ЕКОНОМІКА ТА УПРАВЛІННЯ ІНШИМИ ВИДАМИ ДІЯЛЬНОСТІ

УДК 659.4.012.12
JEL M 37, M 11, L 86
DOI: 10.31471/2409-0948-2021-1(23)-89-97

Goncharenko Nataliia
PhD in Economics,
Associate Professor of the Department of Environmental Management and Entrepreneurship, Taras Shevchenko National University of Kyiv
Vasylkivska str., 90-A, Kyiv, 03022, Ukraine
e-mail: nota7sha@ukr.net
ORCID https://orcid.org/0000-0001-9274-9905

INFORMATION AND EDUCATIONAL TECHNOLOGIES IN TRAINING OF ORGANIC PRODUCTION MANAGERS

Abstract. The article deals with the actual problem of using information and educational technologies in the training of organic production managers. It is established that the development of organic production is important for the diversification of incomes of agricultural enterprises, ensuring the greening of economic activity. The *aim of the study is* to investigate the theoretical and applied aspects of the use of information technology to train managers in the field of organic production.

Despite the fact that Ukraine has the highest rate of increase in the number of producers and retail sales in 2018-2020 in the European countries, the organic sector is significantly behind the European competitors. An important factor hindering the development of organic production in Ukraine is the shortage of skilled workers. It is investigated that decisive factor in the rapid development of organic production in Ukraine is the improvement of professional training of specialists in this field, the provision of human resources, including through the recruitment of young specialists in higher education.

It has been found that enhancing IT training is an important area of training for organic production managers, especially in the field of business process automation. It is suggested to use in the educational process of preparation of managers for organic production specialized business simulator "Strategy of green enterprise development". It is based on the economic-mathematical model of optimization of the production program, taking into account the environmental constraints of organic production. The practical use of the Business Strategy Green Business Development Simulator enhances the information and computer training of organic production professionals, gaining the competencies to develop this type of activity and successful professional implementation.

Keywords. Organic Production, Training of Specialists of Organic Production, Modern Information Technologies.

Гончаренко Наталія Володимирівна
кандидат економічних наук,
доцент кафедри екологічного менеджменту та підприємництва,
Київський національний університет імені Тараса Шевченка
вул. Васильківська, 90-А, м. Київ, 03022, Україна
e-mail: nota7sha@ukr.net
ORCID https:// orcid.org/0000-0001-9274-9905

ОСВІТНЬО-ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ У ПІДГОТОВЦІ МЕНЕДЖЕРІВ ОРГАНІЧНОГО ВИРОБНИЦТВА

Анотація. У статті розглядається актуальна проблема застосування освітньо-інформаційних технологій для підготовки менеджерів у сфері органічного виробництва. Розвиток органічного виробництва важливий для диверсифікації доходів сільськогосподарських підприємств, забезпечення екологізації аграрного виробництва, посилення конкурентоспроможності товаровиробників на перспективних ринках органічної продукції. Метою статті є дослідження теоретичних та прикладних аспектів використання інформаційних технологій для підготовки менеджерів у галузі органічного виробництва. Встановлено, що у 2018-2020 рр. в Україні були найвищі темпи зростання кількості виробників органічної продукції. Проте донині вітчизняний сектор виробництва органічної продукції значно відстає від європейських конкурентів. Важливим фактором, що стримує розвиток органічного виробництва в Україні, є дефіцит кваліфікованих фахівців. Досліджено, що вирішальним фактором швидкого розвитку органічного виробництва в Україні є вдосконалення професійної підготовки фахівців у цій галузі, забезпечення людськими ресурсами, в тому числі шляхом набору молодих спеціалістів у вищі навчальні заклади.

Важливим напрямом підготовки менеджерів органічного виробництва є формування компетентностей щодо використання сучасних інформаційних технологій, насамперед, щодо автоматизації бізнес-процесів (планування, прогнозування, контроль та ін.). Для професійної підготовки менеджерів органічного виробництва пропонується використовувати спеціалізований бізнес-симулятор «Стратегія «зеленого» розвитку підприємства». У його основі лежить економіко-математична модель оптимізації виробничої програми з урахуванням екологічних та організаційних обмежень органічного виробництва. Практичне використання бізнес-симулятора покращить навчально-методичне забезпечення навчання менеджерів органічного виробництва, сприятиме формуванню необхідних компетентностей, впровадженню набутих студентами навичок на підприємствах.

Ключові слова. Органічне виробництво, підготовка фахівців органічного виробництва, сучасні інформаційні технології.

Introduction. In the conditions of introduction of the European standards of production of agricultural products, increase of requirements of consumers to quality and ecological characteristics of food, conditions of their processing, the development of production of organic agricultural products is an important factor of greening of the agricultural sector. According to EU Regulation 834/2007 organic production – is a holistic food management and production system that combines best practices with respect to environmental conservation, biodiversity, conservation of natural resources, the application of high standards of animal welfare and welfare». A production method that meets certain requirements for products made using substances and processes of natural origin [1].

2021 ISSN 2409–0948 print
№ 1(23) ISSN 2415–3311 online

Introduction of organic agricultural production, its processing is one of the important directions of differentiation of economic activity and sources of income of agricultural enterprises, conquering new niches in the market, realization of corporate environmental responsibility. Due to the steady increase in demand, the number of producers applying organic farming certification of products to international standards is steadily increasing in the European Union and Ukraine (Table 1).

Table 1.

Number of producers and retail trade of organic products in the countries of the European Union and Ukraine, 2018-2020

Country	Organic producers, unit			2020 to 2018	Organic retail sales, million €			2020 to 2018
	2018	2019	2020		2018	2019	2020	
France	32264	36691	41632	129,04	6736,0	7921,0	9139,0	135,67
Spain	36207	37712	39505	109,11	1641,0	1903,0	1903,0	115,97
Germany	27132	29764	31713	116,88	9478,0	10340,0	10910,0	115,11
Austria	24213	24998	25795	106,53	1541,6	1723,2	1810,0	117,41
Poland	22435	20257	19224	85,69	167,0	235,0	250,0	149,70
Bulgaria	6964	6471	6471	92,92	28,01	29,21	29,21	104,28
Denmark	3306	3637	3637	110,01	1392,0	1600,67	1807,0	129,81
United Kingdom	3402	3479	3544	104,17	2351,0	2433,7	2536,9	107,91
Netherlands	1557	1696	1696	108,93	1170,9	1205,5	1287,2	109,93
Ukraine	294	304	501	170,41	21,2	29,4	33,0	155,66

Source: FIBL Statistics [2].

Thus, in 2020 the highest number of organic producers were in France - 41632, Spain - 39505 and Germany - 31713. At the same time, the largest volume of retail sales of such goods was in Germany - 10910 million Euro, France 9139 million Euro and Great Britain - 2536.9 million Euro. During 2019-2020, the highest growth rate in the number of organic producers in Ukraine was 70.41%, as well as the growth rate of retail sale of organic products - 55.7%. Despite the positive trends and favorable resource supply, the data from the above analysis show that to date Ukraine is significantly behind other European countries in the development of the organic direction of the agricultural sector.

According to international experience, the scarcity of skilled workers is significantly hampered by the spread of organic production in agriculture. It is urgent to form a cohort of management specialists capable of developing a strategy for the transition to organic production, to provide the necessary financial, material and labor resources, to enter the national and international markets. Particularly acute today is the problem of improving the practical skills of using modern information technologies that help automate business processes, increase productivity and improve customer interaction.

Analysis of research and publications. According to the employees of HR departments of agricultural enterprises, the current situation changes the demand for agrosphere specialists, as well as the requirements for their knowledge and practical skills. According to the Career Hub online resource, managers of agricultural and organic production in particular must be familiar with Ag Tech's agrarian computer technologies, which include precision farming, smart farm management systems, drones and jobs, and electronic systems for product sales [3]. Given the rapid development of information technology, new professions are being formed - environmental manager, agricultural ecologist, agro-cybernetic.

Scientific and educational aspects of organic production have been investigated by a number of scientists. Noting the urgency of providing quality scientific and educational training of specialists in the field of organic production, Milovanov analyzed the world and Ukrainian experience of organizing students' education in higher and vocational schools [4]. Problems of preparation of specialists for taking into account in practical activity of technological and organizational features of organic production were analyzed by N.P. Novak [5]. To ensure the educational process in higher educational establishments Stetsishchin, V.V. Pindus, V.V. Recunenko developed a textbook for students of "Fundamentals of Organic Production" [6]. Problems of training specialists in the field of organic production were also studied by A. Kristiansen, N. Lampkin, Strelnikov Y.V., O. Torubara, P. Taji, J. Reganold, O. Stechkevich, , Yakimovich, T. and others [7-14].

In spite of the above-mentioned scientific researches, many problems of preparation of specialists in the field of organic production remain to be solved.

Given this, the ***aim of the study*** *is* to investigate the theoretical and applied aspects of the use of information technology to train managers in the field of organic production.

Presentation of the main material. Depending on the method of organization of the educational process, training of specialists in the field of organic production can be conditionally divided into formal and not formal. Formal training of specialists in higher educational establishments and professional institutions is formal. At the demand of increased demand on the labor market in Ukraine, training of young specialists in the field of organic production is carried out by leading educational institutions (Table 2).

Table 2.

Higher education institutions that form competences in the field of organic agricultural production in Ukraine

Institution of higher education	Faculty	Structural unit
Zhytomyr National Agro-Ecological University	Agronomic, technological, veterinary medicine, engineering and energy, ecology and law, accounting and finance, economics and management	Organic school
Poltava State Agrarian Academy	Agronomic (educational program "Ecological and economic plant growing")	Polissia Organic Polissya Center
Belotserkov National Agrarian University	Agronomic (organic agriculture education program)	Poltava-Organic Organic Farming Center
National University of Life and Environmental Sciences of Ukraine	Agricultural management, food technology and product quality management, plant protection, biotechnology and ecology	Organic farming training class
Lipkovat Agricultural College	Agrarian, agrarian management	-
National University of Water Management and Nature Management	-	Certified fields and livestock farms
Taras Shevchenko National University of Kyiv	Economic	Regional Consulting Center

Source: compiled by the author on the basis of [3].

2021 ISSN 2409–0948 print
№ 1(23) ISSN 2415–3311 online

The study of the main components of educational programs showed that in the preparation of specialists higher educational institutions of agrarian direction focus on providing students with theoretical knowledge and practical skills to apply the technology of cultivation of crops, taking into account the technological and environmental constraints of organic production. Yes, students study in depth:

– Theoretical and organizational principles of certification of production of organic agricultural products.

– Features of organization of crop rotations in the conditions of transition.

– Technological approaches to conservation and enhancement of natural soil fertility.

– Essence, types and features of application of biological plant protection products, methods of careful cultivation of soil.

– Features of the use of information technologies and modern gadgets to improve the efficiency of technological processes, plant cultivation, monitoring of crops.

We believe that insufficient attention is paid to the formation of practical skills for students to use modern information technologies to manage organic production. This is especially true due to the following factors:

1. The transition to organic production, certification of products and their sale at high prices can take several years. During this period the company incurs operating expenses. To ensure production efficiency, it is important to ensure that such costs are planned and systematically controlled.

2. The situation in the organic markets is changing. Prices for organic products depend on the solvency of buyers, the offer of traditional goods, the quality of products. In order to take into account market and production factors, it is important to develop and implement a strategy for the transition to organic production, which provides a comprehensive analysis and diagnosis of the current state.

3. The use in the organic production of specific technologies, biological products, increasing labor costs. This requires the creation of a detailed accounting and information system to monitor production performance, economic and financial flows.

4. The complexity of implementing organic production information software in small and medium-sized enterprises, which is the driving force behind organic production. The management of small enterprises requires specific information programs, which, on the one hand, form the necessary management information, provide the control function. On the other hand, they do not contain unnecessary information, do not require large labor costs for training and work, as well as financial expenses.

To simulate students' theoretical knowledge and practical skills in business process automation in the field of environmental management, the Department of Environmental Management and Entrepreneurship of Taras Shevchenko National University of Kyiv developed a business simulator "Green Enterprise Development Strategy" based on 1C platform: Enterprise 8. Considering the interdisciplinary, which was founded in the development of educational software, business simulator is used by students including to develop a strategy Company that provides a transition to organic production.

The business simulator is based on an optimization model that provides a justification for the structure of organic production, while reducing costs associated with restrictions that imply standards in the field of organic production (reducing anthropogenic impact on the environment), as well as reducing the cost of purchasing resources (water and electricity) to maximize operating profit. Thus, limiting factors are: water use, drainage, waste management operations, emissions of pollutants into the air (CO2, CH4) and electricity (Table 3).

Table 3.

Input data for development of economic-mathematical model of optimization of production program during the transition to organic production

№	Ecological aspect	Indicator
1	Water use	Water consumption per 100 ha, l
2	Waste management operations	Waste generation per 100 ha, t
3	Fertilization	Use of biologically safe fertilizers per 100 ha, t
4	Emissions of pollutants into the atmosphere	CO2 emissions per 100 ha, t
5	Electricity consumption	Energy consumption of 100 ha, kWh

Source: compiled by the author

Optimality criteria:

1) maximum profit;

2) the regulatory value of the costs associated with the environmental impact of the enterprise (drainage, waste management operations, emissions of pollutants into the air);

3) the normative amount of costs for the purchase of resources (water and electricity).

In order to identify the most advantageous for the enterprise area of environmental management (which will ensure optimal production with minimal resource consumption and maximize economic benefits), it is advisable to develop a set of alternative organic production strategies. This can be achieved by modeling scenarios of probable events, namely the following combinations of variables and target functions (Table 4).

Table 4.

The combination of variables and target functions for the construction of an economic-mathematical model of optimization of the production program for the development and implementation of the strategy of "green" enterprise development

Variable	Function	Cost management of environmental aspects
Revenue per 100 organic hectares, thousand UAH	Water consumption Waste Emissions of pollutants into the atmosphere	Minimum Minimum Normative
	Drainage Emissions of pollutants into the atmosphere Energy consumption	Minimum Normative Normative Normative
	Water consumption Drainage Waste Emissions of pollutants into the atmosphere Energy consumption	Normative Normative Minimum Normative Minimum Normative

Source: compiled by the author

It is necessary to find the values of variables x_1, x_2, ..., x_p that satisfy the constraints on environmental management costs. Then the objective function (increase of profit on 1 production) becomes extreme (maximum or minimum) value.

2021 ISSN 2409–0948 print
№ 1(23) ISSN 2415–3311 online

The admissible solution of the optimization model is the vector $X = (x_1, x_2, ..., x_n)$, whose coordinates satisfy the constraint system (2) and the conditions of invariance of the variables (3). When performing mathematical programming using specialized software based on platform 1:C Accounting 8.2 in addition to the above elements should specify:

1. Variation range of variables - minimum and maximum volume of production of products that are limited by the land bank, natural soil fertility, possible climatic factors;

2. Accuracy - the limits of calculating variables.

3. Weighting factor - a coefficient that reflects the proportion of the studied factor in the structure of the cost of production.

To calculate the planned economic indicators, it is advisable to use an electronic document, developed on the basis of platform 1: C Accounting 8.2 - "Document for working with data": Menu → Calculation → Document for working with data → Add.

Structurally, the economic and mathematical model includes three main elements:

1) a set of managed variables x1, x2, ... x n whose values are to be optimized. Different valid combinations of variable values correspond to the possible solutions to the task.

2) The objective function z (x1, x2, ... x n) is a function that expresses the dependence of the received optimality criterion on the managed variables. The optimality criterion is a measure of approaching the goal. In economic tasks, as a rule, the criterion is an indicator of the effectiveness of the system (such as profit from sales, productivity, etc.) or an indicator of costs.

Multiple criteria of optimality (multicriteria task) can meet the same goal. In this case, the target function must take into account all the selected criteria.

3) Conditions or constraints g (x_1, x_2, ... x_n), which are imposed on the values of the variables, or on the relationship between them.

Where z is the average annual profit of the enterprise from the production of organic agricultural products, thousand UAH;

x_1 - average annual production of products of the i-th type, t (variable);

x_2 is the average annual production of products of the y-th type, t (variable).

s_1 - profit per 100 hectares of the i-th type of crops, thousand UAH;

c_2 - profit per 100 hectares of the y-th type of crops, thousand UAH.

The document has the following structure:

1. The table of parameters:

1.1. An abbreviated parameter name is a symbol used to indicate a primary or a calculated parameter in formula.

1.2. The full name of the parameter is the primary or estimated indicator used in the calculations (planned volume of water for irrigation, evaporation and splashing, m^3).

1.3. The parameter type is a number that indicates the primary and calculated values.

1.4. The parameter type may look like:

"Primary parameter" - a metric entered by the user for use in formulas;

"Resulting parameter" - is calculated by the system on the basis of the formula entered by the user.

1.5. Formula - mathematical calculation of the resulting parameter. Arithmetic actions and built-in functions can be used for formulas: purpose (x) is an integer from an argument; ok (x) - round the argument; log (x) - logarithm; log 10 (x) is a decimal logarithm, sin (x), cos (x), tan (x), asin (x), acos (x), atan (x) are trigonometric functions, exp (x) is y e y power x, pow (x1, x2) - any number x1 in power x2, sqrt (x) is the square root of x.

Data entry table - formed by the button "Generate data entry table" and used directly for calculations (Fig. 1).

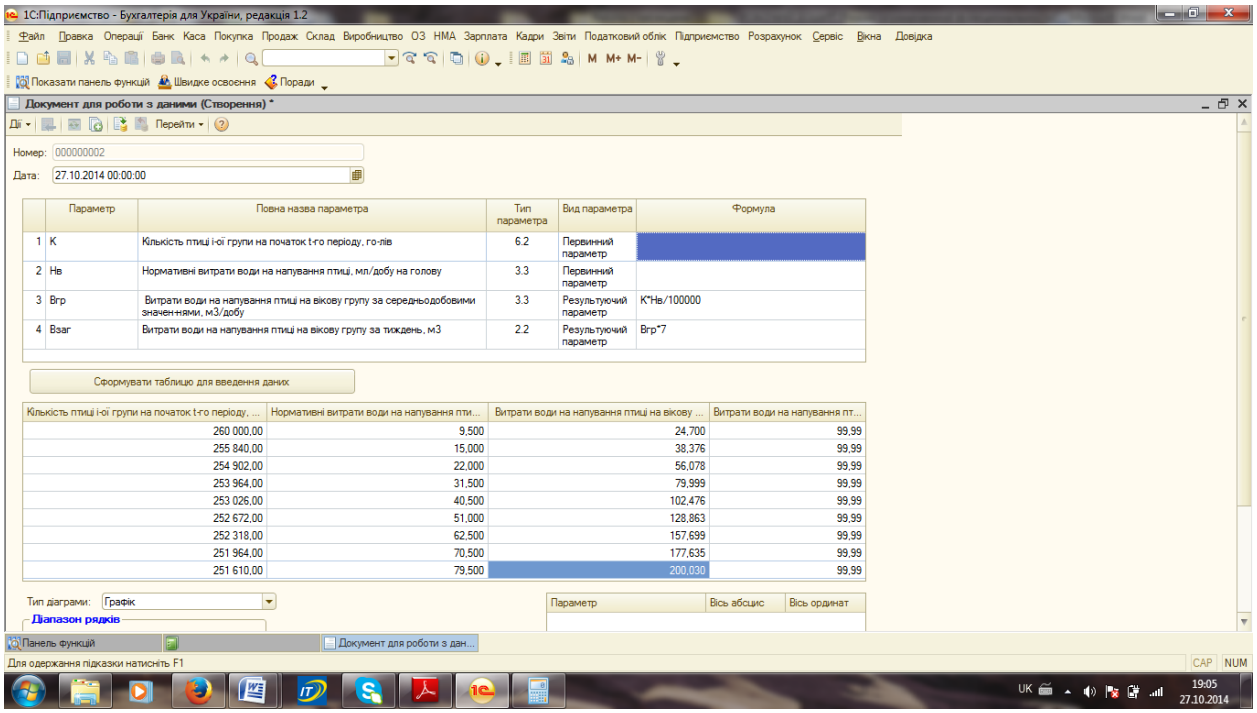

Figure 1 - Document for solving mathematical model of optimization of production structure taking into account environmental constraints provided by organic production
Source: Developed by the author

According to the results of data processing, students determine a set of alternative structures for growing organic agricultural products. Given the selling prices in the current and next marketing years, future managers determine the most economically attractive program of organic production.

Application of the developed business simulator allows students to develop practical skills:

1. economic and mathematical modeling of the production program of the enterprise;
2. planning of economic activity of the enterprise;
3. use of modern information technologies for automation of business processes;
4. formation of a technical task for improvement of existing information-analytical systems taking into account actual management needs.

Conclusion. A decisive factor in the rapid development of organic production in Ukraine is the improvement of professional training of specialists in this field, the provision of human resources, including through the recruitment of young specialists in higher education.

Improving labor productivity and ensuring international competitiveness of organic production in modern conditions is impossible without the robotization of production processes, comprehensive automation of business processes. For effective informatization of production and management activities of agricultural producers, rapid and successful implementation in the labor market, specialists in the field of organic production must have up-to-date information technology AgTech.

At the demand of the labor market, domestic higher education institutions began to actively train specialists in the field of organic production. For this purpose, specialized educational programs (Organic farming, Organic production, etc.) were developed, practice bases were created (including on the basis of their own certified lands, livestock farms and operating farms), non-formal education tools were developed (scientific centers, training classes school organist, etc.).

2021 № 1(23) ISSN 2409–0948 print ISSN 2415–3311 online

References

1. Regulations Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC), № 2092/91, Official Journal of the European Union, 20.7.2007.23 p.
2. FIBL Statistics. https://statistics.fibl.org/.
3. Agrarian business in the digital age - Ukrainian realities. https://nachasi.com/2018/10/02/ it-zemlerobstvo/.
4. Milovanov, E. scientific and educational aspects of organic production development, Agrosvit, 15-16, 32-46 (2018).
5. Novak N., Principles and competitive advantages of organic farming in Ukraine, Agrosvit, 9, 30-33 (2016).
6. Stetsishin P.O., Pindus V.V., Rekunenko V.V. Fundamentals of organic production. Nova Kniga, Vinnitsa (2011).
7. Kallander, I., Organic Agriculture in Sweden. Stiftung Okologie & Landbau (SOL), Bad Durkheim (2000).
8. Kristiansen, Paul; Taji, Acram and Reganold, John (Eds.), Organic Agriculture: A Global Perspective. CSIRO Publishing, Collingwood, CABI, Wallingford, Cornell University Press, Ithaca, Manaaki Whenua Press, Lincoln, Australia (2006).
9. Lampkin N., Foster C., Padel S. & Midmore P., The Policy and Regulatory Environment for Organic Farming in Europe. Organic Farming in Europe: Economics and Policy, 1, (1999).
10. Lapinsky, V., Pylypchuk, A. Means of Information and Communication Technologies of the only Information Space of the System of Education of Ukraine: monograph; for sciences edit prof. V.Y. Bykova Pedagogical Thought, 2010.
11. Stechkevich, O., Yakimovich, T. Using of Audiovisual Means of Training in Professional Training of Future Specialists. Modern Information Technologies and Innovative Methods of Training in the Training of Specialists, 52, 152-155 (2018).
12. Strelnikov Y.V., Britschenko I.G.: Modern Technologies in Higher Education. PUET, Poltava (2013).
13. Torubara, O. Application of the Modern Information Technologies in the Educational Process of Higher Education. https://www. Irbis-nbuv.gov.ua, last accessed 2019/02/21.
14. Tutun, L., Soya, O. Use of Application Packages in the Process of Professional Training of Students of Physical and Mathematical Specialties. Modern Information Technologies and Innovative Methods of Training in the Training of Specialists, 52, 152-155 (2018).