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Providing sustainability of agro-food chains in Ukraine

Abstract. *This article gives the first summary of peculiarities of agro-food chains formation in Ukraine and their typology according to different classification characteristics. The study systemizes distinctive features of agro-food chains functioning from agro-holding to small producers and across some products. The questionnaire of agro-food chains actors, namely in agriculture and processing industry, allowed us to define the binding factors of their development and to justify measures for their overcoming. It is proved that a low level of management systems at agricultural and processing enterprises is one of the binding factors for agro-food chains sustainability in Ukraine. But it requires the activation of measures aimed at implementation of the European standards at all administrative levels. The driving forces for agro-food chains sustainability are explored as well, they are fair distribution of added value, implementation of innovations, reduction in negative impact on the environment, etc. On the base of this analysis, a set of recommendations to support the sustainability of agro-food chains was developed. They can help the government to develop strategic programmes for agrarian sector development and also they can help the chains actors.*

Keywords: *agricultural and food processing enterprises, agro-food chains, sustainable development, value added chains*

Introduction

The chain approach in the agrarian sector of Ukraine was, in its essence, formed on the technological unity and interdependence of natural-biological (growing of food raw materials) and processing (production of food products) processes. In particular, even in conditions of planned economy, food industry enterprises were firmly tied to the raw material base, and direct links to specific agricultural enterprises (ACEs) were sanctified and secured by the state. The rhythm of work of agricultural producers was mostly subordinated to the production process of processing capacity: in order to maximize their load, first of all, and adhere to the schedules of food raw materials supply. Simultaneously, the issue of payment for raw materials was solved deliberately, the control over its quality was more formal, and the sale of the final food products was provided on the basis of its wholesale purchases by the state and cooperative trading systems. The privatization of food industry enterprises in the 1990s for their subsequent resale in 2000-2010 prompted new owners to create and develop supply, production and distribution chains similar to the network marketing. They received the name "intuitive informal clustering" and had no completed form. In particular, systems of food chains for milk and meat processing factories and cheese producers were created through the organization of their own network of rural procurement points and branded stores; sales of products to regular wholesale buyers for subsequent transport of goods to outlets; sales of products to individual consumers; supply of some means of production to producers of agricultural raw materials through their dealers (Krysanov et al., 2009). It should be noted that later in the agrarian sector of the economy they were called agro-food chains, or AFC.

What should be noted are the transformations taking place in the agrarian sector since the 2000s. In particular, in 2000-2015, the number of large and medium-sized enterprises in food industry decreased from 2.5 thousand to 1.0 thousand units, and small ones – from 6.4 thousand to 4.5 thousand units. Significant changes also occurred in agriculture: the number of enterprises, including peasant farms, decreased from 59.0 thousand to 52.5 thousand units, private peasant farms (PPF) – from 5.3 million to 4.1 million units (Krysanov, 2016). Only 19% of the entire number of PPFs are market-oriented, semi-proprietary small farms account for 41%, while the rest produce products for their own consumption (Borodina, 2014). Along with this the influence of transnational corporations on the agrarian sector of Ukraine increased, provoking additional challenges and encouraging active or passive transformations and contradictory changes.

Thus, since the late 1990s, i.e. since the completion of privatization processes, and up to now there are diverse and contradictory processes in the agrarian sector which are mainly related to the concentration of agricultural and food processing production, intuitive search for new organizational and legal forms of enterprises, adequate to a changing economic situation, and creation and development of agro-food chains. They serve as an integral part of the agro-

food system, promote the involvement of individual small and medium-sized producers to co-production in order to increase efficiency and competitiveness of the final food product to more fully meet the needs of consumers. Over the last twenty years, considerable practical experience has been gained in creation and development of agro-food chains, which requires its theoretical comprehension and generalization.

The main objective of the article is the generalization and elaboration of conceptual bases for the chain approach in the study of agro-food chains formation and functioning; the justification of measures for the orientation of their development to the sustainability principles. So, the objective of the article is to clarify the following problems:

a. Systematization of scientific and methodological approaches and principles to the definition, creation and construction of agro-food chains;
b. Typology of agro-food chains according to the main classification features;
c. Generalization of foreign experience in the assessment of functioning efficiency and enhancing of the sustainability of agro-food chains in actual conditions;
d. Justification of the proposals aimed at removing obstacles in the development of agro-food chains and to their sustainability.

Methodology

The theory of a chain approach is a rather young branch of scientific knowledge. The fundamental concepts of the chain approach are developed by well-known western scientists Porter (2006), Gereffi (1994), Kaplinsky and Morris (2003). The methodology of this study was based on works of the above mentioned scientists, as well as evaluative-analytical works and generalization of opinions of experts and practitioners in the agro-food sector of the economy, and included in the analysis of current trends and institutional environment in the field of agriculture, processing industry and trade. The research used scientific publications of leading world and national scientists, the results of studies of state-owned research institutions (on the institutional environment in agriculture and rural development) and those of statistics on production, processing, sale and consumption of agricultural products and foodstuffs.

Additional information on initiatives in creation of value added chains at the location of individual actors not registered by the State Statistics Committee of Ukraine was obtained from representatives of regional agriculture management bodies, technical assistance project staff, associations and international donor organizations operating in the territory of Ukraine. For the study of agro-food chains formation and functioning we applied the written questionnaire of their actors in agricultural and processing production. Namely, the agricultural producers having up to 50 ha, 100-500 ha, 501-2000 ha, 2001--5000 ha of agricultural areas participated in the questionnaire. Every group

was represented by 200 farms except the last one (agroholdings). The last ones were presented by 12 units working in the fields of egg and meat poultry breeding, dairy cattle breeding, cereals production and pig breeding.

Results

Organizational and economic transformations in the agrarian sector of Ukraine under the present conditions are aimed at transforming production into a virtually new system, which will be primarily targeted at the consumer – an indicatively regulated system. Such a production system, firstly, should be orientated at and take into account, as far as possible, the results of population's customization, namely to be targeted at needs, tastes and preferences according to the demands of different groups of consumers and their consumption budgets. Secondly, in the process of functioning, it should demonstrate and strengthen sustainability of its development, which does not only exclude, but also involves insignificant changes in its organizational and legal forms and territorial structure in order to achieve an optimal state and ensure sustainable development.

As known, the sustainable development includes three components: economic development, social progress and environmental stability, that is, preservation and improvement of the natural environment as a defining condition for current and future stability of the biosphere (Vergun et al., 2014). This is a maximum task and, therefore, the advancement to such a model of production system was accompanied by appearance of a number of transitional forms of territorial and production associations, the majority of which are based on network production structures.

Foreign scientists define agro-food supply chains as "a set of interconnected companies that work closely together in order to target the flow of goods and services across the entire value added chain of agricultural and food products, which will bring this flow to consumers at the lowest possible cost" (Beske et al., 2014), or as "activity that covers the stages from production to distribution, which ensures bringing products to final consumers" (Aramyan et al., 2006).

We believe that the most complete definition of agro-food chains is proposed by FAO (United Nations Food and Agriculture Organization) that defines it as a set of agricultural producers and organizations (or actors) that consistently coordinate creation of added value for the production of certain types of cultural products and their processing for the purpose of obtaining food products sold to the final consumer and after consumption are sent to waste, ensuring profitability at every stage, creating wider benefits for the society without permanent depletion of natural resources (FAO, 2014).

At the same time, Borodina defines agro-food chains as not only interrelated links of one process (including six stages: from producers of raw materials to consumers of final food products), but also (and above all) mutually beneficial

relations between groups of producers, sellers, processors and service companies that unite together to increase productivity and create added value based on understanding common benefits and fair distribution of the achieved result. Implementation of the concept of formation of agro-food chain can positively influence the earnings and employment in the agro-food sector, ensuring market access to small farmers and networking of small and medium processors (Borodina, 2014).

Consequently, the agro-food chain is an economic system consisting of different chain operators represented by suppliers of raw materials, providers of services, agricultural producers, processing organizations, distribution logistics organizations, marketing firms that promote delivery of products to the final consumer on the basis of provision of additional services.

The above-mentioned definitions of agro-food chains allow us to distinguish theirkey components: raw materials production, products supply, transportation logistics, economic feasibility, value added formation, sustainability of operation. Foreign researchers' attention is focused on the efficiency of supply and sustainability of agricultural food chains, which, in our opinion, is mainly due to their transnational character. However, national researchers focus on attracting small producers to agribusiness chains and to added value formation. This is perceived as an adequate response to domestic realities: it takes into account current peculiarities of agricultural production in Ukraine, as well as agro-food structures functioning, mainly at a regional and interregional level.

But in implementation of basic fundamentals of the Association Agreement (AA) between Ukraine and the European Union (of 16.09.2014), the focus of problems in agro-food chains is shifted to its lower link – relationships between producers of food raw materials and their processors. One of the key dominants of the AA is the provision / set of regulations on creation of appropriate conditions for gradual integration of the national economy into the EU internal market. For the agrarian sector, it is food production, which will meet the EU requirements for similar products and, therefore, it will have the right to export without hindrance to the European markets. In this regard, the problems of safety and quality of food raw materials and food products move to the level of their producers. Therefore, it is advisable to thoroughly analyse the situation in the primary segment of agro-food chains.

Creation of agro-food chains is an objective condition for combining the natural biological process of cultivation and mechanical harvesting of agricultural products with the process of their processing at the capacities of food industry and production of final food products, that is, it is necessary to launch an objective process of technological integration of primary production with processing and food facilities. How the relations between the actors of an elementary chain will develop can influence economic, social and environmental results of any integrated territorial production association's activity. These are

complex structures that arose on the basis of consolidation and strengthening of a large array of simple, spontaneously formed agro-food chains. It is important to determine the dimension and extent, as well as the minimum and maximum parameters of agro-food chains, in particular:

(a) The simplest (or primary segment) chain involves two participants: production of food raw materials and their processing, output and direct sale of food products.

(b) A full chain – at least five to six participants: production – transportation – processing – storage – transportation – sales. With regard to this chain, we can carry out various optimization options, namely: consolidation, isolation, division (Dankevich, 2011). This is about operations on agro-food chains within agroholdings, but they are completely related to the primary segment – its actors. However, current practice allows for optimization not only through physical separation or association, but also by other methods: (a) outsourcing – transfer of some functions, tasks, business processes to contractors or individual workers who can perform them better (for example, procurement of dairy products raw materials from the population, their accumulation in refrigerated tanks for transfer to processing capacity, provision of services for storage and transportation of raw materials and finished products, their realization); (b) outstaffing – directing employees most often from processing and food enterprises, to firms engaged in the sale of food products for a certain period, etc.

It is important to decide on the number of actors in agro-food chains with whom further research will be conducted. The smallest agro-food chain combines two actors: representatives of primary production and processing and food industry, i.e. enterprise- integrator (in other words, the first participant, or the initial link and the second participant, or the central or key link). Without them, creation and operation of agro-food chains, as well as the replenishment of new actors is impossible. It is due to the density of their connections and agreed coherence of actions that an increase in the chain up to the final participant or the final link – the sale of food products – takes place.

Another question is how many primary agro-food chains can an integrated formation – an agroholding, an alliance, a corporation, etc. – include? The key factor is the capacity of production: in order to ensure its full load, the contingent of primary participants is estimated at dozens (with ACE participation), and when it comes to food raw materials, whose production is concentrated on farms and PPF, their number can reach hundreds and thousands of participants. They are engaged in production of raw milk, cattle breeds, growing potatoes and vegetable crops. Their key feature is closeness to the enterprise-integrator. It forms the system of relations with primary actors of agro-food chains: on the one hand, depending on what the enterprise is like, what its purpose is and what the tools for its realization are; and on the other hand – what the array of primary actors involved in growing, collecting and transferring food raw materials for processing represents.

The union of primary actors in a single mission, to achieve the common goal and under the control of the central link, serves as a kind of "umbrella", under which all production processes take place and economic relations develop. Apart from this, the enterprise-integrator acts as a catalyst in increasing the search for unused reserves and resources, disclosing the innovative potential of each actor and the agro-food chain and their inclusion in effective production activities within the integrated formation. Agro-food chains have a different territorial structure and organizational-legal forms, but to ensure sustainable and continuous functioning are based on a single system of principles (Table 1).

Table 1. Basic principles underlying creation, functioning and development of agro-food chains (AFC)

Principles	Key characteristics
1. System	Use of a systematic approach in case of a natural occurrence or organized creation of an AFC as an organic whole
2. Voluntarism	Establishment of the AFC is carried out on a voluntary basis for the purpose of joint activity on the basis of commercial calculation and self-financing
3. Complexity	Cooperation of business entities (actors of AFC) on the inter-branch basis "raw materials – processing – finished products – realization"
4. Purposefulness	Vision of the common mission and the sole purpose of meeting the needs, demands and preferences of consumers for safe and quality food products
5. Unity of interests	Achievement of higher efficiency, productivity and profitability of agro-food production
6. Fairness	Objective consideration of production costs and fair distribution of income and / or profits received by AFC actors
7. Constancy	a) Maintaining the internal organization of the AFC with respect to external influences; b) Promoting economic development and social progress and eliminating dangerous environmental impacts
8. Collectivity	Conscious of the activities of all groups and employees of entrepreneurial structures included in AFCs as a necessary condition for survival, conservation and sustainable development in a changing economic environment
9. Innovation	Orientation to the involvement of social, environmental, organizational, marketing, logistic, information and computing and technological innovations, production of innovative types of food products and provision of innovative services

Sources: FAO (2014), Borodina (2014), Krysanov (2016).

Significant interest is caused by agro-food chains typology, the key classification parameters of which are various features:

– Technological: horizontally integrated, in which the output of finished products is carried out in ACEs or agricultural service cooperatives (ASCs), which maintain food-processing capacity; vertically integrated, in which

participants take part in various stages of creating a final food product; diversified – may be related, non-related, conglomerate (i.e. production of a new, linked or unrelated to the principal product, primary or final product);

- Territorial: the production and network structure which may cover different administrative and territorial enterprises: local (within a territorial community), regional (within several districts), interregional (within several regions), transnational (within two or three countries; for example, production process of processing of domestic semi-finished products ends abroad, for instance, processing of raw oil from Ukraine and turning it into the final product – oil for consumer purposes);
- Branch: dairy products (raw milk – processed milk and dairy products of industrial production); oil products (seeds of oil crops (sunflower, flax, rape, mustard, soya, corn) – vegetable oil); meat products (pig farms and poultry farms with a closed cycle of production: reproduction of young animals – production of forages – fattening of industrial herds – industrial processing of pigs and poultry – meat and meat products); grain products (grain – flour – bread); forages (grain (waste from food processing production) – mineral and organic additives – feed and feed additives (premixes); fruit and vegetable products (fruit and vegetables – essential ingredients and consumables – canned fruit and vegetable products), etc.;
- Organizational: small format (created with the participation of farms and PPFs, small and medium ACEs and ASCs, where food processing facilities are operating); medium format (created with the participation of farms and PPFs, small and medium ACEs and food processing facilities); large-scale (created with the participation of farms and PPFs, small, medium and large ACEs and food processing facilities, research institutions, design and development organizations, enterprises for production of technological equipment for national agribusiness, bank and parabank structures, etc.);
- Organizational and legal: "mild" – actors of agro-food chains carry out joint activities while maintaining full legal and economic independence; "firm" – chain actors in the organization or in the process of operation lost completely or to a greater extent legal and economic independence;
- Spatial-temporal: permanent functioning (raw materials are supplied daily: raw milk, eggs, fattened poultry and pigs); seasonal functioning (raw material are supplied seasonally: fruit, vegetables, potatoes); episodic functioning (repair young animals, fodder), etc.

It should be noted that foreign researchers, depending on the specifics of primary and final actors, as well as the scale of the served food market, distinguish the following types of agro-food chains:

- Traditional, consisting, as a rule, of small farmers, who directly sell products produced at their own households to consumers, mainly in local markets;
- Modern, covering national and transnational agro-food enterprises that deliver and sell food (agricultural, i.e. unprocessed or fresh (green) products from producers to the networks of powerful supermarkets;

– Modern-traditional, which include national and transnational agro-food enterprises, which sell their own food products through a network of traditional sellers and retailers;
– Traditionally modern, covering the supply of food products from small farmers and agro-food enterprises to small traders and modern supermarkets (Gómez, 2013).

It should be emphasized that the above typology refers not to a single agro-food chain, but mainly to their aggregate. This allows, at a certain stage of generalization, to speak about integrated formations based on a united network of primary agro-food chains and "targeted at" the enterprise-integrator.

At the present stage, the views of scientists and practitioners are increasingly focused on peculiarities of organization, conditions of functioning, institutional norms and informal rules and forms of socio-economic relations, both between actors in the agro-food chains and between members of participating teams. Ensuring improvement of functioning of agro-food chains is possible on the basis of a deep and comprehensive disclosure of their internal innovation potential, intensifying the role of each actor in the chain of increasing value added, identifying and eliminating problems and obstacles that hinder these positive processes. Consequently, special attention should be paid to the issues of effective and targeted interaction between actors in agro-food chains, which requires a detailed analysis of their structure.

In particular, agricultural producers include the entire spectrum of business entities: farms and commercial PPFs, ACEs of various organizational and legal forms (joint-stock, cooperative, state), etc. But, given the technological need for the transfer of grown products to the next actor, their safety and quality are at the forefront. According to expert estimates (Buryak, 2013), in Ukraine, most agrarian enterprises do not have a systematic approach to quality management, and introduction of systematic safety methods is practically in their infancy – only 3% of agricultural producers have introduced them (Krysanov, 2016). Therefore, a logical question arises: how is compliance with the normative parameters of quality and safety of food raw materials guaranteed by agricultural producers, where there are no functional management systems (MS), that is safety and quality?

In our opinion, on the one hand, there exists the effect of traditionally used technology, as well as the deficit and high price of agrichemicals, chemical plant protection products, hormonal preparations for accelerated growth and veterinary preparations for treatment of animals, which leads to the maintenance of natural and environmentally safe technology of raw materials production. On the other hand, at ACEs, where the technology of industrial production is implemented, all these aspects are detailed in technological cards and their strict performance is a guarantee of compliance with quality and safety parameters of raw materials. However, on the way to European integration, this approach is unacceptable and particularly risky in animal products.

Key characteristics of enterprises – integrators of agro-food chains, which form relations with other actors, are:

- Food specialization of the enterprise and available (design) and actually operating (used) capacities for processing of food raw materials;
- Number of employees (from a few workers to several thousand);
- Territorial placement of food industry capacities in relation to the location of food producing enterprises;
- Transport accessibility between points of growing of food raw materials and production facilities for their processing;
- Markets for realization of finished food products, etc.

It is important to draw attention to the problems of relationships between actors in agro-food chains. It is necessary to fully reveal their internal potential and to provide additional diversified preferences: increase of cash receipts, mitigation or complete "removal" of contradictions between separate units and between members of their labour collectives, reduction of ecologically dangerous load on the environment, dematerialization of production, etc.

Integration of enterprises requires proper convergence of technological transitions, in particular products with processing facilities. But problems in organizational and technological units (places of transition from the primary link to the key one) are not limited by only optimization of volumes of food raw materials with processing and food facilities under current conditions. In our opinion, actual and potential inconsistencies, neglect, asymmetry and discrepancies are much larger and include:

- Deficiency, poor quality unconfirmed by certification (necessary laboratory-diagnostic procedures) compliance of food raw materials with the safety requirements fixed in national standards or technical regulations of the European Union;
- Low level of implementation of systematic safety methods by enterprises of primary production, as well as lagging with the introduction of MS of safety (HACCP and State Standards of Ukraine (DSTU) ISO 22000: 2007) on processing facilities in accordance with the Law of Ukraine on food safety (Law of Ukraine, dated July 22, 2014, No. 1602-UII);
- Lack of perfect methodological developments regarding objective evaluation of each actor's contribution to creation of the final food product, as well as the increase in value added by each of its links;
- Absence of perfect methodological developments regarding fair distribution of income and / or profits between chain actors;
- Lack of economic interest in the development and strengthening of direct relations between primary and key actors in chains outside the zone of influence of integrated formations, etc.

According to the provisions of the framework law of Ukraine on food safety, one of the obstacles hindering the integration of the agro-food sector into the EU internal market, is compliance with the requirement for the mandatory introduction of HACCP on food production facilities. Consequently, this is the key issue, whose successful and comprehensive solution will have an impact on sustainable and efficient functioning of agro-food chains.

One of the indicators for solving this problem is availability of functional MSs (safety and quality) at food industry enterprises, as well as introduction of other systemic safety methods by primary production entities. It should be noted that as of 01.01.2017 in accordance with the requirements of international standards in food industry there were functional MSs:

– ISO Series 9000: there were certified 403 units of Quality Management Systems, in the stage of development and implementation there were 46 units;
– ISO Series 14000: there were certified 43 units of Environmental Management Systems, under development and implementation there were 14 units;
– HACCP: there were certified 342 units of Food Safety Management Systems, under development and implementation there were 150 units;
– DSTU ISO 22000: there were certified 552 units of Food Safety Management Systems. Requirements to any organization of the food chain, at the stage of development and implementation there were 128 units.

In general, 1340 MSs were certified in food industry, and there are 338 functional systems under development and implementation at 979 enterprises out of 1118 (i.e. 87.5%) that are subject to the relevant ministry. The total number of enterprises is 5.5 thousand, including more than 4.4 thousand of small ones. Thus, more than one hundred medium-sized enterprises are waiting for the implementation of the HACCP. As for small enterprises (SEs) in food industry, there is no statistical information and, therefore, it would be advisable to conduct a survey and find an answer to the key question: what type of possible systemic safety methods is appropriate for them. Its main variants are as follows:

(a) Introduction of HACCP (or DSTU ISO 22000:2007 provided that SEs are a link of a functioning agro-food chain);
(b) Auditing for the conformity of production with minimum requirements of basic programmes (ISO / TS 22002-1: 2009 Programme of mandatory preliminary measures for the safety of food products – Part 1: Production of food products) in order to further eliminate identified nonconformities (i.e. being not ready to meet these requirements);
(c) Introduction of flexible or simplified procedures based on the principles and approaches of the HACCP, taking into account the level of product safety.

In primary production (agriculture, forestry and fishery), there are 77,400 business entities. In particular, among agricultural producers, according to expert estimates, there are approximately 1.1-1.5 thousand agricultural enterprises, where such procedures are permanent, namely:

(a) Implemented Safety Systems (HACCP or DSTU ISO 22000:2007) as an integral part of agro-food chains;

(b) Independently conducted an audit for production compliance with the minimum requirements of the basic programmes (ISO / TS 22002-3: 2011 Programme of mandatory preliminary measures for the safety of food products, Part 3. Production of agricultural products);

(c) Conducted a similar audit within the framework of agro-food chains to which they were included; such practice is realized both in integrated formations, and by independent entrepreneurial structures, connected by technological ties (raw materials – processing) (Krysanov, 2016).

In the structure of primary production, according to the framework law of Ukraine on food safety it is necessary to select a group of producers of meat, dairy products and fish raw materials that will be aimed at processing of raw materials into final food products, after the cultivation process is completed. Fixed terms (to 20.09.2017) for introducing systemic safety methods have been set. Statistics points out three subgroups:

(a) Animal husbandry – 2426 enterprises and 87.9 thousand employees (on average 36 employees per livestock farm);

(b) Mixed agriculture – 1028 enterprises and 4.7 thousand employees (on average 4 employees per one farm);

(c) Fish farming - 881 enterprises and 5.5 thousand employees (on average 6 employees per one fish farm).

The rest of agrarian enterprises mainly produce the products of plant origin, among them there are three main subgroups:

(d) Cultivation of annual and biennial crops – 38,856 enterprises and 409.6 thousand employees (on average 10 employees per one farm);

(e) Growing of perennial crops – 1121 enterprises and 15.4 thousand people employed (on average 14 workers per farm);

(g) Plant reproduction – 159 enterprises and 5.5 thousand employees (an average 11 employees per farm).

Introduction of systemic safety methods at agricultural enterprises for cultivation of products of plant origin will depend to a large extent not only on the level of compliance with the minimum requirements of the basic programmes, but also on the interest of food processing enterprises in obtaining safe and quality raw materials. Under current conditions, creation of agro-food chains takes place without a clear identification and appropriate fixing of specific commitments in Agreements, taking into account specifics of economic relations and technological requirements on both sides in order to bring products and food processing production to regulatory parameters.

The economic activity of Ukrainian agroholdings should be assessed as well. In 2012, there were 129 agroholdings functioning in the Ukrainian agriculture. They controlled about 8.7 million hectares, namely 21.0% of the country's agricultural land, completely absorbed or took under control more than 6000 conventional agricultural units (Lupenko and Kropyvko, 2013). In our opinion, the results of operation of chains are contradictory and asymmetric, in particular:

– The economic development has a positive trend, but at the same time we should highlight the welfare worsening of rural areas that became a territorial-production base for holdings;
– The social progress takes place in the groups of actors, but declines in the social sphere and rural territories degrade;
– The fertility becomes lower and agricultural land degrade, etc.

Agro-food chains also operate outside agricultural holdings, but the nature of their emergence, resistance to external influences, and the length of existence do not allow us to make a definite conclusion about their sustainability. This is due to the domination of economic interests of food processing enterprises over the subjects of entrepreneurship of primary production, which causes resistance of agricultural producers and often leads to curtailment or even to termination of their activities. A classic example: low prices for raw milk, which dairy enterprises collected from individual households. Practical results: a long-lasting stable trend in reducing dairy livestock in the individual households as a result of discriminatory economic relations. It should be noted, though, that this was preceded by other factors, in particular, aging of rural population and its reduction.

Consequently, in order to overcome the existing disparity, to develop and strengthen direct relations and to establish equal relations between actors in agro-food chains, it is necessary to consider the following as a defining condition: guaranteeing the balance of economic interests of producers of food raw materials with food processing enterprises. At the same time, since even the simplest agro-food chains, as a primary production system, function and are closely linked to the natural environment, not only economic but also environmental and social problems generated by entrepreneurial activity, require the search for adequate approaches to their successful solution.

The strategy of sustainable development of agro-food chains on the basis of a combination of agro-zoo-veterinary, and food processing technology and resource support, taking into account trends of climate change, ecology of the environment, deterioration of water quality and reproductive functions of soils, is worth paying attention to. Understanding the acute need for agro-food production on the basis of sustainable development, the background of which is sustainable development of primary agro-food chains, by all subjects of entrepreneurial activity, power structures and consumers of food products is of paramount importance. On the other hand, key problems of agro-food produc-

tion should be considered in a comprehensive manner, namely: taking into account the acute need to comply with ecological requirements for functioning of rural, forestry and fishery sectors – namely through the prism of maintaining, preserving and protecting natural resources, and the environment in general.

Of particular significance is the problem of harmonizing the interests of actors in agro-food chains with public interests related to ecology, social climate in teams and society, employment of population and possibilities of expanding the sphere of application of labour, etc. Since both primary and key actors in agro-food chains are represented by a diverse spectrum of subjects of entrepreneurial activity, it is necessary to systematize common problems of scientific-methodical and applied nature including:

(a) Identification of sources of pollution, assessment of direct consequences and delayed destructive effects of agro-food production on the environment (see case);
(b) Legislative fixing of permissible load parameters on the environment;
(c) Substantiation of directions, development of tools of localization and overcoming destructive consequences of pollution of the environment with the direct participation of actors of agro-food chains;
(d) Identification of causes, direct and indirect consequences of dissatisfaction with conditions of employment and payment, etc. among workers in labour collectives.

We believe that national scientists are only at the initial stage of identifying the above-mentioned problems and finding solutions to them. But abroad there has been gained a lot of experience in this area, which needs to be analysed, adapted and implemented where possible in accordance with our realities.

In particular, foreign researchers believe that main challenges for agro-food chains in modern conditions are seasonal nature of production, losses from damage, absence of necessary market infrastructure in certain regions, weak market relations at the level of farmers, and the strengthening of the requirements for the quality and safety of food raw materials and finished products (Canavari et al., 2002). At the same time, other researchers point out that the process of commodity flow management is central to the supply chains, where the market and regulatory decisions of the state interact through decisions of the government, private players and the rural community to achieve efficiency and responsibility (Chandrasekaranand and Raghuram, 2014). For us, it is important to exchange the latest knowledge at all stages of agro-food chains to ensure their sustainability. This will be critical for maintaining quality and safety of products, extending expiry dates while storing perishable food products.

One of the essential indicators of the efficiency of agro-food chains functioning is the level of satisfaction of final consumers with food products (Fischerand and Hartmann, 2010]. This requires establishment of systematic quality con-

trol and product safety at all stages of commodity movement, which will foster the confidence of consumers in these products. Changing consumer preferences and the environment plays a decisive role in ensuring sustainability and efficiency of agro-food chains, as the quality and volumes of agricultural products depend heavily on weather conditions. The best international practice has convincingly proved that increasing the efficiency of agro-food chains functioning is possible when following key principles such as: high transparency, hygienic safety, clear traceability and quality of food products.

In particular, hygienic safety is provided by the so-called "cold chain" at all stages of storage and transportation of products from the manufacturer, carrier, wholesale and retail trade and to the final consumer. It should be noted that the "cold chain", which guarantees preservation of freshness and quality of agricultural products, is planning and controlling flows of agricultural and food products in the supply chain in order to meet the needs of consumers, subject to strict observance of the specified temperature regime. At the same time, the ability to monitor changes in the state of products in the process of production, processing and commodity circulation, is also an important element in the food safety system.

Foreign scientists who conducted research under the auspices of FAO adhere to the view that the concept of sustainable functioning of agro-food chains is based on the following three important provisions:

(a) Agro-food chains are dynamic market systems, where the main element of the association is vertical management;
(b) Concepts of sustainable agro-food chains cover different scales (region, industry, country);
(c) Added value and sustainability are precise and multidimensional indicators of the efficiency of functioning of agro-food chains in the integrated (complex) value.

An important connecting element is the agro-food chain management system, which implies the nature of relationship between participants both at a certain level of the chain (horizontal links) and the chain as a whole (vertical links). This relates to elements such as information exchange, pricing, product compliance with standards, payment mechanisms, contracts between food chain actors as to distribution of food to the final consumer, which play an extremely important role in the value-added process.

Consequently, agro-food chains are the driving force behind economic growth, as they contribute to creation of added value on the basis of the following components: salaries and wages of employees; return on assets (profit) of entrepreneurs and owners of assets; tax revenues to the budget and non-budgetary funds; diversified food supply to final consumers; total impact on the environment (positive or negative). In its turn, added value creates conditions

and preconditions for the growth of such components that can be correlated with economic, social and environmental sustainability, namely:

(a) Investments – profit and savings are reinvested in the economy and for the needs of improving the consumption by the population;
(b) Social progress – the state spends money received to support proper development of the social sphere, preservation and protection of the natural environment;
(c) Welfare of the population – income of employees of groups – participants of agro-food chains is increasing and the opportunities to meet their needs and demands more fully are expanding.

In order to ensure stability of chains, it is necessary to use actively various effective institutional mechanisms that will promote:

(a) Fair distribution of increased value added;
(b) Reduction in the use of non-renewable natural resources;
(c) Limiting the negative impact on the environment, etc.

At the same time, the three constituents of sustainability are closely interrelated: social and environmental sustainability largely determine access to the market (compliance of products with the requirements of standards), and economic sustainability contributes to increasing competitiveness on the basis of market differentiation.

It should be noted that the agrarian sector of Ukraine is gradually adapting to the European requirements regarding safety and quality of food products, which is an important prerequisite for the development of regional and national agro-food chains to the level of transnational ones. Under such conditions operational access of food products to the European markets will be ensured and, on this basis, incremental value added will be generated. This opens up new opportunities for small producers to have an access to these markets, and, accordingly, will help them to receive additional revenues.

Ukraine entered into the new economic reality linked with the processes of globalization, European integration and climate conditions changes for the agriculture. It requires the development of new strategic priorities for the agrarian sector in general, as well as for the development of agro-food chains in new conditions taking into account macro-economic, technological, external-commercial and climatic risks. At the same time, the agrarian sector of Ukraine became more stable in its development as compared with functioning of all national economy. But, this stable tendency to growth can be observed only in plant production. Although, regarding the fact that during the last 5 years the humidity has been insufficient, we can say that this field has risky character and we can expect the lowering of yields in the nearest perspective. Other risk consists in the domination of raw materials (grains, colza) in the export structure. It does not allow using potential of the

added value creation in agro-food chains. Beside this, the functioning of the Ukrainian agricultural sector is followed by higher economic risks. This factor decreases stability of its growing namely due to rapid inflation, devaluation of the national currency, low accessibility to credits, absence of complex insurance programmes, etc.

The following measures should become strategic tasks for achieving sustainability of agro-food chains:

- Increasing added value in agro-food chains by their prolongation (deep processing of agricultural raw materials, creation of competitive logistic units, processing of agricultural and food wastes on biofuel etc.);
- Increasing competitive ability of Ukrainian agro-food products, that will contribute to the creation of added value in export oriented agro-food chains;
- Formation of efficient system of commodities movement for promotion of agro-food products at internal and external markets, this system should minimize cumulative expenses and risks of lowering quality;
- Aiming at interaction with the world scientific community for adaptation of the agriculture to climate changes, creation of the background for abilities to apply innovative agricultural technologies on the base on public-private partnership for increasing agricultural production productivity and for minimizing negative impact on the environment.

Discussion and conclusion

Agro-food chains are an integral part of the agro-food system, whose effectiveness and sustainability will largely depend on economic well-being of their actors. However, under current conditions, creation, development and functioning of agro-food chains are burdened with a number of problems such as: disparity of economic relations between the participants, a low level of implementation of systemic safety methods in the sectors of primary production, lagging behind with the introduction of safety management systems at processing and food facilities, unconfirmed compliance of food raw materials with normative parameters of safety and quality, unregulated relations regarding distribution of income / profits between the actors, etc. In order to attract small and medium-sized commodity producers to these chains so that they can obtain appropriate benefits, it is necessary to deal with: disparity of economic relations between its participants; low implementation of system safety methods in the sectors of primary production, lagging behind the introduction of safety management systems at processing and food facilities; unconfirmed compliance of food raw materials to normative parameters of safety and quality; unregulated relations in relation to the distribution of income / profits between the involved persons (actors) etc.

In order to attract small and medium-sized commodity producers in these chains in order to obtain the appropriate benefits, the following is necessary:

- Intensification of the practical activities of the administrative structures of the profile of the ministry and industry associations for the introduction of systemic safety in the sectors of primary production, especially in relation to the cultivation of animal products (milk, meat, eggs, fish, other seafood) and its subsequent processing or marketing on food markets.
- In further studies of agro-food chains functioning in Ukraine we should emphasize the development of measures for minimizing impact of every chain's actor on the environment. It should be necessary to justify and to codify by law the quantitative indices of the tolerable impact on the environment in agro-food chains of meat and eggs poultry breeding, meat and dairy cattle breeding, etc. Nowadays, the processing of agricultural and food wastes on biofuel have high importance. For example, law-grade fats generated from meat poultry breeding are not used, but their processing could contribute to the prolongation of agro-food chain, to the accumulation of added value, and of course, it could minimize negative impact on the environment.
- In present conditions it is necessary to study further social aspects of agro-food chains functioning, namely fair distribution of incomes among their actors. A very important in the Ukrainian conditions is the employment of rural population and providing a proper salary. As in actual conditions big agroholdings renting large surfaces do not take care of the development of rural territories. So, it could be helpful to elaborate scientific and methodological provisions for the evaluation of contribution by every agro-food chains' actor to the income and added value and their distribution among different actors. These provisions should be elaborated on the basis of inter-sectoral agreements (agreements of conciliation commissions).

The experience of developed countries in Europe shows that the main benefits for actors in the agro-food chain are formed through the production of safe and high-quality products, its operational delivery to the enterprises of the commercial network and its timely implementation.

In this sense, domestic producers should actively explore the world's leading experience and implement it through the understanding of the realities of an economically changeable market environment. Only in this way we will be able to master modern production technologies and find ways to promote our own food products to European markets and other countries, as well as to form positive changes towards increasing the culture of consumption of quality and safe agricultural products on the domestic market.

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