers, as well as higher or at least occupational education or training from engineering and technical staff, specialists and people those who perform service functions. It is enough for ordinary workers to have vocational or even secondary education. Although experience in general is important for all staff groups, ordinary workers are the only group, according to respondents, for which having only practical experience without appropriate education is sufficient. Only 4.3 per cent of respondents pointed to the importance of higher basic education for workers, explaining this by the high level of automation and the complexity of the equipment that workers have to operate.

In general, the qualification requirements for employees from all groups and demand for soft skills will increase. The main ones are a desire to work, an ability to learn lifelong, responsibility, initiative, ability to pursue self-development, self-motivation and so on (see next section «Skills of the Future» for details).

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«Higher education is the basis for the profession, although it does not guarantee that an employee is highly qualified.»

«If people have higher education, it is easier for them to learn something new.»

«For narrow-profile specialists (agronomists), a diploma is important, because they must have at least basic theoretical knowledge. But education must be obtained in parallel with getting practical experience (real work). This will give young people the opportunity to really decide on a career path and follow technological innovations.»

«It takes six months to train a specialist. But if they do not have specialized knowledge, there is no place for them at any agro-enterprise.»

«In general, there is no value in education. If a person without vocational education comes to us, after a year they will know more than someone who has a diploma (ed. – but no practical experience). The most successful vets and zootechnicians were students who had been working starting from the second or third year, so they were studying and simultaneously performing their duties at the workplace.»

«By 2030, education will be closer to practice due to dual education. Young people should immerse themselves as early as possible in the content of real work. Being on production sites should be part of education: people must learn from the inside and learn the most applied things. Dual education gives an understanding the vinside of the kitchen< – an understanding of the business logic of the enterprise – what it does and why, and this knowledge and skills are universal.»

«Vocational education should be organized as distance learning, because it is important to gain experience in the workplace.»

«Lifelong learning is a priority for adaptation to rapid change; the main thing is to «learn how to learn».»

### **SKILLS OF THE FUTURE**

Technological progress has always led to the obsolescence of hard skills, namely the skills essential for effective performance in the current role. In addition to hard skills there are soft skills based on personal qualities, such as leadership, responsibility, communication and others.

With the acceleration of automation and the introduction of artificial intelligence, the focus has shifted to the development of soft skills. Machines have begun to do some work better than humans. But skills such as communication, creative thinking and management skills have only increased in value. Enterprise competitiveness increasingly depends on people's ability to adapt to change and to engage in lifelong learning: to determine their own vector of development and learn new things on their own to help businesses create new products and stay ahead of competitors. Employees' versatility in respect of flexibility of thinking and the ability to quickly learn new knowledge and skills is the key to business success and stability in modern conditions, with its insane speed of change and daily hyper-increase in the growth of information.

A study by the McKinsey Global Institute<sup>65</sup> looked at changes in employment patterns through the proliferation of automation, artificial intelligence and robotics, as well as skills needed to stay competitive in the job market: critical thinking, problem solving, active learning, resilience, flexibility and more.

According to a study by Accenture and Qlik, 74 per cent of employees experience discomfort when working with data, which leads to lost productivity.<sup>66</sup> The cost to different economies is significant: \$24 billion in Germany and \$13 billion in the United Kingdom.

According to a World Economic Forum report on the future of jobs, 50 per cent of all employees will require retraining by 2025 to gain skills in new technologies.<sup>67</sup> For 40 per cent of employees such training will last six months, which means significant costs for companies and national economies.

For employees who remain in their positions, the share of professional skills that will change by 2025 is 40 per cent.

In recent years, the possession of digital skills has increasingly come to the fore as an additional advantage when hiring professionals.

> «Today we want to buy a new combine harvester for 5-7 million. But who will you get to operate it? We do not have employees with the appropriate skills to operate such complex equipment. Well, we shift people among partner farms to raise their qualifications, but they have the same obsolete equipment. So where to learn how to work with new technologies?»

McKinsey & Company (2021): Defining the skills citizens will need in the future world of work; available at:

https://www.mckinsey.com/industries/public-and-social-sector/our-insights/defining-the-skills-citizens-will-need-in-the-future-world-of-work Future Learn (2020): Seven skills employers of the future will be looking for; available at:

https://www.futurelearn.com/info/blog/careers/7-skills-employers-of-the-future-will-be-looking-for

World Economic Forum (2020): These are the top 10 job skills of tomorrow - and how long it takes to learn them; available at: https://www.weforum.org/agenda/2020/10/top-10-work-skills-of-tomorrow-how-long-it-takes-to-learn-them/

BLOCK 3



### DEMAND FOR HARD AND SOFT SKILLS BY PERSONNEL CATEGORY

To assess the skills of the future that will be in demand by 2030 in domestic agricultural, forestry and fisheries enterprises, the project team formed a list for the questionnaire, based on the report «Talent transformation in Turkey in the digital age».<sup>68</sup>

According to respondents, by 2030 employers will demand developed soft skills for all categories of staff, such as flexibility, openness to dynamic change, initiative, communication skills, digital skills (basic level), multidisciplinary aptitude (multifunctionality, versatility, multidisciplinarity), work in teams cooperating remotely.

«Soft skills are important as they are the basis for professional skills: the desire to work, motivation to learn, to pursue self-development, and to treat work responsibly, because modern equipment based on recent technologies is expensive, more than 400,000 euros.»

«It's about working with digital devices and understanding software algorithms, not just swiping the screen.»

«We hire people from the villages. They have very low qualifications. It is impossible to find an adequate specialist to work on a simple tractor. We can't find an accountant. Another problem is that there are people who have the right skills but no education.»

«It's important to have an ability to adapt to the work environment.»

For managers, the skills of data entry and analysis, leadership and people management, project management, decision-making (including in conditions of uncertainty), as well as a high level of literacy and initiative will be most in demand.

Professionals, in addition to the above skills, will need to have good research skills, general skills in managing mechanisms, diagnosing and maintaining equipment, and the ability to process and interpret complex information. Because of the digitalization of people management through appropriate applications created on the basis of AI, the tasks of managers, such as the distribution of tasks, monitoring and accounting of work performed, become part of the functionality of narrow-profile specialists.

For these two categories of staff, one of the important skills that is relevant today is knowledge of foreign languages. This is a prerequisite for career growth, in particular, employment in multinational corporations, and success in the global market. However, given the expected significant improvement in the quality of interpreting and translation algorithms (which according to some estimates may lead to the disappearance of the professions of translator and interpreter), the relevance of this skill may be offset.

<sup>68</sup> McKinsey & Company Turkey in cooperation with the McKinsey Global Institute (2020): Future of Work. Turkey's Talent Transformation in the Digital Era; available at: https://www.mckinsey.com/~/media/mckinsey/featured%20insights/future%20of%20organizations/the%20 future%20of%20work%20in%20turkey/future-of-work-turkey-report.pdf

Figure 13.	Skills that	will be in	demand
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	Managers	Profile specialists	Workers
1. Digital skills (basic level)			
2. Entering data using software			
3. Processing and interpretation of complex information			
4. IT skills, programming			
5. Development, elaboration			
6. Modelling, comfortable "man-machine cooperation"			
7. Creativity (innovation)			
8. Research skills			
9. Literacy and text writing			
10. Critical and strategic thinking			
11. Multifunctionality			
12. Flexibility			
13. Initiative, decision-making			
14. Leadership and human resource management			
15. Communication, interpersonal relations and negotiations			
16. Teamwork working online			
17. Project management			
18. Mechanisms management (general skills)			
19. Diagnostics and equipment repair			
20. Physical strength			

Significance

High

Middle

Low

Almost no

In future, workers will be required to have general skills in managing machinery, and diagnosing and maintaining equipment, which will increase the requirements for their qualifications. Although from the standpoint of project respondents the ability to perform physically complex work will remain mandatory for this category, some experts believe that robotics or human-machine cooperation will completely replace people in jobs that require sheer physical strength. Thus, workers will control work remotely, or with the help of an exoskeleton they will be able to perform it regardless of individual physical characteristics.

In addition, the respondents themselves indicated hard skills that they consider relevant in the World of Work 4.0:

- programming of robots and robotic lines;
- management of GPS systems and GPS modules, including work with Fort Monitor;
- work with geographic information systems (GIS);
- control of drones, unmanned agricultural machines and equipment with software;
- · diagnostics, maintenance and repair of agricultural machines, robots and robotic lines;
- work in special programs and apps, in particular for precision agriculture, animal husbandry, forestry and so on;
- developing products with specified properties, in particular the adaptation of agricultural crops to climatic conditions (genetic modification of plants);
- use of technologies for conservation of natural resources (biotechnology and eco-technology);
- · use of technologies to change weather conditions;
- utilization and processing of agricultural waste.

Given the rapid pace of technology development, companies are already experiencing a significant gap between the quality of human capital and employment needs. Regardless of size, domestic companies are looking for ways to improve staff skills to overcome staff shortages and identify affordable strategies to bridge the skills gap.



In the study, domestic companies indicated which of the proposed list of strategies recognized as «global best practices» they use to bridge the skills gap.



### Figure 14. Strategies for bridging the skills gap



# SEARCH FOR TALENTED YOUNG PEOPLE (IN UKRAINE AND ABROAD)

The search for talented young people is one strategic objective for ensuring the future survival of agricultural enterprises. It encourages them to cooperate with educational institutions in various formats. However, this may not be enough, given the outflow of young people from rural areas to large cities and abroad.

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«The problem with the lack of skilled workers remains. Many of those who are able, go to other countries. Retention policy is very important. Therefore, employers in agriculture have agreed to build up an infrastructure that might motivate well-trained employees to stay, so that next year you will not have to look for new people and train them how to pick berries. Large farms are building their own small towns, where they not only provide workers with housing, but also create mini-kindergartens, gyms and recreational areas for their families, so that they feel comfortable and are less likely to want to go elsewhere. This is another level of enterprise social responsibility. On each hectare of the field there should be a place where people can have a rest: a room with a microwave, a refrigerator, a cool room, water, a toilet. The workers who perform the simplest tasks, mainly seasonal workers, should also return to already «settled» places, because the employer has already invested time and resources in their training. However, with the introduction of digital technology, fewer people are likely to be needed.»

«Today it is necessary to change the image of an agricultural worker. The modern farmer no longer works in the mud, but with high-tech equipment in clean rooms. Young people do not understand that, so they should be shown the reality. The prestige of the agro-sphere professions should be raised.»

«We invest in training young people today, but tomorrow they will go to Poland or Spain. It is OK that someone is looking for a better place. But the shortage of staff is becoming more acute every year.»

«People are emigrating on a massive scale; but we expect others to come to us instead. Cultural diversity is good.»

Finding a young workforce abroad is not a relevant strategy for most of the companies surveyed, as it is difficult for Ukraine to compete for talented young people in the global labour market due to relatively low wages, lack of developed infrastructure and overall low living standards. For comparison, according to the International Economic Forum, developed countries will be ten times more active in using such a strategy.<sup>69</sup>

<sup>&</sup>lt;sup>39</sup> World Economic Forum (2016): Global Challenge Insight Report. The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution; available at: https://www3.weforum.org/docs/WEF\_Future\_of\_Jobs.pdf

It should also be noted that the problem of finding and retaining young talent is more acute among small businesses, which cannot offer young people career opportunities, systematic training programmes or other bonuses.

The Global Talent Competitiveness Index (2021) measures 134 countries on 68 criteria. More economically developed countries are more competitive in the international market in the struggle for talent.

Ukraine ranked 61st and is the first in its group, namely of countries with below average incomes, along with Senegal, Zambia, Kenya, Mongolia, Honduras and Cambodia, among others. In particular, the country ranks 85th in terms of its ability to attract talent.<sup>70</sup>

### TALENT MANAGEMENT / PROFESSIONAL DEVELOPMENT PROGRAMMES FOR EMPLOYEES

Promoting professional development is often declared to be an important task, as management sees it as a guarantee of productivity and competitiveness.

Large companies create special bonus programmes that encourage staff of all categories to pursue self-development and learning on their own initiative. For example, according to the results of their annual performance appraisal, employees may take educational courses offered by the company, forming part of a minimum training quota in so-called «development zones» for the year. At their next assessment they would, as a result, receive a wage increase, even promotion.

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«There is a shortage of skilled labour. But farms are socially responsible, they train their staff. It is better to «bring up» your own agronomist than to look for someone on the side and have to keep adapting people to the corporate culture and retrain. There is a program for encouraging the self-development of our employees; in particular, we are providing training for managers at all levels, which gives them the opportunity to grow in management positions.»

«Special bonuses for self-education are generally not applied; we use a performancebased reward system. Still, there is a direct connection with self-development (selfeducation): if you study more, you get to know how to use the latest equipment – you will perform better and, accordingly, you will be paid more.»

 INSEAD (2021): The Global Talent Competitiveness Index 2021: Talent Competitiveness in Times of COVID, Fontainebleau, France. Available at: https://www.insead.edu/sites/default/files/assets/dept/fr/gtci/GTCI-2021-Report.pd These are the resources that determine strategies and approaches for stimulating and motivating employees to pursue occupational or professional self-development.

Interestingly, large companies are recruiting psychologists, whose task is to maximize employees' potential, based on their natural abilities, their vision of their place in the company and personal and professional development. They also provide stress relief, combating burnout. This allows them to assign tasks or choose positions for employees that ensure maximum satisfaction from the work process, and thus improve the productivity of both the individual and the company. This approach also helps to create an optimal «climate» in the team.

«The basic principle of the psychologist in the organization is 'successful employee = successful company'.»<sup>71</sup>

### **INVESTMENT IN TRAINING AND RETRAINING OF EMPLOYEES**

Although investments in training have been discussed by small, medium-sized and large enterprises, the size of such investments and the quality of training that the enterprise is able to provide differ significantly. Small businesses' options are limited and draw on one another's capacities to train their employees. However, given the general low level of technology implementation among small enterprises, this is more like mutual assistance in a situation of limited resources than a strategy to increase competitiveness. However, there are those who invest in internships abroad for their specialists, often agronomists. Owners of small businesses say that they are constantly improving their own level of professional knowledge by visiting exhibitions, to which they also take leading specialists.

Large enterprises believe that training should be carried out systematically. Therefore, almost all of them have their own internal system of training and development of their own employees.

The acquisition of sophisticated new equipment or technology encourages training, as purchase and maintenance agreements include a clause on mandatory training of employees in the skills necessary to use the purchased product. Usually such training is ensured by the distributor or producer companies.

It should be noted that the state should prioritize the development of strategies, mechanisms and cooperation programmes with companies to ensure joint work on training/retraining of staff, because, ultimately, the burden of re-training the unemployed is borne by the State Employment Service, and social benefits are covered from the state budget. Thus, even in the event of job losses due to automation, people will be better prepared for reintegration into the labour market thanks to skills acquired in the course of training.



«The past 10 years have shown that if we [the company] don't teach ourselves, no one will teach [current and potential employees].»

«Our company does not have strategies to bridge the skills gap, but we are clearly convinced that everything that will be done in this regard will be done by private companies, not the state.»

<sup>71</sup> PSY Practice (2020): Psychologist and management, or why do you need a psychologist in the company?; available at: https://psy-practice.com/publications/biznes/psikholog-ta-menedzhment-abo-dlya-chogo-treba-psikholog-u-kompanii/ «The company itself is working on certain skills, without any systemic approach, situationally, but there is a certain non-monetized collaboration with partners-suppliers of new equipment, who teach our employees to use new equipment that we purchase.»

«Drone control training takes place either directly in the workplace (involving two days of theory, and then another two or three days of practical exercises and tasks), or in the partner companies that supply this type of equipment, in accordance with their programs and often free of charge.»

«I sent my tractor drivers, who had been working on John Deeres, to take a qualification test – they didn't pass! I decided to find out why this happened. It turned out that the tests were made for old Soviet tractors, which my employees had only heard about, but never used.»

Overcoming the problem of training and social protection will require additional resources at a time when public budgets are being cut. The minimum cost of retraining workers in high-risk occupations (an average of 14 per cent of the workforce) ranges from 1 to 5 per cent of GDP per year. These costs include both direct training costs and indirect costs due to lost wages, as full-time employees will not be able to work. In addition, retraining will cost 32 per cent of the workforce, which faces a «significant risk» of automation, although the cost per employee may be lower.<sup>72</sup>

### INTRA-INDUSTRY COOPERATION (TRAINING / INTERNSHIPS IN DIFFERENT COMPANIES WITHIN THE INDUSTRY)

This strategy is considered promising and is already used by large and medium-sized enterprises; smaller ones consider it only as potentially attractive given the growing need to consolidate efforts in response to a growing technology gap and future loss of competitiveness.<sup>73</sup>



«We send our employees to study at large enterprises.»

<sup>&</sup>lt;sup>72</sup> OECD (2019): Preparing for the changing nature of work in the digital era. OECD Going Digital Policy Note. Paris OECD; available at: https://www.oecd.org/going-digital/changing-nature-of-work-in-the-digital-era.pdf

<sup>&</sup>lt;sup>73</sup> On improving the learning opportunities of small businesses, see »Strategies for bridging the skills gap« item 2, »Investing in professional development and retraining of employees«.

# COOPERATION WITH EDUCATIONAL INSTITUTIONS — DUAL STUDIES AND INTERNSHIPS

Cooperation between enterprises and educational institutions may be either a success story or a fiasco. The key thing determining the outcome is the human factor. Only when representatives of both parties seek real, not merely formal changes in the content of educational programmes and the organization of the educational process are able to understand the needs, opportunities and limitations of each other and find a balance of interests. Otherwise, the dialogue turns into mutual accusations of unwillingness to understand each other, lack of motivation to use new cooperation formats, different from the established ones, and superficial changes in the educational process, which does not help bring learning outcomes closer to what the labour market needs.

Nevertheless, in-company training remains a widely used and widely understood tool for joint training of the future workforce. The mentoring format is well known to employers, who select those they would like to invite after graduation (and sometimes during training) for permanent employment.

Awareness of dual education (dual studies) is gradually rising. This has the potential to accelerate the renewal of educational content and revitalize the interaction between educational institutions and enterprises. However, this is possible only if parties adhere to the philosophy inherent in this form of education.<sup>24</sup>

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«We tried to create joint classes with the Free Economic Zone on the basis of our company, but it all ended in just talk. Unofficially, they say that students and teachers do not want to go to the outskirts of the city, and the bureaucracy involved in the approval of new programmes was enormous.»

«I have field lectures, in particular, at NULES. And to be honest, I was quite surprised that such technologically knowledgeable teachers and students work and study in higher agricultural educational institutions. They cooperate, firstly, with large agricultural holdings and secondly, with manufacturers of machinery and agrochemical products, and, thirdly, they have landfills where you can test all these innovations. It is fantastic! But when it comes to colleges, there is a big gap. Especially for students and young people who can't find such opportunities themselves, we developed the programme I talked about earlier. We should not forget about such modern technologies as vertical farms, closed greenhouses, the use of drones and more. Young people need to see that agriculture is cool.»

«In the current conditions, when there isn't a queue of people seeking employment, it is better to train your own staff: not to teach young people «from scratch», providing basic specialized knowledge, but to involve them in working with the latest technologies during the training period.»

<sup>&</sup>lt;sup>74</sup> Davlikanova, O./Ishchenko, T./Tchaikovsky, A. (2020): Analytical report on the results of the first year of the experiment on the dual-studies introduction of a pilot project in pre-tertiary and tertiary education in accordance with the order of the Ministry of Education and Science of Ukraine No. 1296. Kyiv; available at: https://mon.gov.ua/storage/app/media/rizne/2020/09/28/zvitza20192020nrshchodorealizatsiyidualnoh onavchannya.pdf.

BLOCK 3

#### Note

In 2018, Ukraine began the process of creating a legal framework for the introduction of dual education/studies.

Dual education/studies emerged in Germany in the middle of the twentieth century as a tool for preparing the future workforce to meet the needs of the labour market, in terms of both the number of future professionals and creating the conditions needed to acquire in-demand skills and qualifications. The company thus becomes the second place of study for students, which requires employers to actively participate and make a significant contribution to the educational process. This is not just internship, but the early introduction of young people into the world of work.

Relevant amendments have been made to the Ukrainian laws «on education», «higher education», and «professional education». This has created appropriate conditions for a «reset» of cooperation between enterprises and educational institutions at various levels.

The introduction of the dual form of education (dual studies) at the level of pre-tertiary and tertiary education is important, given rapid technological development and the transition to a knowledgebased/post-industrial economy, in which the main driver of progress is knowledge concentrated in human capital. New knowledge gives rise to new technology, which in turn leads to economic change and, ultimately, to the creation of a new paradigm, or a new worldview. This model can be used to explain the major economic and social changes currently taking place in the world. Some professions that did not previously require higher education have undergone some transformation and, as a rule, now require it.<sup>75</sup>

Dual studies is an in-depth, integrated form of education for those who are ready to combine training in an educational institution and gaining experience in real production. And the role of employers in this process is key.<sup>76</sup>

Employers who already have experience in establishing such cooperation and training students underlined some advantages:

- targeted investments in human capital;
- the opportunity to get a ready-made specialist adapted to the realities of production with a sound theoretical knowledge and skills required immediately after graduation;
- the possibility of adjusting educational programmes;
- the possibility of attracting a young and motivated workforce;
- image benefits for the company as socially responsible.

More details on experiences of cooperation between employers and educational institutions in training applicants for dual education can be found in the annual reports prepared within the framework of the national experiment introduced by the Ministry of Education and Science of Ukraine.<sup>77</sup>

Institutions emphasize that the development of technology and the gradual transition to the use of expensive agricultural machinery with software, requires them to work more closely with enterprises because it is not always possible to buy such expensive training equipment. In addition, educational institutions work with developers of software for agriculture in order to create opportunities for training and subsequent certification of students. Industry 4.0 hubs are being created.

<sup>&</sup>lt;sup>75</sup> Teichler, U. (1992): Occupation Structures and Higher Education, in Clark, B./Neave, G. (eds): *The Encyclopaedia of Higher Education*. Oxford: Pergamon Press.

<sup>&</sup>lt;sup>76</sup> The methodology for calculating the costs to the enterprise for training dual students was proposed by O. Davlikanova in »Development of management of dual higher education in Ukraine« (2021); available at: https://essuir.sumdu.edu.ua/bitstream-download/123456789/84101/5/diss\_Davlikanova.pdf

<sup>&</sup>lt;sup>77</sup> Buchynska, O./Davlikanova, O./Lylyk, I./Tchaikovska, A. (2020): Analytical report »Employers 'opinions on dual education«, based on the results of a study of employers' awareness of the dual form of education and experience in participating in a pilot project for its implementation at the level of professional higher and higher education in Ukraine: Kyiv: Friedrich-Ebert-Stiftung Office in Ukraine; available at: https://mon.gov.ua/storage/app /media/rizne/2020/11/10/Dualna\_2\_2%20edit%206-11.pdf.

BLOCK 3

Industry 4.0 Centres play the role of modern information and educational hubs and platforms for the generation and implementation of ideas and projects.

The main purposes of such centres include: development and implementation of promising solutions based on Industry 4.0 technology; effective training of relevant specialists; organization and carrying out of informational and educational activities; training; formation of links between enterprises, technology developers, manufacturing companies, higher education institutions, research institutions, public authorities, associations of citizens. On 1 September 2021, the Poltava State Agrarian University launched a structural unit within the Educational and Scientific Institute of Economics, Management, Law and Information Technology – Industry Implementation Centre 4.0.

As a result of signing a memorandum between APPAU, Poltava Regional Council, the Department of Agro-Industrial Development of Poltava Regional State Administration and Poltava State Agrarian University, a regional cluster «Agro-Industry 4.0» was created. The memorandum of cooperation with one of the territorial communities of Poltava region was signed in relation to the management of community land resources by means of modern information systems and technologies.

In order to disseminate information about the benefits and prospects of Industry 4.0 technologies, representatives of the centre and university researchers have held field seminars in recent months in local communities: Bila Tserkva, Velykorublivska, Dykanska, Kotelevska, Opishnyanska, Novosanzharska, Nekhvoroshchanska and Reshetylivska amalgamated communities. The total number of participants was over 240 people.

The course on «Information Technologies in Agronomy» for the MA programme «201 Agronomy» is already off the ground. Seminars and training courses on the «management of agricultural production on the basis of the information system Soft.farm have been «held to acquaint people with the system's capabilities and tools. About 180 people have already obtained certification. The training programmes offered to small and mediumsized businesses, as well as to amalgamated territorial communities, include «Land audit as part of a comprehensive community spatial development plan» (automation of land fund audits of territorial communities based on the information platform KADASTR.UA), «Organization of a single information space on the platform of the software package Universal7», «Prospects for the introduction of smart technologies in amalgamated communities», and «Methods of using electronic trading information systems for agricultural products in agricultural business and marketing».»

> Dr Yuriy Utkin, Head of the Department of Information Systems and Technologies, Associate Professor

Dr Olena Kopyshynska, Professor at the Department of Information Systems and Technologies, Associate Professor

Dr Volodymyr Muravlyov, Head of the Industry 4.0 Implementation Centre of Poltava State Agrarian University, Associate Professor

#### Note

Implementation of the Agrokebety MA Programme in Eastern Ukraine with the support of the USAID Economic Support to Eastern Ukraine Project is an initiative to be mentioned.

The main goal of the «Agrokebety» master's programme is to train highly qualified managers for agricultural companies in eastern and southern Ukraine. Practical teaching methods, guest lectures, on-the-job training and business mentoring are used to improve students' knowledge and skills. Certification as a «farm manager» can be obtained from six Ukrainian universities (NULES, SNAU,

VNAU, LuhNAU, TSATU, KSAU), in cooperation with business. All programme participants are accompanied by a mentor, a top manager of a successful agricultural company.

The programme was initiated by the Ukrainian Agribusiness Club (UCAB) in cooperation with NULES and supported by the Agroosvita Research and Methodology Centre, the Ukrainian Ministry of Education and Science and Agribusiness. In 2019, the «Agrokebety» master's programme» received the Aggeek AgTech Award.

### INTERSECTORAL COOPERATION IN AND BETWEEN COMPANIES

The transfer of staff within a diversified company or between companies operating in different industries is practiced mainly by large and medium-sized enterprises. The expansion of the list of required skills for narrow-profile specialists, the tendency to «universalize» them, the growing need for digital skills and the complexity of technology will intensify this trend.

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«We sent our managers to study at the developed corporate academies of completely different economic activities, such as energy, which have a good training base and programmes tailored to our needs, to develop managerial and soft skills. These include «Lean production», «Continuous improvement system» and «Effective leaders» programmes.

### STAFF MOBILITY AND ROTATION

Redistribution of labour between units of a large enterprise that are geographically distant from each other is possible only for a certain level of management. In this case, staff may be shifted due to promotion or rotation to meet company needs for employees with the required qualifications at a particular production site.

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«There is no mobility of employees in our company as such.<sup>78</sup> The villagers who work for us are tied to their land and they cannot leave for long. That's why this approach will work only if it does not require relocation.»

«Rotation may apply to the management of agricultural holdings, which are guaranteed a salary that allows them to live away from their place of permanent residence for a certain period of time. Or they may come home for the weekend. Or they are provided with company-paid housing, which allows them to live with their families in a new place.»

<sup>&</sup>lt;sup>76</sup> Mobility reflects an employee's ability to experience professional growth and relocate, based on their readiness to move to a new place and, if necessary, learn a new profession.

Rotation of employees is usually not practiced in medium-sized and small enterprises or within one unit. It should be borne in mind that most employees are workers who stay with a particular employer for a long time and whose skills are known to HR. In addition, most settlements where farms or their plots are located are relatively small villages, where HR (manager performing HR duties or company director) tends to know the locals; they have some information about their skills, even if they have not worked for these employers.

Another goal of this strategy is the fostering of workers who can combine and perform different functions, given enterprise demand for a «universal soldier». For example, an employee able to perform duties of an agronomist + mechanic + data analyst or carpenter + glazier + locksmith allows hiring one person instead of several, saving company's money. That is, the strategy is focused on hiring specialists with multidisciplinary functionality. This type of rotation (the so-called «carousel»), applied to young professionals, will make it possible to train such specialists with a broad range of qualifications.

«At Zmiiv Vegetable Factory, the gap in management skills is bridged through training in project management.

Previously, the company had a rigid structure and each unit dealt exclusively with its own issues and was responsible for its own tasks. For example, the agronomist was responsible for technology and productivity; the chief engineer for utilities; the head of the trucking department for trucking; and the personnel department for staff.

Today, the coordination of work on the farm on the principle of «looking after one's own business» is entrusted to the project manager (it can be an agronomist with management skills), who manages the process, starting from budgeting, expenditure, planning and the final result, namely a 2.5 million euro margin. Thus, the farm gets specialists who are familiar with the specifics of working with different departments, and who have the necessary experience and connections. Such specialists are not trained at educational institutions and this is a big problem from the point of view of the company.»

### SEARCH FOR TALENT AMONG WOMEN

This question turned out to be fairly difficult or unexpected for most respondents, as almost none of them considered it a specific option for the development of the company. But at the same time, some noted that there is a problem in the agro-industry with equal rights and opportunities for women, due to the clear gender division of professions and types of work, as well as the «patriarchal character of this industry». Women are not represented among tractor drivers or machine operators, underrepresented among agronomists and foremen, and overrepresented among milkmaids, accountants and so on.



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«There are women agronomists, but very few of them, and their path to success is much longer and more difficult than for men.»

BLOCK 3

### Note

In Ukraine, the division of industries and occupations/professions into «women's» and «men's» is still very noticeable. Agricultural production falls clearly into this categorization.

From 1994 to 2017, Order No. 256 of the Ministry of Health on Approval of the List of Heavy Work and Work with Harmful and Dangerous Working Conditions Prohibiting the Employment of Women was in force in Ukraine. This list consisted of 458 occupations, including some related to the agricultural sector. Women were not supposed to catch or process fish, collect seeds from trees over 4 meters high, or be a worker engaged in the cultivation, harvesting, transportation and primary processing of tobacco. Moreover, women could not be agricultural tractor drivers (working on tractors, combines and other self-propelled agricultural machines) or drive buses with more than 14 seats. That is, farming was officially a closed field for women.

Since Order No. 256 was repealed not so long ago and even then, not completely, many of these professions remain purely «male» in many people's minds. In order to overcome this perception, in 2020 the Cabinet of Ministers approved the Concept on Communication in the Field of Gender Equality. One of the ways of addressing gender inequality enshrined in the Concept is to promote greater participation of women and men in areas where they are less represented.

Thus, in 2019, according to the State Statistics Service of Ukraine, the share of female workers by type of occupation was as follows: skilled agricultural workers, women 42.4 per cent, men 57.6 per cent. However, workers in machine maintenance, respectively, broke down as 16.0 per cent women and 84.0 per cent men, while skilled workers working with tools comprised 15.3 per cent women and 84.7 per cent men.

During training conducted by the Women's Committee of the Trade Union of Agricultural

Workers of Ukraine on achieving gender equality in pay, access to the profession and labour protection, students cite examples of existing stereotypes and social pressure on women when attempting to enter the so-called «male» professions. Thus, in one agricultural concern in Bilopil district, Sumy region, a woman trying to get a job as an agronomist was presented with many reasons why they did not want to see her in this position. The reasons included that it was a purely male team, there was an unregulated work schedule, night trips, remoteness of agricultural land, business trips and more. In the agricultural sector in Cherkasy region, no more than 1-3 per cent of mechanics and operators of milk collection lines are women. Due to societal stereotypes and the labour market over the decades, school leavers remain in extremely low demand for agroengineering occupations.

In these circumstances, delegates to the VII Congress of the Trade Union of Agricultural Workers of Ukraine in a separate Resolution «Problems of women working in the agro-industrial sector in Ukraine» protested against discrimination against women's rights in the field of labour and pay inequality, including in the Labour Code. They:

- condemned the decline in employment and the growing trend of long-term female unemployment; and
- stressed the unacceptability of the spread of stereotypes that lead to unequal distribution of men and women by professional level and field of activity, classification of vacancies into «female» and «male», age discrimination, and more. The resolution was addressed to the heads of government and industry in Ukraine.

Nadiya Burlaka, Chair of the Women's Committee of the Trade Union of Agricultural Workers of Ukraine, Chair of the Ivano-Frankivsk regional organization of the trade union of food workers and processing industry

### **ONLINE AND DISTANCE LEARNING**

The opportunities provided by technology are also used by large enterprises for training purposes. The pandemic has accelerated the transition to the use of proprietary training platforms, similar in functionality to Moodle, to increase employees' level of knowledge on current professional issues at a convenient time and without being tied to certain training deadlines. A manager, HR or specialist from head office download information/education materials on the platform – for example, specialized distance learning courses, which target employees in a particular department, such as information on updated legislation for accountants – and they can read the materials at a convenient time. Sometimes it is necessary to perform test tasks. Small and medium-sized enterprises do not have the necessary resources to create/use information materials for dissemination on similar training platforms.

According to the results of the quantitative survey, the most common practices for bridging the skills gap are searching for talented young people, programmes to promote occupational/professional self-development, and investment in employee training and retraining.
# CONCLUSIONS

CONCLUSIONS

«Difficult to see. Always in motion is the future.» Master Yoda



With the growth of the world's population and climate change, global priority has been given to the introduction of innovations in agriculture, forestry and fisheries as types of economic activity that help to ensure human life on a sustainable basis. The technologization of enterprises will increase productivity, help preserve the environment and foster competitiveness in the global market during the 4th Industrial Revolution. At the same time, realizing this potential is impossible without appropriate changes in the quality of a country's human capital, adaptation of the workforce to innovative changes, and overcoming the growing skills gap.

The introduction of new technologies, which are considered to be drivers of Industry 4.0, in agriculture, forestry and fisheries in Ukraine has been uneven, and depends significantly on the size of the enterprise. Large and partly medium-sized enterprises have long-term strategies that include a vision of innovative development and sufficient resources for their implementation, in contrast to small enterprises, which prioritize the values of «survival.» Only 10 per cent of the surveyed agricultural enterprises carry out long-term planning, and of those that currently have at least some strategies, about 40 per cent do not envisage the introduction of digital technologies as a priority. In general, small-scale enterprises in agriculture, forestry and fisheries find it more difficult to look into the future, in particular with regard to the impact of technology on employee functions, changes in the employment structure and the emergence of new professions.

Another factor that determines the prevalence of the use of certain technologies is domestic farms' level of awareness of technological innovations and their functionality. The most widely used are unmanned aerial vehicles, mostly drones, integrated systems based on artificial intelligence, the internet of things, cloud technology and big data, which is the basis for smart/precision farming. In addition, agricultural enterprises are actively moving to the use of green technologies, noting the importance of green business and reducing anthropogenic impact on the environment as

important priorities. Blockchain, 3D printing, advances in genetic engineering and digital twins are used much less.

If large enterprises are able to develop digital solutions based on their own AI, IoT and blockchain, small ones, with limited resources, mostly use ready-made technological solutions, most of which they purchase, in particular abroad.

There is a significant gap in the technology of different subsectors. While domestic smart farming and crop production are already becoming the «new norm», smart forestry, fishing and hunting exist to a greater extent merely on the conceptual plane.

In the long run, the transition from fragmentary automation to highly or fully automated digital production is likely to be made by large and partially medium-sized enterprises, which will reduce production costs, expand production and introduce additional production links in value chains, while small enterprises may lose competitiveness and will be forced to look for new niches, which can be the production of organic products and green tourism, as well as urban farming.

In addition to the lack of strategic planning, we should note other significant factors hindering the introduction of new technologies, such as:

- lack of specialists in small enterprises with a high level of awareness of existing solutions that can facilitate technology implementation;
- lack of resources for the purchase of expensive solutions, limited access of small and partly medium-sized enterprises to cheap and long-term loans;
- the quality of available human capital, the outflow of young professionals from rural areas to work in cities or abroad;
- lack of infrastructure, in particular uninterrupted access to the internet in remote rural areas, which hinders data transmission;
- logistical problems related to the supply of equipment and components (under quarantine restrictions) and others.

New technologies have always changed the nature of work and occupational/professional structure, contributing to the transformation or disappearance of some professions and the emergence of others. The Fourth Industrial Revolution is leading to unprecedented large-scale and rapid changes that will affect agriculture, fisheries and forestry. Full or partial automation of fertilization, irrigation, water abstraction, container turnover, fruit and berry picking, milking and animal care, environmental protection, logging and other types of work already require redistribution of functionality, upgrading existing professions.

The most significant changes are in the functionality of narrow-profile specialists, which will include work with complex systems and mechanisms, analysis and interpretation of data sets. Top managers will be least affected by such changes. With the introduction of new technologies this group of staff will receive better tools for management and decision-making.

Another important consequence of the introduction of technology and automation of production processes is the gradual reduction of the number of employees and increasing requirements with regard to the level of qualifications of the remaining employees. Currently, this trend is observed in the sub-sectors most open to innovation, such as livestock and crop production, in contrast to fishing and hunting. In addition, due to the relatively low rate of innovation, significant reductions in enterprises can be avoided by expanding and increasing production, as well as additional training or retraining.

However, workload is already decreasing for workers, including livestockmen and handymen, as hard physical work and routine tasks are automated first, even those that require well-developed fine motor skills. For the same reason, the need for seasonal workers will be reduced. It should also be noted that accelerating the pace of automation in developed countries will reduce the demand for Ukrainian labour for seasonal work abroad, which could lead to a significant deterioration in the situation of many households.

Also, as a result of the digitalization of accounting, data analysis and reporting, the number of in-demand non-core employees, such as accountants, will decrease. At present, they are protected from significant reductions by the incomplete transition to full electronic document management in Ukraine. In large and medium-sized enterprises, there is a tendency to reduce the number of accounting employees and economists, their functions being transferred to agronomists-economists or analysts who are able to develop appropriate business strategies based on digitized data. However, significant reductions in the number of creative professionals working in marketing, design, social media marketing and so on are not expected, as in large and medium-sized enterprises their number is still small, and small farms in most cases do not use their services, or such services are outsourced.

There are also risks for middle managers, whose functions will be partly performed by algorithms or AI, and partly redistributed between senior managers and specialists.

As for narrow-profile specialists, there are two opposite trends: some agricultural enterprises expect to maintain their number by expanding production, subject to a significant transformation of their skills, while the other still predicts a reduction. In future, the requirements for specialist qualifications in diagnosing or adjusting the technical and software parameters of equipment will increase.

No increase in the number of engineering and technical staff is expected. The dominant trend is the maintenance of expensive and complex equipment and agricultural machinery in specialized service centres, or companies leasing equipment.

The number of IT specialists will grow at large agricultural enterprises, mainly to ensure digital security and develop new integrated solutions, while small enterprises will use such specialists through outsourcing.

Professions such as labourers, accountants, foremen and, in the long run, HR staffs and logistics workers are threatened with extinction. A significant transformation with a possible change not only in functionality but also in the names of professions is also affecting milkmen, stockbreeders and pig farmers, who may become operators of robotic complexes, while combine harvester/ tractor operators may turn into operators of unmanned vehicles.

In general, there is a demand for «universal specialists» and combinations of related professions. Professions such as climate agro-engineer, bio-engineer, zoo engineer, and so on may emerge. Brand new professions should be singled out: precision farming engineer, urban farmer, 3D food printing engineer.

Respondents testify to the need to amend the the National Classifier of Professions 003: 2010 to include new professions and job titles, so as not to have to include in the staff list «fictional» positions.

Digitalization will increase the tendency to reduce the share of standard employment and expand the range of forms of atypical (non-standard) employment.

However, the interviewed business people did not openly declare their intention to abandon the practice of using permanent contracts (currently the most common form of employment) and expressed hope for the introduction of more flexible labour relationships. This is due not so much

to reductions in the number of jobs, or of functionality through automation and digitalization, but rather enterprises' economically justified desire to reduce costs and the tax burden. However, when reforming labour legislation, one should keep in mind the negative socio-economic consequences of the spread of atypical forms of employment.

Fixed-term contracts are likely to remain the second most popular form of employment. The importance of outsourcing will increase, especially for small and medium-sized enterprises, which cannot afford to retain all the narrow-profile specialists they need. In addition, by way of outsourcing companies will attract not only IT specialists and accountants, but also some highly qualified specialists, such as vets, zoo engineers and even agronomists. This approach will be especially economically justified for cooperatives and other associations of small businesses. In addition, the leasing of staff is becoming more widespread, which will be facilitated by the spread of the practice of leasing complex expensive equipment, together with the necessary specialists.

Another interesting trend is the demand among small and medium-sized enterprises to create a database or register of narrow-profile specialists needed by agriculture, forestry and fisheries on a regional basis. This will allow individual companies to agree on hiring one specialist working part-time for all of them. In this way, such specialists will be provided with a sufficient workload and income, and companies will benefit from their skills. On one hand, such enterprises will not have to overpay for the work of specialists, hiring them only for the time necessary to perform the relevant tasks, and on the other hand, they will have access to experienced specialists with a profound knowledge of individual enterprises. Currently, accountants are already providing their services on this basis, serving several companies and organizations. However, there is an urgent need to extend this practice to other narrow-profile specialists. Such a register could be maintained by the State Employment Service.

Such forms of employment as «employee sharing» or «job sharing» are not considered potentially attractive.

Only top managers, IT specialists and service providers will be able to take advantage of remote employment, including work in the home-office format or performing work tasks from any location without being tied to production, while narrow-profile specialists remain tied to their workplaces.

Among the main reasons for the exacerbation of «staff shortage» companies have noted the outflow of young people to work abroad, which may have increased since the pandemic, and the unsatisfactory quality of training for young professionals in educational institutions.

Although the demand for work experience or significant practical training is most relevant, by 2030 there will be a growing demand for specialists with higher education, which for employers is an indicator of a person's ability to learn throughout life and perform complex tasks that require information analysis and synthesis, decision-making in conditions of partial uncertainty, and most importantly, to work with complex machines and systems.

It is not enough for a specialist to have a thorough general knowledge, a certain level of knowledge of engineering and programming is also required. Currently, entering international markets is boosting demand for knowledge of foreign languages, especially English and Polish, but with the development of translation technologies, this trend may diminish.

There is a tendency to raise the requirements for educational level and qualifications for each group of employees in the enterprise: jobs that previously demanded only secondary or vocational education, in the future will demand higher education. In general, the rapid development of technology requires that employees acquire specializations and qualifications while pursuing lifelong learning to remain relevant in the labour market.

Technological progress has always led to the obsolescence of professional/occupational skills (hard skills). New hard skills that will become especially relevant in the next ten years are: operation and maintenance of robots and robotic lines; work with GPS systems and drones; work with special programs and apps; creation of new products with set properties; knowledge of bio- and eco-technologies, and technologies for changing meteorological conditions, and utilization or processing of agricultural waste. Digital skills will be a must-have for all employee categories in agriculture, fisheries and forestry in future.

But in the Fourth Industrial Revolution no less important for all categories of staff is the possession of soft skills, including analytical thinking, research, versatility, multidisciplinarity, responsibility, flexibility, initiative, creativity, communication skills, ability to work in teams in a remote format, and most importantly, the ability and desire to learn throughout life and the willingness to quickly learn new technologies.

Progress has exacerbated the problem of skills gaps. Bridging this gap should be a strategic task not only for individual enterprises, but also for public policy in an era of unprecedented technological transformation, when the quality of human capital is becoming a key factor in economic growth and competitiveness in the global market.

Currently, companies use all available strategies, but not the full arsenal of global best practices. In addition, the choice of strategy is determined by the level of investment in training, which largely depends on size of enterprise. Small businesses often solve the problem of lack of skills among their employees through additional training at neighbouring or friendly farms, through a kind of mutual assistance. However, given the general low level of technology implementation in small enterprises, these steps are difficult to imagine as a strategy for boosting competitiveness.

Enterprise acquisition of new complex equipment or technology necessitates employees' acquisition of the skills necessary to use it. Large enterprises believe that training and retraining should be carried out systematically and for this purpose create their own internal training and personnel development systems. Company retraining is widespread, which makes it possible to avoid redundancies and reassign employees to new jobs. Managers of small and medium-sized enterprises note that they constantly improve their level of professional knowledge by attending exhibitions and seminars, where they also encounter leading specialists. Managers are sometimes even sent to study abroad.

The state should prioritize the development of strategies, mechanisms and programmes of cooperation with business, so as not to bear all the costs associated with retraining and social insurance benefits in case of dismissal due to obsolete skills in high-tech enterprises.

Large enterprises create favourable conditions for self-development through special bonus programmes, which entail employees from each occupational/professional group, after their annual assessment, choosing the so-called "individual minimum", as they call it, in other words, additional courses to upgrade their knowledge and skills in identified areas. The following year, as a consequence, they will receive a wage increase. Such programmes ensure a company's productivity and competitiveness in the long run.

Cooperation between enterprises and educational institutions is expanding. This is in addition to the already well-established, albeit criticized, format of practice-oriented/work-based learning, such as dual education/studies and the creation of Hubs Industry 4.0. The key factor determining the outcome of such initiatives is people. Only when representatives of both parties seek real rather than formal change are they able to find a balance of interests. Otherwise, the mere imitation of educational innovations does not help bring learning outcomes closer to those expected by the labour market.

Educational institutions emphasize that the development of technology and the use of expensive agricultural machinery requires them to work more closely with enterprises, because it is not always possible to buy such expensive equipment for training. In addition, cooperation with developers of software for agriculture makes it possible to update the content of curricula and certify future professionals.

The strategic goal of ensuring the future survival of agriculture, forestry and fisheries is to find talented young people, especially in the context of the outflow of young people from rural areas to cities and abroad. It should be noted that it is difficult for Ukraine to compete for talented young people in the global labour market. All this encourages companies to invest in the development of infrastructure or to offer bonuses, including accommodation, food and more. At the same time, small and medium-sized enterprises are inevitably at a disadvantage in relation to large ones, because they cannot offer such conditions or career opportunities.

The search for talent among women is not currently seen as a promising strategy to bridge the skills gap. In general, the issue of gender equality in the industry remains quite problematic.

Intra-industry and inter-sectoral cooperation are considered promising, given that the expanding list of required occupational/professional skills, the trend towards «universalization» of professionals and growing demand for digital skills and technology have already made large and medium enterprises apply this strategy. Small enterprises see it only as potentially attractive because of the growing need to consolidate efforts due to the widening technological gap and the loss of competitiveness in the long run.

The pandemic has updated the relevance of online and distance learning and has encouraged the creation of their own learning platforms, similar in functionality to Moodle. Using them, employees can improve their knowledge at a convenient time and without being tied to certain training deadlines. However, medium and small enterprises do not have the necessary resources to create their own platforms or content for existing ones.

The technologies of Industry 4.0 will gradually change Ukrainian rural forestry and fisheries. Due to the slow pace of technologization of small enterprises, which make up the largest share of business entities, some staff reductions should be expected, but the greatest problem which has already manifested itself is a growing skills gap and a gradual transformation of existing professions. Therefore, programmes should be developed to ensure the acquisition of digital competences by rural residents. In addition, the development of professional standards for new or transforming professions should be a priority by both the state and the industry. This will promote non-formal/ informal learning and help validate learning outcomes.

## ANEX 1. LIST OF INTERNATIONAL STUDIES OF SOCIO-ECONOMIC CHANGES CAUSED BY THE INTRODUCTION OF NEW TECHNOLOGIES

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Nº	Title	Author(s)	Year	Link
1	A future that works: automation, employment, and productivity	McKinsey Global Institute	2017	https://www.mckinsey.com/~/media/ mckinsey/featured%20insights/ Digital%20Disruption/Harnessing%20 automation%20for%20a%20future%20 that%20works/MGI-A-future-that- works-Executive-summary.ashx
2	Agriculture 4.0: The Future of farming technology	De Clercq M., Vats A., Biel A. World government summit	2018	https://www.worldgovernmentsummit. org/api/publications/ document?id=95df8ac4-e97c-6578- b2f8-ff0000a7ddb6
3	Automation, skills use and training	Nedelkoska, L., Quintini G. OECD	2018	https://doi.org/10.1787/2e2f4eea-en
4	Digital Agriculture and Labor: A Few Challenges for Social Sustainability	Prause, L. Thaer-Institute of Agricultural and Horticultural Sciences	2021	https://www.mdpi. com/2071-1050/13/11/5980/pdf
5	EU 4.0 – The Debate on Digitalisation and the Labour Market in Europe	Karen Grass, Enzo Weber Research institute of the German Federal Employment Agency	2016	http://213.241.152.197/ discussionpapers/2016/ dp3916_en.pdf
6	Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution	World Economic Forum	2016	https://www3.weforum.org/docs/ WEF_Future_of_Jobs.pdf
7	Future of the workplace 2030+	Kjaer Global	2020	https://www.unily.com/media/ pwmisrwf/unily-future-of-workplace- report.pdf
8	Future of Work: Turkey's Talent Transformation in the Digital Era	McKinsey & Company Turkey, McKinsey Global Institute	2020	https://www.mckinsey.com/tr/~/ media/mckinsey/locations/europe%20 and%20middle%20east/turkey/our%20 insights/future%20of%20work%20 turkey/future-of-work-mckinsey-turkey- full-report.pdf
9	Overview of the national strategies on work 4.0: a coherent analysis of the role of the social partners	Byhovskaya Anna European Economic and Social Committee	2018	https://www.eesc.europa.eu/en/ our-work/publications-other-work/ publications/overview-national- strategies-work-40-coherent-analysis- role-social-partners-study
10	Preparing for the changing nature of work in the digital era	OECD	2019	https://www.oecd.org/going-digital/ changing-nature-of-work-in-the- digital-era.pdf
11	Skills forecast: trends and challenges to 2030	Cedefop, Eurofound	2018	https://economix.org/a55ets/ publications/CEDEFOP_Skills_ Forecast_2030Forecast_2018_1.pdf
12	The Future of Jobs Report 2020	World Economic Forum	2020	https://www3.weforum.org/docs/ WEF_Future_of_Jobs_2020.pdf

Nº	Title	Author(s)	Year	Link
13	The future of skills employment in 2030	Bakhshi H., Downing J., Osborne M. and Schneider P Pearson and Nesta	2017	https://futureskills.pearson.com/research/ assets/pdfs/technical-report.pdf
14	The Future of Work in Agriculture : Some Reflections	Christiaensen, Luc; Rutledge, Zachariah; Taylor, J. Edward World Bank	2020	https://openknowledge. worldbank.org/bitstream/ handle/10986/33485/The-Future-of- Work-in-Agriculture-Some-Reflections. pdf?sequence=1&isAllowed=y
15	The future of work: implications and responses by the PES Network	ICF International Inc, European PES Network	2018	https://ec.europa.eu/social/BlobServlet ?docId=20520&langId=en
16	The impact of new technologies on the labour market and the social economy	Bernhard Dachs European Parliament's Science and Technology Options Assessment Panel	2018	https://www.europarl.europa.eu/ RegData/etudes/STUD/2018/614539/ EPRS_STU(2018)614539_EN.pdf

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