
INTRODUCTION TO THE ECONOMICS OF ANIMAL HEALTH IN UKRAINE

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Abstract. *The world has long recognized the importance of studying the economic impact of animal health problems on livestock, the veterinary service, and the economic and food safety of the country as a whole. Animal health economics is a branch of the economy and, in particular, the agricultural economy, which applies the principles and methods of economic analysis to animal health problems. It is established that it has already been quite successfully integrated into the veterinary services of developed countries and in the curricula of the leading faculties of veterinary medicine.*

The article examines the foundation, stages of the formation and development of animal health economics. The main scientific schools and their contribution to the development of animal health economics are highlighted.

So far in Ukraine, the scale of animal health economics has been rather modest. The concept was based on disease losses and a cost-benefit analysis of disease control or coping strategies. It is extremely necessary to establish its own scientific school that will take into account the world experience, realities and features of veterinary medicine and animal husbandry, and be implemented in the modern science and production of Ukraine.

In our opinion, animal health economics in Ukraine should include the following components: economic theory and methods, health economics, economic analysis of diseases, economics of the veterinary business.

Knowledge of the basics of animal health economics allows the veterinarian to more effectively cover all areas of work from the state veterinary inspector to the doctor at the farm level, to be a real consultant on effective animal husbandry. This knowledge also adds value to private practitioners, making them better prepared to compete in the veterinary services market. Animal health economics should be included in the curriculum for veterinarians in Ukraine.

Keywords: *animal health economics, economic analysis, control of infectious diseases, anti-epizootic measures, animal husbandry, economic efficiency of veterinary measures*

*Economics is a difficult discipline and requires special knowledge,
but no one will ever believe it*
John Keynes

Introduction

The economy is an integral part of our lives. Regardless of our interest in the economy, the economy always affects our lives – what we do, in what conditions we live, what and how we eat, how we rest, how we develop and receive education, how we treat ourselves and treat our animals. Every day we have to take a lot of economic decisions: to ensure our well-being, to cooperate with staff, suppliers, representatives of state institutions, to make economic decisions that will have an impact on us in the long run.

Almost two-thirds of the population in Ukraine now live in urban conditions, where they have the best access to work, a higher standard of living, a better developed social sphere, and simplified access to benefits of civilization, but limited or no access to land, livestock, and food production. It implies the dependence of most people on agricultural producers. Also, the effective functioning of this sector of the economy, in particular, the livestock sector, which covers all aspects: production, supply, processing, logistics, and sales, has become a critical issue for guaranteeing the country's food security.

In the context of globalization, it is important to gain knowledge at the intersection of different specialties, and it becomes important to provide economic justification for any veterinary activities to improve and protect animal health through funding and organization of activities. Both the private business and the public sector operate within

the current legislation and use well-known economic instruments to assess the effectiveness. However, theoretical principles and economic tools that shed light on the problems are currently poorly understood in relation to animal health and the functioning of the veterinary service. At the production level, economic theory and tools are especially important when planning veterinary activities, distributing financial resources, the effectiveness of anti-epizootic work, and ensuring the appropriate level of veterinary service.

Analysis of recent researches and publications

Animal health economics in a very short time of its formation and development has already been integrated into the training programs for students of leading faculties of veterinary medicine. However, a small group of scientists, consultants, and specialists is currently working on this area of research. Among them are Bennet, Buhr, Carpenter, Chilonda, Davidson, Dijkhuizen, Ellis, Hugh-Jones, Hurd, Kaneene, McInerney, Mlangwa, Morris, Ngategize, Otte, Perry, Renkema, Rushton, Stott, Tisdell, Vagsholm, and others.

Purpose. The purpose of the study is to investigate the beginnings, stages of formation and development of animal health economics; to identify the main scientific schools and their contribution to the development of animal health economics; to define and thoroughly structure the components of animal health economics; to consider each of

the components and identify features; to assess the state of economic research from this direction in Ukraine.

Materials and methods of research

Research materials were data from literature sources, statistical information, FAO data. Statistical, analytical, historical, and system methods, as well as system-activity approaches, were used.

Results of the research and their discussion

The importance of farm animals in the modern world is difficult to exaggerate. First of all, it is food security of people, products of animal origin are contained in a third of products presented on store shelves. Raw materials of animal origin are used in light, food, cosmetic, and pharmaceutical industries. Farm animals are the main part of mammals in the world and are an important part of aquatic biomass. In addition, billions of pets around the world are serious capital, investment, and working capital. Only in Ukraine, according to the State Statistics Committee (2020), in the field of agriculture, forestry, and fishing almost three million people are officially employed on the farm. This is more than in the industry, construction, and education. And yet, the private sector and individual households are not taken into account. The world of agriculture employs more than 700 million people. This is a colossal labor market where quantity employees are independent of fashion, political decisions, international conflicts, and other macroenvironmental factors, and most importantly, it is a significant part of the world economy. Livestock is the most labor-intensive branch of agricul-

ture. Also, unlike crop production, the industry provides work and income all year round, not seasonally. That is why, ensuring the health and welfare of animals, and accordingly, the countries' food security is one of the important tasks of the world community. These tasks must be considered in the political, social, and economic context.

To make an economic assessment of health and veterinary animal care, it is important to have an understanding of the socio-economic conditions in which a branch of animal husbandry and veterinary animal care operates. Often there are animal diseases, the origin and spread of which are closely related to socio-economic human activities. International and national policy, subsidies, product market regulation of animal husbandry, the epizootic situation in the country and the world, the development of the pharmaceutical market, and many other factors have both direct and indirect effects on animal health economics. Animal health economics is quite a young direction compared to other economic disciplines. And the first scientific schools in this area of research appeared only in the 1960s.

Ellis (1972) and Konigshofer (1977) in the mid-1960s documented the information received from the veterinary services of different countries and compiled the so-called "Health Yearbook", which made a thorough assessment of the economic losses for each infectious disease, which are the most common. Ellis was in many ways a pioneer in animal health economics, he is the founder of the Department of Veterinary Epidemiology and Economics Research Unit (VEERU) at the University of Reading, UK. The efforts of Ellis in economic development and animal health were assessed by the EU Economic Council and established in 1975 the VEERU.

Carpenter (1979, 1980) was another pioneer in animal health economics during the 1970s. His early work focused on the economics of *Mycoplasma gallisepticum* and

Mycoplasma meleagridis in turkeys. Carpenter was the first to study the use of various methods of economic analysis for the study of diseases and their control. These are methods such as micro-economic disease analysis, simulation models for animal disease assessment, dynamic programming, assessment surplus consumers, willingness to pay for vaccinations, linear programming, use economic analysis to review subsidies to veterinary institutions, and others.

Hugh-Jones (1975), who worked in the Department of Epidemiology and Health of the University of Louisiana, specializes in geographic information systems (GIS), modeling diseases such as anthrax, anaplastic dermatophilosis, and trypanosomiasis. He is famous for careful assessment of the economic impact of infectious diseases on production.

McInerney (1996) and Howe (1992) worked at the University of Exeter, UK. They began research on the theoretical foundations of animal health economics and conceptual model of farmers' behavior during epizootics. Scientists tried to teach their veterinary colleagues about new approaches to disease assessment. However, their views on the economics of animal health were largely limited to concepts and theories. This group is considered the first to initiate the conceptual foundations of economic analysis of the disease and its control.

Dijkhuizen (1995) (Wageningen, the Netherlands) began a study in the 1970s of the economic costs of the disease with an emphasis on mastitis. He also studied the economics of surgery in animal husbandry and production

problems. In 1997, together with Morris (1997), they published a textbook on animal health economics which described in detail such issues as basics of economic analysis of animal diseases, decision-making in animal health management, economic consequences of outbreaks of infectious animal diseases, linear programming in economic analysis of herd health, dynamic programming to optimize the treatment of animal diseases, risk management in the elimination of disease outbreaks, etc.

Tisdell, Harrison & Ramsay (1995) began to study animal health economics in the second half of the 1990s at the Universities of Queensland and Brisbane, Australia. They started with a study of the economics of cattle health, with an emphasis on foot-and-mouth disease. They analyzed the cost of elimination of foot-and-mouth disease and the economic effect of eliminating these diseases.

Perry (2001) (ILRI Institute in Nairobi, Kenya) was one of the most famous epidemiologists from the 1990s to the 2000s. He brought together several important topics in animal health economics: economic analysis and forecasting at the farm level; the impact of sanitary requirements on profitability and market of livestock products and financing of veterinary services at the state level. In addition, Perry, along with Randolph (2001) and McDermott (2002), have quite fruitfully cooperated in the field of economics of parasitic animal diseases and discovered the relationship between poverty and virtually no investment in animal health in countries of the African continent.

Bennett (2003) from the University of Reading (UK) also made his contribution to the study of animal health economics, he initially worked on the economic foundation's control of cattle

leptospirosis. But his main contribution to this day is his research work on animal welfare economics and the assessment of endemic disease losses in the UK.

Rushton (2016) is an economist specializing in animal health economics, the economics of animal husbandry, and the development of this industry. He has experience in livestock development in Africa, Asia, Europe, and Latin America, collaborates with many governmental and non-governmental organizations. He currently teaches animal health economics at the Royal Veterinary College, London. He investigates food security, reducing production costs of animal husbandry, animal welfare, optimization of veterinary costs for prevention and localization of transboundary emergent animal diseases in developing countries, etc. He is the author of the textbook on animal health economics and animal husbandry economics.

Otte (2007), his research is funded by FAO. He uses different economic approaches and methods aimed at making decisions to ensure animal health in industrial livestock. In his opinion, the issues of animal health economics and anti-epizootic funding measures are in close connection with political, social, and economic aspects.

Stott (2005) is a representative of the Scottish agriculture college. He first applied the method of optimization and feasibility in decision-making treatment and prevention of animal diseases; his monograph was published in 2005.

During the Soviet era, research was also conducted to determine the economic damage caused by animal diseases and the cost-effectiveness of veterinary measures. During the times of independent Ukraine, no new research has been conducted in the field of animal health economics. From the above,

we can draw an intermediate conclusion that the economics of animal health has already been integrated into veterinary services around the world and the curriculum for veterinarians at universities.

Economics includes economic theory and the methods used to analyze economic problems or to plan for the future. To effectively apply economic laws and principles of management in agriculture, the economist must understand biological principles of agricultural production. And then it comes to animal health economics, the basics of animal husbandry and the principles of veterinary medicine. In our opinion, animal health economics is a branch of the economy and, in particular, the agricultural economy, which applies the principles and methods of economic analysis to animal health problems. Quite often, economics is defined as an industry that measures things in monetary terms, while other disciplines use physical units: number of animals, body weight gain, body temperature, milking, and more. This view is fundamentally wrong and even demeans this field of knowledge. Economics is not about money. Economics helps to make rational decisions in the allocation of limited resources, using different methods of economic analysis.

Currencies serve as criteria for comparing different resources and achieving goals as well, taking direct participation in decision-making. Livestock economics and animal health help to decide problems of lack of resources. Decisions concerning the allocation of limited resources by animal owners, agribusiness, veterinary specialists, government officials, should be balanced and well analyzed with the help of various economic instruments. The decision, which will bring the greatest benefit in terms of resources used, will be rational.

According to McInerney (1987), the underlying conceptual models of economic analysis include three main components: people, product, and resources. People want a certain product and make decisions, products are goods and services that satisfy human needs, and resources are the basis for product production and resources are the starting point for economic activity.

Animal diseases have a negative impact on the process of transforming resources or factors of production into a product, goods, and services available to people. Animal diseases lead to direct economic losses for the producer and the potential loss of product value for the consumer. Therefore, animal diseases have a significant impact on the regional, national, and global economy as a whole. The analysis of such systemic influence is complex and multi-vector.

Animal health is not a problem, disease is a problem. A world with perfect competition would be ideal, where all manufacturers have equal access to the latest technology, access to all required resources in unlimited quantities, minimum production costs, and total people's well-being is constantly growing. But, unfortunately, we all understand that achieving such a balance in the economy is unrealistic. The same situation is true for animal diseases. Imagine a world where no animal gets sick, gets infected, does not die. That is not possible. But we can and in most cases take measures to prevent the spread of infectious diseases, reducing morbidity, preventing death in animals, minimizing the period of reduced productivity, etc. This becomes more important when providing quality assistance in deciding on animal health measures at various levels.

In our country, the scale of animal health economics was quite modest. The concept was based on losses due to dis-

ease and cost-benefit analysis of control strategies or overcoming diseases. Conventionally, this work can be called economic analysis of animal diseases and eradication strategy. In the past, economic principles and methods for analysis have been little used in veterinary systems, management of such systems, analysis of animal health policy, impact development of veterinary business on animal health, and much more. This situation has changed in the world a few decades ago with the contribution of livestock experts, political scientists, economists, and veterinarians who are interested in the management of veterinary systems.

The development of animal health economics has had a positive impact on:

- financing of veterinary services in different countries;
- quality of veterinary services;
- division of responsibilities between the state and private practitioners;
- planning and level of financing of anti-epizootic measures.

In our opinion, animal health economics in Ukraine should include the following components:

- economic theory and methods;
- health economics;
- economic analysis of diseases;
- economics of veterinary business (Fig. 1).

Economics is the object of knowledge of many sciences, each of which chooses its subject for analysis and research, i.e. the range of phenomena, processes, and laws that are characterized by specific features and combined into a certain system of knowledge. Economic theory in the system of economic sciences occupies a central place. Economic theory is a set of interrelated scientific categories, laws, propositions, and hypotheses. These hypotheses take the form of models of economic behavior, and each model can be tested em-

pirically. Economic models are abstract logical constructions consisting of two components: assumptions and the consequences of such assumptions (Parkin & King, 1992). The theory can be used to describe, explain, or predict the economic behavior of subjects or economic variables. In addition, it is the theory that directs the direction of research. Thus, economic theory guides economists in choosing appropriate concepts, models, methods, and techniques for the study of economic problems and data analysis in both basic and applied work.

What is the subject of science, such is its method of research: the subject generates the features of the method, and the method produces the tools of cognition, through which economists penetrate the essence of economic phenomena and

processes. Many of the methods are borrowed from related sciences: mathematics, mathematical statistics, accounting, psychology, management, biology, veterinary medicine, and others, which are the result of the interpenetration of different sciences at certain stages of their development and features of economic analysis, formed and developing at their intersection. In the scientific literature, there is no unity in the classification of methods of economic analysis. The most appropriate is the classification of methods of economic analysis according to their internal content and purpose. In economic theory, the system method is widely used in the analysis. It involves the consideration of each economic phenomenon as a system. Integrity is an important element of a systems approach

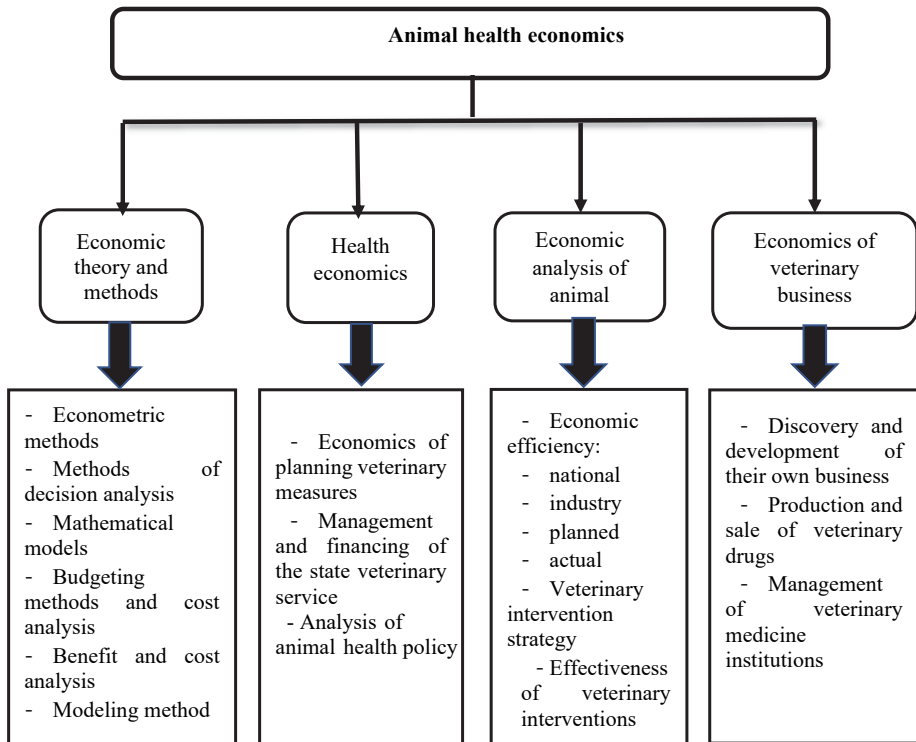


Fig. 1. Components of animal health economics

that requires the study of individual components of any phenomenon and the study of internal relationships between these elements and subsystems, as well as identifying the overall purpose of the system. The researcher must establish the nature, place, and role of each element of the system, their relationship. The synergetic approach to economic analysis is to consider the object of analysis as a complex system that is self-developing, the study of processes of self-organization, streamlining and maintaining the sustainability of the entity. The synergetic approach is the development of a system approach, which traditionally studies the processes of maintaining balance in systems through feedback, as well as systems management processes.

Economic and mathematical methods are the conditional name of the methods of mathematics and cybernetics used to solve specific management problems. These include methods of multidimensional complex estimation, econometric, methods of mathematical programming (linear, nonlinear, dynamic, and discrete), and others.

Factor analysis methods are used to study causal relationships or the influence of factors on performance. These include the following methods: deterministic (economic) factor analysis (chain substitutions, absolute and relative differences, integral, partial participation, etc.). However, in animal health economics, as a rule, a relatively narrow range of methods is used.

Morris (1999) argues that economic analysis of animal health problems uses five common methods of economic analysis, namely:

- partial or full budgeting;
- profitability analysis;
- cost-benefit analysis;
- decision analysis;
- system modeling.

Econometric methods (econometric modeling) are often used in animal health economics to predict production and socio-economic indicators or to study different approaches to disease prevention or control. The methods of models have a special place in determining the directions and assessing the prospects for the development of the field of research. The process of applying modeling methods is an important way of theoretical and practical actions aimed at stabilizing and ensuring the effective development of veterinary services. Statistical and epizootic models use Ngategize & Kaneene (1985). And Hurd (1993) examines in detail the application of "simulation" models. Buhr (1993), Carpenter (1991), and Vagsholm (1991) pointed to the benefits of econometric methods for comparison and relationship in epizootology and economics. The use of econometric methods of quantitative modeling in decision-making on the prevention, treatment and control of animal diseases was considered by Bennet (1992), Dijkhuizen (1991), and Renkema (1980).

Decision analysis methods are used to make decisions in conditions of uncertainty, features in terms of warehousing, but poorly structured economic problems (Mlangwa & Samui, 1996). Risk analysis is included in this methodology, which is based on the synthesis of expert opinion. Data on risk opportunities (empirical or variable) is significant. The equipment can be used at the manufacturer's level or higher levels up to the international level. The models used in the methods of decision analysis can be divided into the following:

- mathematical;
- technological schemes;
- repayment matrices;
- decision trees.

Davidson and co-authors (1981) gave an example of such an approach to thromboembolic meningoenophthalmitis in cattle.

Optimization of mathematical models uses linear programming. Although this technique is purely mathematical, it is a very useful tool in the allocation of resources and funding of anti-epizootic measures on a limited budget. The pioneers in this were Bennet (1992), Dijkhuizen (1991), and Ngategize (1985).

Budgeting methods and cost analysis in animal health economics are in fact the basis for planning anti-epizootic measures and calculating the effectiveness or feasibility of financing animal disease prevention. These methods are used by the vast majority of scientists in the field of animal health economics, public veterinary services of different countries and non-governmental organizations in the formation of annual or short-term plans. Budgeting methods are the basis of planning in animal health economics. They allow either to completely prevent the occurrence of diseases or to minimize losses from diseases (to achieve the minimum cost of the disease). Moreover, it is effective both at the level of a small farm or agricultural enterprise and at the level of an entire industry or country. Accordingly, the partial budgeting methods use the partial analysis methodology.

Benefit-cost analysis is used in cases where the planning of veterinary measures covers a period of more than one year. It can also be used in combination with a partial analysis methodology. This method is more often used at the national and international levels, in the implementation of multi-year programs for the rehabilitation of large areas, countries, and regions, and the development of programs to support and finance the control of epizootics in poor countries. Socio-economic indicators are also taken into account in this method and the analysis of the corresponding level is carried

out. The main purpose of this method of economic analysis is to achieve the desired result at a minimal cost.

The last of the most widely used methods of economic analysis, but not the last in its importance, is the method of modeling. It tries to simulate real variables (state, distribution, magnitude, and quantity) over time. Typically, this method allows you to make decisions or analyze the relationship between the epizootic and economic model. Epizootic modeling is used in two ways. The first option is when individual animals in the herd are "supervised" for a certain period of time. Their state changes stochastically, i.e. in accordance with the laws of probability. Alternatively, the livestock moves over time and these animals change their state deterministically using fixed transition factors (Bennet, 1992; Mlangwa, 1996). In stochastic modeling, the risk is taken into account by means of a probability distribution or by means of random numbers. Simulation is a non-optimized method that is useful for analyzing the dynamics of variables in different scenarios. Economic variables can also be modeled.

Many methods and techniques have been used to analyze losses in disease control. The idea of choice is central to any economic analysis. The main premise of the analysis is to compare one disease control strategy with the consequences of inaction.

Economic analysis is not a form of financial accounting. The main task in animal health economics is to compare and create a rating of alternative disease control measures according to the preferences of each. Accordingly, making the most appropriate decision, rather than calculating the exact monetary value.

The economics also investigates the risks of investing in the control and pre-

vention of animal diseases, and risk assessment is an important component of animal health economics (Anteneha, 1991).

Control of animal diseases also involves the allocation of financial resources, both to prevent and further control diseases and their consequences (elimination of epizootic outbreaks, costs of treatment or destruction of animals, compensation to animal owners, etc.). All this together has a significant impact not only on the economy of farms, agricultural enterprises, and large producers but has a much broader impact. Including the competitiveness of the livestock industry and the economy as a whole. Because the crises in the livestock sector entail the processing industry, feed production, crop production, industry, exports, regional economies, and, consequently, the national economy. That is why animal health economics is of the greatest importance for the food and economic security of the country and, unlike economic theory, evolves much faster in its development. It also has significant differences depending on the country and continent, as well as crucial practical significance.

The most important factor in animal health economics is the level of funding and the level of implementation of anti-epizootic measures. Three components are needed for full-fledged anti-epizootic measures in Ukraine: highly qualified veterinary specialists, legal framework, and adequate funding. It should be noted that in recent years, the underfunding of anti-epizootic measures has been systematic, which has prevented the competent authority from carrying out its functions according to the anti-epizootic plan, and as a result, we have a tense epizootic situation in the country for some diseases. 2016 was a critical year, with funding amounted to

only UAH 52.86 million. For comparison, a small country like North Macedonia spent 4 million euros in 2016 just to control nodular dermatitis.

If in Ukraine in 2018 UAH 687.195 million was allocated for the implementation of the plan of anti-epizootic measures for the prevention of major infectious and parasitic animal diseases, in the future this amount remains stable, although at least the inflation index must be taken into account.

According to world practice and reports of competent authorities of different countries, to ensure the effective functioning of such a component of animal health as animal health economics, the ratio of budget expenditures for anti-epizootic measures to the cost of livestock products at market prices should be at least 0.7–2.0%. Unfortunately, this figure does not exceed 0.06% in Ukraine.

In addition, unfortunately, in Ukraine, there is only one source of funding for anti-epizootic measures – the state budget and the reserve fund at the national or regional level. This can be partly explained by the almost complete lack of attention from economists and research on the economic component of protection against the introduction and spread of infectious diseases in Ukraine.

While in many countries several sources are used. For example, in Germany and the Netherlands, there are several sources of funding for anti-epizootic measures and compensation for epizootics:

1. financing from the budget of the European Union;
2. financing at the expense of the state budget;
3. mutual funds of public-private financing are legally enshrined;
4. compulsory insurance funds;
5. voluntary insurance funds;

6. schemes that are not enshrined in law;
7. various voluntary funds.

It is clear that funding from the EU and the state budget will be present in any case, but almost all pet owners use public-private funding. Currently, in Germany and the Netherlands, anti-epizootic cash registers have been established in all lands, the legal mechanism of which is prescribed in the Animal Health Act.

Rat-Aspert & Krebs (2011) also point out the effectiveness of systematic collective work in the field of control of infectious animal diseases. Animal owners need to collectively manage this risk in order to improve their welfare and ensure a high level of profitability in the livestock industry. Manufacturers can collectively influence the level of anti-epizootic work. Their goal consists of two achievements: epizootic (elimination of the disease and restriction of the pathogen circulation) and economic (maximization of collective welfare).

The success of collective action depends on their acceptance by all producers and systematic work.

Economic analysis of animal diseases primarily includes the economic efficiency of veterinary measures. They are the prevented amount of losses in animal husbandry, the added value (obtained by increasing the number of products, improving its quality, savings labor and material resources due to the use of more effective means), and methods of animal disease prevention and treatment, as well as savings in related industries.

In modern conditions, there are planned, actual, sectoral, and national economic efficiency.

Planned economic efficiency is determined by substantiation of plans for the prevention of infectious and non-communicable diseases, means and methods of treatment of animals, etc.

The actual economic efficiency is calculated based on the consequences of a set of preventive, health, and therapeutic measures, the use of certain methods of treatment, tools, and equipment.

Sectoral economic efficiency is calculated based on the consequences of veterinary measures, in particular, preventive, anti-epizootic, and rehabilitation in a particular area of animal husbandry.

National economic efficiency is calculated as a result of veterinary measures that have been carried out in the livestock sector in the country as a whole and have had an impact on other related industries: processing, food, international trade, and others.

The economic efficiency of veterinary measures can be calculated for the method of treatment or prevention, one animal, group of animals, farm, agricultural enterprise, livestock complex, settlement, district, region, region, industry, and country.

Indicators of economic efficiency of veterinary measures:

1. Reducing the incidence and mortality of animals;
2. Reduction of damages and losses;
3. Increasing the productivity of animals;
4. Increasing the number of livestock products;
5. Reduction of feed costs per unit of output;
6. Reducing the unit cost of production;
7. Improving profitability and increasing profits.

In addition, economic analysis of animal diseases allows determining the profitability of specific programs for disease control and animal health management. Through economic analysis, quantitative assessment of the economic consequences of animal diseases, it is possible to develop approaches to opti-

mize decisions on veterinary measures in the future and thus manage animal health (Ababneh, 2003).

The impact of animal diseases in the production system (livestock at different levels) is to reduce profitability and production results. The consequences of the disease can be divided into two groups: direct and indirect losses (Otte & Chilon-da, 2013). Direct losses include:

- diseases destroy the main resource of animal husbandry, lead to the death of animals or cause their mass destruction;
- diseases reduce the efficiency and productivity of production processes, as an example of reduced feed absorption;
- diseases reduce the productivity of animals, namely reduced milk yield, egg production, live weight gain, and most importantly, reduced quality and cost of production.

Indirect losses include the following:

- veterinary costs for the prevention, eradication, or treatment of animal diseases (vaccination, veterinary drugs, quarantine costs, etc.);
- damage to human health due to zoonoses or consumption of low-quality contaminated products;
- suboptimal use of available resources by making forced changes in production (closing of export markets due to epizootic distress, other).

The economics of the veterinary business is a very significant area of animal health economics. Starting your own business, licensing, and working in market conditions. All these are civilized components of the market of veterinary services. If veterinary control and supervision is a function exclusively of the State Food and Consumer Service, then other aspects of veterinary activities (diagnosis, prevention, treatment, some an-

ti-epizootic measures, production, sale of veterinary drugs and services, consultations, advisory activities, etc.) are a wide space for private veterinary business.

In countries where market relations have been developing for centuries (for example in developed European countries), about 80% of all veterinarians are involved in private practice. Forming your own private veterinary practice cannot be an easy path. Therefore, everyone who dares to start their own business must find answers to many questions, master the basics of economic, financial and tax literacy, develop new skills. To be not only a doctor, but a good analyst, consultant, manager, to have the basics of foreseeing, to be interested in the socio-economic situation, and to monitor the epizootic situation both in the country and in the world.

Veterinarians, who understand the assessment of profits, profitability, production costs, compromise decisions in the elimination and treatment of diseases that can manage animal health will have more opportunities and demand among animal owners.

The practice of market relations proves that the market of veterinary goods and medicines is largely differentiated depending on consumer groups and consumer properties of veterinary goods. And this requires maximum consideration of the characteristics of its individual areas.

Conclusions and future perspectives

Animal health economics is an integrated dynamic field of production and research, which has already been integrated into veterinary services around the world and training programs for veterinarians in universities. In order to effectively apply economic laws and

management principles in agriculture, it is necessary to comprehend the biological basis of animal husbandry and the principles of agricultural production. At the same time, animal health economics is based on animal health and the principles of veterinary medicine.

Of course, various groups of scientists, consultants, and specialists are concerned with the issues of animal husbandry efficiency and animal health management. Currently, new priority areas for the development of animal health economics are the study of the economics of animal husbandry systems and animal health problems due to the impact of these systems, in particular transboundary emergent animal diseases. The feature of this economic direction is the priority of the implementation of laws and approaches of the “old economy” to the “new realities” – cross-border animal diseases and their impact and control.

Since Ukraine has for many years stood aside from the development of such areas of economic research as animal health economics and relied on the outdated system of determining the economic efficiency of veterinary measures, which inherited from the planned economy, it is now essential to start its own scientific school. This organization will take into account the world experience, realities, and features of the field of veterinary medicine and animal husbandry of our country.

Knowledge of the basics of animal health economics allows the veterinarian to more effectively cover all areas of work from the state veterinary inspector to the doctor at the farm level, helps to be a real consultant on effective animal husbandry. This knowledge also adds value to private practitioners, making them better prepared to compete in the veterinary services market.

Animal health economics should be included in the university curriculum for veterinarians in Ukraine to give students a sufficient understanding of economic concepts and tools and to prepare them for different roles and activities in their future careers.

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Жуковський М. О., Недосеков В. В. (2021). ВСТУП ДО ЕКОНОМІКИ ЗДОРОВ'Я ТВАРИН В УКРАЇНІ. *Ukrainian Journal of Veterinary Sciences*, 12(3):91–107, <https://doi.org/10.31548/ujvs2021.03.008>

Анотація. Світ давно усвідомив важливість вивчення економічного впливу проблем здоров'я тварин на тваринництво, ветеринарну службу та економічну й харчову безпеку країни загалом. Економіка здоров'я тварин – галузь економіки і, зокрема, сільського господарства, яка застосовує принципи та методи економічного аналізу до проблем здоров'я тварин. Встановлено, що вона вже досить успішно інтегрована у ветеринарні служби розвинених країн та в навчальні програми провідних факультетів ветеринарної медицини.

У статті розглядаються основи, етапи становлення та розвитку економіки здоров'я тварин. Висвітлено основні наукові школи та їхній внесок у розвиток економіки здоров'я тварин.

В Україні поки що масштаби економіки здоров'я тварин були досить скромними. Концепція ґрунтується на втратах від хвороб і аналізі рентабельності стратегій боротьби з хворобами або їхнього подолання. Вкрай необхідно створити власну наукову школу, яка враховуватиме світовий досвід, реалії та особливості ветеринарної медицини й тваринництва та буде впроваджена в сучасну науку і виробництво України.

На нашу думку, економіка здоров'я тварин в Україні має включати такі складові: економічна теорія та методика, економіка здоров'я, економічний аналіз хвороб, економіка ветеринарної справи.

Знання основ економіки здоров'я тварин дає змогу лікарю ветеринарної медицини ефективніше охоплювати всі напрямки роботи від державного ветеринарного інспектора до лікаря на рівні господарства, бути справжнім консультантом з ефективного тваринництва. Ці знання також додають цінності для приватних лікарів, роблячи їх краще підготовленими до конкуренції на ринку ветеринарних послуг. Економіка здоров'я тварин має бути включена в програму підготовки лікарів ветеринарної медицини в Україні.

Ключові слова: *економіка здоров'я тварин, економічний аналіз, боротьба з інфекційними захворюваннями, протиепізоотичні заходи, тваринництво, економічна ефективність ветеринарних заходів*
