

EU Municipal Organic Wastes Management and Its Implementation Prospects in Ukraine

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Abstract – The article focuses on the issue of the prospects of municipal organic wastes management in Ukraine in the context of the applicable EU practices in the field. The investigation was made according to the SWOT analysis. The general scientific and specific scientific methods were used at all the three stages of the investigation. The peculiarities of the Ukrainian legislation and their compliance with the EU directives and policies were analysed. The key problems of the Ukrainian wastes legislation, political and legal relations in the field were reviewed. The New Ukrainian Wastes Management Strategy was analysed. The main principles and priorities of the EU wastes strategies were presented. The best (and the most applicable for Ukraine) European practices were examined, including the five-step hierarchy and features of the national wastes collecting, sorting and disposal systems. Wastes composting technologies were discussed in detail. Possibilities of using wastes as bio fuel for refuelling municipal equipment, air transport, etc. were determined. The futility of expanding landfill areas for solving wastes management issues was noted. The main requirements to be met for regulating wastes management market in accordance with the Association Agreement with the EU were outlined. Recommendations on implementing circular economy principles and extended producers' responsibility to encourage the public society to sort wastes, businesses to minimize wastes generation and draw interest to recycling were suggested.

Keywords – Composting; efficient practices; food waste; legislation; responsible consumption; strategy

1. INTRODUCTION

Wastes management is a key environmental concern across Europe with many countries witnessing the significant increase of the amount of Municipal wastes especially organic ones [1] produced and accumulated. Since Ukraine confirmed the European path of development in 2014, having concluded the Association Agreement with the European Union, our wastes management system now needs to be modified to reflect the positive European experience in the field [2].

For the effective development of the state in modern situation a number of conditions are required. The key condition is the development of the regions, since providing the efficient service to the public is usually dependent on the regional authorities [3]. Therefore, given the current changes in the political system of the Ukrainian society, it is needed to understand the necessity of administrative and regional reforms, introducing effective social

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cooperation between the capital city and the regions, taking into account the existing European models of decentralization.

Therefore, the main research problem of the article is to identify the best practices in wastes management, especially the organic ones in the EU countries (mostly decentralized) and the EU legislation that can be critically borrowed by Ukraine as well as to conduct investigation of the way passed by the country to fulfil the requirements to the system of wastes management after signing the EU-UA Association Agreement. Taking into account the current changes in the political system of the Ukrainian society, it is needed to understand the necessity of the administrative and regional reforms, introducing the effective social cooperation between the capital city and the regions, taking into account the existing European models of the decentralization.

In order to meet the EU requirements for the management and efficient disposal of wastes, especially household organic wastes, there should be introduced modern systems of their separating, collecting and using or destroying which should also be environmentally friendly and energy efficient. Collecting more wastes via source separation, wastes collection systems make up the essential part of increasing resource efficiency, achieving the European recycling targets and closing the loop in the circular economy [4].

Wastes management requires both forming proper modern infrastructure and free access of residents of the local communities to information on wastes management [5]. Introducing, implementing and developing such programmes are only possible in the country, provided the formation of the system of regulatory acts of different levels in the field of wastes management, which belongs to the field of environmental law in the countries of the European Union, has long been introduced, with its comprehensive approach to wastes management, including different levels of implementation, control and financing.

It should be noted that the most important aspect of the practice is introducing it into the lifestyle of every Ukrainian citizen, to make them conscious of the responsible consuming food and managing the organic wastes as close to zero level as possible. According to the official data, Ukraine produces over 50 million m³ of wastes annually, which are buried on about 6 thousand dumps and landfills with the total area of more than 10 thousand hectares, while 78 % (average number) of the population are involved in collecting wastes in all the regions of Ukraine [6]. The situation in Ukraine has already proved to be critical in many cities and regions due to the lack of proper wastes management infrastructure and adequate government policy, business approach and public response. The example of Sumy region is vivid here as the amount of all kinds of wastes (including organic and food wastes) was about 100 thousand tons in 2000 and it grew to 990 thousand tons in 2018 [7]. It should also be noted that of 3271 tons of organic wastes produced in Sumy region in 2018, 0 % was recycled [8] while the programmes of redistributing food are not working and they are simply unknown to the authorities and to the community. Therefore, this is the urgent task for the local authorities in the region, which is active in applying the reform of decentralisation and the efficient EU experience would be appropriate.

In implementing the Association Agreement with the EU, Ukraine has committed itself to managing one of the vital areas – the management of all kinds of wastes in accordance with the European principles. In 2014–2017, Ukraine took initial important steps to change the situation through commitment of compliance with the EU Directives as a part of the Association Agreement with the EU [3].

Since the beginning of 2018, the new rule of the law of Ukraine in the field of household wastes management came into force. As of January 1, 2018, Ukraine should have already sorted all the wastes at the collection stage, according to Article 32 of the Law of Ukraine

'On Wastes' [9], to which the relevant paragraph was added in 2012. This point corresponds to two EU Directives – 1999/31/EU and 2008/98/EU, which regulate wastes management in the European countries. One of the key points of these directives is the development of organic wastes policy [10]. After all, landfilled organic wastes make up the cause of methane emissions, which is very harmful to the climate. In particular, Directive 1999/31/EU requires measures to reduce the disposal of organic wastes and to set down the technical requirements for its disposal (capture of landfill gas and its combustion, compaction of the landfill bottom and layer coating, collection of filtrate at the bottom of the landfill, its withdrawal and processing) [11]. Directive 2008/98/EC refers to the importance of the processes of recycling and reusing organic wastes, for example by fermentation or composting [12].

Among the legal acts of the European Union which govern processing organic wastes, the following ones should be noted: the Directive 75/439/EC "On the disposal of wastes oils" (June 16, 1975), Directive 91/689/EC "On hazardous wastes" (December 12, 1991), Directive 94/62/ EC "On packaging and its wastes" (December 20, 1994) Directive 96/61/EC "Concerning the comprehensive prevention and control of pollution" (September 24, 1996) Directive 2006/12/ EC "On wastes" (April 5, 2006) [13].

Different aspects of the problem of managing wastes were the object of the investigation of numerous researches in the EU, Ukraine and the other countries. The Ukrainian and foreign scientists and specialists, like Ladychenko [2], were engaged in researching the theoretical and practical aspects on ensuring processing and utilizing household, in particular, organic wastes. The problem of consuming behaviour in dealing with purchases and food wastes investigated in the works of Aschemann-Witzel [14] show that a number of authors interpret their findings with regard to the important role of the context/situational factors determining the perceived convenience of behaviour and habits of relevance.

The article of Minelgaitė and Liobikienė proves that wastes generation is a critical problem globally and for the European Union in particular [15]. The problem is especially burning for the organic compounds, where food wastes take the first place. The recent estimation by the European Commission provided the value of 161 kg/p/y of food wastes generated in the EU in 2012 [16] and this amount tends to the annual increase. Guerrero *et al.* stress that wastes problem is even more a challenge for the developing countries due to the increasing generation of wastes, insufficient technologies of its treatment, the burden posed on the municipal budget as a result of the high costs of their management, the lack of understanding over a diversity of factors that affect the different stages of wastes management and linkages necessary to enable the entire handling system functioning [5].

The works of Melnyk [10] deal with the issues of decentralization processes in Ukraine which are inseparably connected with the problem of managing household wastes on the local level. Melnyk and Obiyukh stress [17] that the regional reforms affect the quality of the municipal services provided to residents of the local communities, they help to solve the problems of the regional development more effectively, especially with regard to household wastes management in Ukraine. The researches prove that the problem is recognized and actively investigated [6] but the progress in implementing the practices is still insufficient, so the study of the European practices in the field of waste processing is relevant now.

Therefore, given the current changes related to the signing of the EU-Ukraine Association Agreement and implementing the reform of decentralization it's necessary to understand that wastes management policies have to be improved, based on the EU legislation and organic wastes reducing and the most efficient practices of treatment. All the above mentioned objectively predetermined the necessity for the thorough analysis of such practices, and the possibilities for their implementing in Ukraine, in particular, while

realising the administrative-territorial and regional reforms and the National Wastes Management Strategy 2030 [18]. The aim of the article determining the relevance of the research consists in investigating the possibilities of applying the EU experience with its adaptation to the institutional, economic and social conditions of Ukraine.

2. METHODOLOGY

The research work on the article was divided into **three stages**. The *first stage* consisted in collecting background data regarding to EU organic wastes composition and management systems such as wastes generation, wastes collection, processing and disposal methods. The study includes the literature review where the presented information primarily originates from the following sources: scientific reports from Elsevier journals, Sciendo journals, Google scholar, Semantic scholar, Research Gate; proceedings of the international conferences; UNO and EU legislation; legislation of Ukraine; local legislation papers from different countries and regions; publications in Springer; the Google search engine; personal communications with the scientists representing the European Commission and different countries and communities.

All the scientific reports were studied with the aim to find comparable organic wastes management data from both the developed and developing countries. Since investigations of different countries represent a variety in characterising wastes, data were taken both from the sources indicating similar conditions and approaches and those not presented in Ukraine.

The *second stage* involved organizing and analysing the obtained data and comparing them in terms of the geography, principles, approaches, attitudes, results and prospects. The best practices used in different EU countries were analysed [19], [20], [21], [22], [23], [24], [25], [26], [27] and compared with the Ukrainian experience [28]. The following **methods** were used to realize the research aim and the tasks set [29]:

- **general scientific:** analysis, synthesis, abstraction, comparison and generalization, which provided the opportunity to formulate baselines and generalized conclusions of the study, to identify the main theoretical ideas and scientific approaches that make up the theoretical basis of the study;
- **specific scientific:** *theoretical* (terminological analysis, which made it possible to characterize the conceptual apparatus of the study; historical and logical analysis, which allowed distinguishing the periods and stages of the development of the process of waste management development; structural and functional analysis, on the basis of which the principles of waste management both for the EU and Ukraine were represented; structural and logical analysis of the EU legislation on waste management; the comparative analysis of the EU and UA legislation and its implementing into practice; scientific extrapolation used to substantiate the prospects for the reasonable applying the EU positive experience of waste management in Ukraine; *empirical* (document analysis (legal papers, government reports, scientific researches, local newspapers), providing convincing answers for the investigated problems; interviewing and e-mailing), which made it possible to specify the obtained results and formulate recommendations on how to apply the progressive EU experience in waste management in Ukraine; *statistical* (operating the statistical data for analysing all kinds of organic wastes management in different countries and cities).

The *third stage* was aimed at investigating the reasons of the problems in Ukraine, identifying the proper decision, developing alternative solutions and recommendations that can converge towards an optimal decision space.

3. RESULTS AND DISCUSSION

Organic wastes are those prone to biodegradation under aerobic or anaerobic conditions [30]. According to Table 1, a large proportion of wastes consist of food wastes. The global problem of mass food wastes accumulation has received a lot of attention recently. According to the statistics from the European countries, a third of food ends up in garbage containers. Food wastes management is a serious problem for the world economy and the environment. Discarded food would be enough to feed 870 million starving people. The food currently wasted in Europe could feed 200 million people [31]. The total cost of food thrown into the trash reaches 400 billion USD a year [32].

TABLE 1. MORPHOLOGICAL COMPOSITION OF THE ORGANIC COMPONENT IN THE LANDFILL [28]

Morphological composition of the organic part of the SHW at the landfill	Landfills		Content of the basic chemical elements in the dry substance of organic components, %					
	Content by weight of SHW, %	Content in the organic part SHW, %						
			C	H	O	N	S	Ash
Paper	21.0	44.5	45.40	6.10	42.10	0.30	0.12	6.00
Food wastes	12.0	25.4	41.7	5.80	27.60	2.80	0.25	21.90
Wood	2.1	4.5	48.30	6.00	42.40	0.30	0.11	2.90
Textile	2.6	5.5	46.20	6.40	41.80	2.20	0.20	3.20
Leather, rubber	4.6	9.5	59.80	8.30	19.00	1.00	0.30	11.60
Plastic	3.40	7.2	67.90	8.57	10.30	1.13	0.05	12.02
Bones	1.6	3.4	59.60	9.50	24.70	1.02	0.19	4.99
Mixed	47.2	0	48.10	6.53	33.3	1.18	0.15	10.74

This situation also affects climate change, as excess production uses huge amounts of water and land resources, as well as significant finances for energy and transportation. The types of the negative influence were classified and calculated for ten categories of the environmental impact, including global warming and depletion of water and even indirect impacts on changing in using land. The impact of food wastes on global warming can be avoided on condition of responsible consumption which is a must for every household. With the growth of the earth's population, the problem will only deteriorate. According to the SWOT analysis this can be seen as the weak aspect of the European practices leading to the possible threats in the future.

To minimize the scale of the problem, food production datasets should be chosen and used carefully, to avoid double counting and overestimation of the final impacts [33]. It should be noted, that in Ukraine the share of organic wastes is higher than in Europe. This trend depends on the degree of the economic development of the country. Distribution of organic wastes depending on the level of population's income: countries with the low level of income (<USD 876 GNI/per capita) have 64 %; countries with the level of income below the average (USD 876–3465 GNI/per capita) – 59 %; countries with the level of income over the

average (USD 3466–10 725 GNI/per capita) – 54 %; countries with the high level of income – 28 %.

In Ukraine, the amount of organic wastes accounts for about 40 % of total household wastes. Considering that in Ukraine, 92 % of household wastes go to landfills, most organic wastes are irretrievably lost. In addition, it causes health problems and is a source of spreading infectious diseases. The placement of organic wastes in landfills leads to bacteriological pollution of water sources, soils, and forming harmful gases that have the greenhouse effect, are explosive and fire hazardous [34]. This is the weakness of the Ukrainian ecological policy.

In general, waste management in the European countries begins with a well-written, detailed, without legal conflicts, legislation, which is supported by the financial viability of stakeholders and high environmental awareness of citizens. One of the successful practices in the EU is the NGO *Waste Zero Europe* [35] which is aimed at implementing the strategy in cities, in business, and in lifestyle. The organisation is known for its work on a diversity of projects and policy aimed at advancing the ambitious environmentally-friendly zero waste future for all the European countries. The approach enables the NGO to effectively influence the European policy and implementing a wide range of zero waste projects. It is worth mentioning that this practice is being introduced into the realities of Ukraine through the programme *Zero Waste Alliance Ukraine*, which has already achieved creation of the centres in the cities of Lviv and Kharkiv, creation of wastes management strategy for the city of Lviv, organisation of Zero Waste Festival in Lviv. The main objectives of the programme include campaigns and lectures for dismissing the useful experience and involving the other communities in Ukraine into the programme.

It should only be proper for the Ukrainian public organisations to wider implement the applicable experience into the realities of our local communities and business. But the most important aspect of the practice is introducing it into the lifestyle of every Ukrainian citizen, to make them conscious of the responsible consuming food and managing the organic wastes as close to zero level as possible. Both the European and Ukrainian practices in this programme can be seen as strengths guaranteeing the opportunities for success in the future.

For achieving the objectives of proper management of wastes in Ukraine the efficient education strategy for different population strata should be developed and realised. Proper ecological education of students is of great importance in spreading the ecological knowledge and for the future success of Ukraine in managing the wastes for improving the ecological situation in Ukraine. Involving young people into the efficient ecological practices will lead to the efficient wastes management and clean environment.

3.1. The European wastes management policy

3.1.1. Principles of wastes management

It should be mentioned here that the whole EU policy of managing wastes is based on the following principles [36]:

- prevention principle (production must be minimized where possible);
- producer's responsibility and polluter pays principle;
- proximity principle (treating and disposing wastes as closely as possible to generation site);
- precautionary principle should anticipate potential problems.

Every principle should be commented from the point of view of the Ukrainian realities to realise the degree of the problem and the amount of efforts and their direction to achieve the

European level of solving the issue of the organic wastes. The prevention principle is not fully realised in Ukraine because of the mentality of the people, especially of senior age, which goes back to the times of lack of food and even the intentionally organised famine. It means that with the growth of the economy and relative wealth level of the population it is traditional that people buy more food than they can consume. As a result, the amount of the organic wastes grows and consequently the amount of the organic garbage grows. The situation with the pandemic spreading of COVID-19 made people buy almost all the cereals from the supermarkets. Obviously, it is not going to be consumed properly and the amount of waste will still increase. The second principle is also still a problem, both for producer and consumer. Food shops and supermarkets are unwilling to reduce the price at the end of the day and as a result food is out of date and it goes to a garbage can. The principle of anticipating the possible problems is poorly realised in Ukraine because of the poor analytical traditions concerning the ecological problems on the whole, it being the negative heritage of the Soviet epoch. For realizing the last principle of the above mentioned ones it is necessary for the society and the state to possess sufficient cultural traditions and material resources. Being a developing post-Soviet country, Ukraine lacks both. For example, the problem of premises for storing vegetable and fruit in winter time is a problem for the country and it results in increasing organic garbage and wasting the efforts, money and time of the agrarian producers.

It should also be mentioned that the EU began introducing those principles into life in 1973 while in Ukraine this activity began only recently and we have to work hard and for long to achieve the sufficient progress in the field. The analysis of the principles shows that they can be referred to the weaknesses of the Ukrainian ecological situation, consequently making up the threats.

3.1.2. *Priorities of the European wastes management directives*

The main priorities of the European wastes management directives are as follow: wastes preventing or minimizing, collecting, sorting and preparing for reuse, reuse, using of wastes as energy resources, wastes disposal. So, the first step is to minimize the formation of organic wastes. It should be noted here that the main part of organic wastes is made up by food wastes as it concerns every household and everybody (unlike agriculture and its wastes) and reducing food wastes (to zero waste) should become the duty of every responsible citizen.

All the EU countries participate in the programme of food redistribution for surplus food (that might otherwise be wasted) to be recovered, collected and provided to people, especially to those needing it. All the aspects of this process – roles and obligations of actors, hygiene regulations, food information to consumers (information requirements, language requirements, date marking) and fiscal rules (taxes and incentives) – are taken into account to make this tool efficient [37].

The EU annually generates more than 88 million tons of food wastes, and the associated costs are estimated at 143 billion Euros [38]. Each country has its own way of solving the problem. We gathered information on successful practices in some EU countries which can be analysed as strengths allowing opportunities. They can become strengths (and opportunities consequently) for Ukraine on condition they are critically applied in the Ukrainian realities.

All the EU countries have adopted the unified standard: on packaging products on the shelves, two dates should be written. The first date is when the product should be on the shelf, the second is when it would be good to eat. Though after that the product is still quite

suitable for use, it is removed from the shelves. Such products are taken to warehouses and then sent for disposal or returned to farmers who can dispose them.

The initiative of the Federal Ministry of **Germany** for Food and Agriculture “Too good for the bin!” launched in spring 2012, informs citizens about food wastes and possibilities for food wastes reduction. In this regard, they published guidelines to clarify legal aspects in relation to food redistribution to social facilities. Germans promote food redistribution and make food charities more aware of when goods are available for pick-up (Guidebook on donating food to social welfare organisations, 2018). Nowadays rational use of food by way of food sharing (restaurants and shops give people tons of still quite suitable for food pastries, salads, delicacies, vegetables and fruits) is widespread in the country.

The decision of the French Senate in 2015 made **France** the first country in the world to prevent the loss or destruction of food in supermarkets. Any store with an area of more than 400 square metres must have contracts with charitable organizations (breaking the law will result in 75 000 Euros fine or 2 years in prison) [39].

French policymakers released ambitious proposals for a national policy against food wastes, offering a rich set of ideas for prevention, recovery and recycling. To implement this plan a set of measures and tools in two main areas were developed [40];

- forming convenient infrastructure for the collection of food wastes;
- full informing the population (updating instructions for collecting, disseminating new guidelines for sorting, conducting campaigns to raise the awareness of Parisians about the necessity of separate collection of food wastes).

Denmark has launched a new model of supermarkets – *WeFood*. *WeFood* does not work on a commercial basis, and their staff consists of volunteers; all the profits go to help poverty reduction initiatives all over the world. Volunteers collect surplus of goods –bread, dairy and other food products and sell those for 30 %–50 % cheaper than the conventional supermarkets. Unlike ‘social supermarkets’, which sell surplus food to people in need, *WeFood* is meant for the general public, low-income, high-income and everyone interested [40].

The UK, being the integral part of the European Union for many years, has gone a long way in managing the food wastes [41]. So, it is worth mentioning this country experience in spite of the fact of its leaving the EU in January 2020. To reduce the share of food wastes, the government promotes the principle of reasonable consumption [42] and realised by sending food with valid use-by date from shops to women’s hostels, canteens for the poor, shelters for the homeless and the other institutions engaged in municipal councils. The level of consumption of goods is not reduced, but the amount of wastes is reduced, (e.g. concept as ‘the rule of two fingers’ meaning that garbage bag can be only light [43]. Experts say that the ambitious scenario of 60 % reduction in food wastes by 2030 could reduce Europe’s burden of land use by an area greater than the size of Croatia, generate financial savings to European householders of over € 73 billion and avoid over 80 million tons of greenhouse gases (GHG) [44].

The next priority of the European directives is garbage collecting, sorting and preparing for reuse. On the base of the investigation we can define **5 best European models of food wastes collection from the population**. Data collection took the form of consultation with stakeholders and an extensive literature review of national reports and isolated case studies.

1. The first place is given to the model when food wastes are composted directly on the territory of their formation: local residents make food wastes into the common composter. This method provides the maximum benefit to the climate, since compost is made from local ‘raw materials’ and is used locally in public gardens and plots, which increases soil fertility and reduces greenhouse gas emissions associated with the transport.

2. The second model is a door-to-door collecting, which requires careful attention to garbage collection and sorting. In different countries and even regions of the same country sorting rules may vary. For example, in some areas of the UK organic wastes must be stored in the special biodegradable bag. In the other parts of the country, owners of private homes should have a separate tank for garden garbage – branches, mowed grass, dry flowers are thrown.

3. The third model is an open container in the street, available only to the owners. In some counties of Britain, each homeowner has their own garbage cans, in which special chips are built, that read information about the garbage and its owner. The mini-computers then enter information into the database about who owns the container and where it is located. This information is very important, because in the UK citizens are fined not only for the fact that the wastes are sorted incorrectly, but also for its weight and location of the tank.

4. The fourth is the collection of household wastes divided into two streams ‘wet/dry’, where organic and inorganic wastes are separated. Berlin can be seen as the example of such model. Some 90 % of tenement buildings are included in the system of separate collecting. People sort garbage voluntarily; they are driven by environmental consciousness.

5. The fifth system is an open container, where, even the organic wastes are separated, there are many wrong residues, and the compost is of very poor quality.

The analysis of the conducted studies of the wastes management system with the different algorithms of organic matter collection showed that the model of food wastes collection ‘from door to door’ allows obtaining high-quality compost. It involves the maximum number of residents to the collection and therefore is the most effective.

The third priority of the European directives is the recycling of organic wastes. Today there are 3 main technologies of industrial recycling of organic, in particular food wastes: windrow composting, in-vessel composting, anaerobic recycling [45]. The first two require oxygen, while the third one does not. Composting organic wastes is a common practice in the European Union and the researchers investigate the most appropriate and efficient recipes of managing food remnants [46]. The technology is standardized and it includes both simple composting, carried out directly by households, and operations that require the use of complex technological complexes. If recycling technology becomes more complex, its costs increase, but so do the capabilities of the technology and the value of the material at the output [27]. If there is a need for compost, or the production of biogas is unprofitable, or a small amount of its production does not allow running an energy facility, it is advisable to use the technology of industrial or open bio thermic recycling of organic wastes (composting).

Anaerobic digestion is an expensive choice, but one of the most perspective. The positive aspect of such recycling consists in the ability to generate electricity, which corresponds to the programme of increasing the share of renewable sources in electricity generation. Anaerobic digestion utilises biomass to produce biogas, a mixture containing 50–75 % of methane with the rest being carbon dioxide [47]. Anaerobic fermentation of food wastes is recognized by the environmental legislation of the EU countries as the most appropriate way to disposing them. Compared to composting, this technology prevents the emission of greenhouse gases – carbon dioxide and methane – into the atmosphere, and additionally produces green electricity, heat or motor fuel – bio methane from food products [48].

More than 16 % of solid household wastes are composted in anaerobic installations in Belgium. Composting is carried out mainly in small installations with the capacity of 20 000–65 000 tons per year. Most aerobic composting plants are also designed to produce biogas, which is used to generate electricity [49].

One of the world leaders in the technology of converting food wastes into energy is the United Kingdom. According to the British government, on average, anaerobic installation can produce energy in the amount of 200 kWh from one ton of garbage. In the UK this technology is used by several hundred factories. They are able to provide energy to more than half a million homes. Some garbage trucks in the cities of Britain also work on electricity obtained through garbage [50]. As a part of the pilot project, London's famous red Double-Decker buses are already running on bio fuel, partially made from coffee waste. The British processing company Bio-bean supplies bio fuel for London Double-Deckers. It also produces pellets and briquettes from used coffee grounds [51]. Garbage of the capital will soon become fuel not only for garbage trucks, but also for airplanes. There is a programme to reduce the area of landfills surrounding the city; the government of London signed the contract with the British Airways. This British air company will fill with bio fuel part of its aircraft flying to the United States. The American company *Velocys* will be the supplier of fuel, produced from household wastes [52].

Besides, among the first airlines which announced their intention to use bio fuel on regular flights there were German 'Lufthansa', the Dutch 'KLM' and Finnish 'Finnair'. The increased attention to this issue is paid in the countries of the Northern Europe, where a lot of efforts are spent traditionally on the protection of the environment. In particular, one of the largest fuel suppliers – Air BP – offers bio fuel refuelling at the airports of Bergen, Oslo (Norway) and Halmstad (Sweden).

One more method of wastes management is wastes burying in landfills. But this method is very limited in use for the most EU countries. The landfill Directive [30] also requires member countries to reduce the amount of organic wastes dumped in landfills and to reduce the number of landfills. In Poland, the children's playground was made in one of the recultivated landfills to teach children wastes management. Germany banned extensive use of landfills as early as 2005, and of the 300 existing landfills, only half continue to operate in the limited mode. Wastes burying directives adopted in Austria, Belgium, Denmark, France, Italy, Norway and a number of the other countries generally prohibit or restrict burying biodegradable/organic wastes in landfills.

For Ukraine at present it is a moment of demonstration, which will show the effectiveness of the Ukrainian policy on the introduction of the European values. Unfortunately, Ukraine is now included in the list of countries with the highest level of wastes accumulation. More than 11–13 million tons of household wastes are annually exported to 6700 specialized landfills, which occupy 9 thousand hectares and contain about 40 billion tons of wastes [53].

Eurostat 10 estimates that the total amount of wastes per capita in Ukraine is twice bigger than in any EU country. In addition, there is no clear statistics on the accumulation of wastes in the unauthorized landfills in Ukraine (only according to the official data their number is about 30 000). At present, there are very few controlled landfills to meet the needs of the state, and safe landfills built according to all the European standards, units. At the same time, creating new landfills instead of finding alternative ways to solve the urgent problem, the problems for the future generations are created. The amount of wastes is increasing and the wastes management system itself is regressing. At present, in Ukraine there is practically no system of processing household garbage. As of January 1, 2018, from 29 722 cities, only 575 have separate collection systems for household wastes, 22 wastes sorting lines, and 3 wastes incinerators, which provide recycling and disposal of about 5.76 % of household wastes, of which: 2.72 % is burned, and 3.04 % falls on the procurement points of secondary raw materials and wastes processing plants [6]. While in some European countries up to 97 % of household wastes go to recycling, this figure is

slightly higher than 3.0 % in Ukraine. In the European countries, the modern ‘formula for solid home waste management’ is the following: about 30 % of solid wastes are recycled through their separate collection and sorting; 20 % are recycled into compost and biogas; and about 50 % are disposed, usually by burning for energy purposes with the production of heat, electricity. All the data make up the weakness of the Ukrainian wastes management and the possible threats for both the country’s economy and environment.

Nevertheless, the Ukrainian authorities are making steps to improving the ecological situation in the country which can be seen as strengths with the possible opportunities for the future. For solving wastes problems strategic planning and quality wastes management is needed at the state level. In particular, on February 8, 2017, the National Strategy for wastes management in Ukraine till 2030 was approved, which provides [18]:

- conducting national awareness-raising campaign with the aim of raising understanding to ensure awareness of key stakeholders in sustainable management of household wastes, its advantages and the required contribution to the system;
- involving the population in separate collection of household wastes and stimulation of such collection;
- introducing composting the organic component of household wastes in private households in rural areas, as well as in suburban areas of cities;
- ensuring the use of resource-valuable potential of household wastes;
- developing an action plan to reduce the volume of disposal of household wastes, biodegradable;
- creating till 2022 in the regional centres the network of collecting points for reuse of furniture, household appliances, clothes and other goods;
- providing in 2023 recycling 15 % of household wastes by means of stimulating tools, increase in the population which carries out separate collection of household wastes, to 23 % and commissioning wastes sorting lines, wastes recycling plants;
- ensuring in 2030 recycling 50 % of household wastes from the total amount of their formation by increasing the population, which carries out separate collection of household wastes, up to 48 % and commissioning additional wastes sorting lines, wastes recycling plants;
- improving the procedure for the formation of the tariff for services for the treatment of household wastes;
- ensuring the active network of the regional landfills in accordance with the requirements of the Council Directive 1999/31/EU of April 26, 1999 on wastes disposal.

More precisely, the National Waste Management Strategy anticipates reaching the targets in wastes preventing, processing, recycling and disposing (2016 was taken as the base date) in the short-term (2016–2017), mid-term (2019–2025) and long-term (2026–2030) perspective. The main targets in wastes prevention include decrease of using raw materials (from base 90 % to 70 % in long-term perspective); increasing the number of settlements with separating wastes (from 575 to 5000 respectively); increasing the amount of reused municipal wastes from 5 % to 10 % respectively); increasing the number of wastes collecting centres (from 0 to 250 respectively). It should be noted that according to the strategy the increase of wastes processing and recycling must be from 3 % to 20 % and 50 %, respectively. As for the wastes disposal, the most crucial decrease must be in the number of landfills for municipal wastes from the base 6000 to only 300 [3].

The next step in adjusting the Ukrainian legislation and practice to the EU hierarchy of managing wastes, including the organic ones, was made by the Ukrainian Parliament in

2020 when the project of the Law 'On Waste Management' (registration number 2207-1-д of June 4, 2020) was approved by the Parliament of Ukraine (Verkhovna Rada) in the first reading on July 21, 2020. The project of the law includes Article 1 which enlists the main terms and bio wastes, food wastes, biodegradable wastes, municipal system of managing wastes, sorting wastes are among them. Article 4 of the project of the law describes the hierarchy of the wastes management and includes all the levels of responsibility and stages (from preventing to recycling) [54]. The main aim of the future law is securing its realisation the conditions of the Ukrainian society mentality and decentralisation reform in the shortest possible time.

For the best understanding and visualisation of Ukraine prospects in the context of the applicable EU practices in the field of wastes management the SWOT analysis was made (Table 2).

According to the analysis of the policy of managing organic wastes and the relevant legislation in Ukraine, it is possible to sum up the results of our investigation:

- The EU countries have gained the rich experience in dealing with the organic wastes in all the aspects: legislative, economic, financial, and social;
- Ukraine has to get acquainted with the best European practices for improving its own situation with managing the wastes;
- At present implementation of EU directives in Ukraine is too slow and fragmented; institutional and legislative changes have to be done in the shortest possible time;
- Tariff calculation principles are very outdated and do not facilitate the introduction of new wastes recycling technologies, certain rates of environmental tax and fines for unauthorized wastes removal are too low to significantly affect the behaviour of wastes owners; to foster reforms, tax incentives, tariffs reform, introduction of extended producer responsibility are required;
- There is no prudent attitude to resources and environment protection in the Ukrainian society; measures toward population awareness, improvements in wastes management behaviour, recovery and disposal code have to be implemented.

The process of implementing the National Waste Management Strategy 2030 will inevitably contribute to developing positive environmentally-friendly legal and practical aspects of the Ukrainian realities such as legislation concerning wastes management, ecological situation in the country, economic growth as the result of investments, technological progress as the result of introducing advanced wastes management practices.

It should be noted that the decentralisation reform is still at the very beginning of its implementing into the Ukrainian realities; besides, the local elections were held and the local authorities can have the other priorities in their activities concerning managing wastes. All the reforms require financial support both for informing the population and for the technical implementing them into practice. The European practices should be considered by the local authorities when the financial situation affords and at least some of them can be successful in the local communities too. First of all, the experience of France, Czech Republic and Belgium in the cooperation between supermarkets and charitable organisations can be useful as for the present shops are ready only to reduce the price of unsold food when the expiry date approaches. Besides, the British practice of implementing the idea of reasonable consumption for the population is worth borrowing for the local communities as preventing losses of food is always more efficient than managing food wastes. The latter statement was supported by the results of the on-line questionnaire conducted by the authors among the Sumy local community representatives which showed that preventing policy is one of the most appropriate for the Ukrainian people, because Ukrainians historically consume less than Europeans do and this practice doesn't require a

lot of additional financing, it should be only advertised at all the possible levels and resources.

TABLE 2. SWOT ANALYSIS OF UKRAINE PROSPECTS IN THE CONTEXT OF THE APPLICABLE EU PRACTICES IN THE FIELD OF WASTES MANAGEMENT

S	W
<ul style="list-style-type: none"> - In accordance with the requirements of the Association Agreement with the EU, Ukraine is obliged to implement Directive № 2008/98/EU on wastes, in particular, organic ones; - There is the National Wastes Management Strategy in Ukraine until 2030; - The implemented decentralization reform gives more powers and requires more responsibility from local authorities in terms of local wastes management policies; - Existing regional programmes in most regions solid household management and separate collection of wastes with the stress on forming of the population's awareness of its necessity and punishment for violation of wastes management rules. 	<ul style="list-style-type: none"> - In Ukraine the share of organic wastes is higher than in the EU; - The tendency to increase the scale of generating and accumulating organic wastes; - Wastes management system focused on the landfills mostly; - A quarter of the population is not covered by services for centralized removal of household wastes; - More than 99 % of operating landfills do not meet the European requirements (Council Directive 1999/31/EC of 26 April 1999 on the landfill of wastes); - There is no infrastructure for separate collecting and processing organic wastes; - The system of payment for household wastes does not encourage households to reduce their amount (depending on the area of housing or the number of registered residents); - Effective state control over emissions from incinerators is not provided; - Lack of informing citizens about cases of prosecution for offenses in the field of wastes management; - There is no purposeful system of training and retraining specialists in the field of management and treatment of solid wastes.
O	T
<ul style="list-style-type: none"> - Implementation of the framework law "On wastes management" to introduce the new transparent rules in the market, develop wastes processing industry and promote environmentally sound management, introduce the hierarchy of wastes management; - Introducing the new principle of calculating the fee for wastes "Pay-As-You-Throw" will encourage households to reduce the amount of organic wastes and ensure proper functioning landfills and ensure their safety; - Creating conditions for attracting investments to allow building the new garbage processing capacities; - Implementation of the Directive 2008/98/EU to provide the reduction of food wastes in primary production, processing, retail and distribution in restaurants and cooking services, at households; - Introducing the European approaches to donation of food and other redistribution for human consumption and processing into non-food products; - Promotion of composting organic wastes at the level of the local communities, establishing local infrastructure for composting organic wastes. 	<ul style="list-style-type: none"> - The National Wastes Management Strategy until 2030 does not include a percentage for processing bio-wastes, which should be achieved by the country, which does not encourage the further development of specific measures in this direction; - Low fee for wastes disposal does not take into account the costs of proper operating landfill, ensuring its safety, monitoring, reclamation and the cost of closing and the further treatment of the wastes accumulation site; - The system of payment for wastes removal is imperfect and does not promote interest in investing in this industry; - Municipalities often do not implement their own regional programmes on wastes management.

The strength of the ecological practice in Ukraine at present is mainly based on the decentralisation process as wastes sorting and processing are realised basically in households and local communities. The following programme can be seen as the considerable opportunity for the ecological progress in the country. Ukrainian local communities take part in the programme 'European Union for Environment' (*EU4Environment*) financed by the partners of Ukraine (with involving foreign professionals for instructing). One of the programme directions is wastes mapping in the frames of the community (city, town, settlement). The activities within the programme include, among the others, collecting data on the types of wastes, analysing the situation with gathering and sorting wastes in the communities, analysing the degree and efficiency of sorting wastes, comparative analysis of the results and the initial obtained data with the set goals, discussing the analysis results (defining possible gaps and the most efficient practices for separate kind of wastes).

4. CONCLUSIONS

The European long-term experience in sorting and managing organic wastes is rich and successful, taking into account its diversity depending on the number of countries–members and it is worth further investigating by the Ukrainian scientists, governing bodies, local authorities and society on the whole to find out the most suitable practices and implement them into the everyday life of the country. Besides, ecological education with the emphases on proper managing the organic wastes is of great importance at present. The financial aspects should be of the concern for the authorities of different levels – from the central government to the municipal ones in the towns and villages. Promoting the reform of decentralization will be supportive to solving the problem of wastes managing. The situation in the wastes management sector of Ukraine is continuously defined as critical in the recent market studies, official documents, reports and analytics by NGOs/CSOs in terms of the status and trends in wastes generation, accumulation, storage, processing, recycling and disposal. The situation is critical in many cities and regions and in many wastes subsectors due to the lack of proper wastes management infrastructure and adequate government policy, business approach and public response.

Introducing the New Strategy will allow the full-scale information campaign among the population and producers, introducing the principles of the circular economy and expanded producers' responsibility, which should encourage the population to separate wastes collecting, and business to minimize producing waste and increase interest in their recycling, as well as to introduce the five-step hierarchy of wastes management, which operates in the European Union. Taking into account the results of the conducted SWOT analysis on the issue (strengths and opportunities, weaknesses and threats), the further activity of the Ukrainian authorities of different levels (especially in the conditions of the decentralisation reform) can lead to avoiding problems and achieving success in the ecological sphere by way of introducing the efficient ecological European practices; ecological education can be of help in these activities.

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