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CONCEPTUALIZATION OF LATENT ECOSYSTEM SERVICES

Abstract. *The technology of waste sorting and recycling can build a profitable business, provide a return to the turnover of secondary resources, reduce the amount of landfills, and simplify the storage of garbage, which makes it possible to create a resource-efficient, competitive economy. By turning waste into raw materials and materials, recycling allows you to save on natural resources, create new jobs and thus reduce the unemployment rate in the country, and reproduce competitive production. The sector of recycling of secondary resources creates a social effect – contributes to the creation of new jobs. The recycling generates demand for low, medium and highly skilled labor.*
Key words: *ecosystem services; recycling; secondary raw materials*

Introduction

Speedy progress of the service sector within the information society determines the complexity of unification and interpretation of its new types: consulting, information and interactive in particular. There is a phenomenon of closing in the categories "product" and "service" and formation of the continuum "classical material goods – classical nonmaterial service" with a variety of properties options combination peculiar for both categories [2, 3, 7, 10]. Given the many-sidedness of this phenomenon and the complexity of its unification, L.D. Zagvoyska [5, 6] suggests considering the economic category of "services" as a specific product that is offered and consumed directly during the process of producer (proponent) certain activities deploying of the service (an individual personal or a system of different nature – technical, social, environmental or ecological and economic) and it turns out in the change of the consumer's service or his/her life conditions. Thus, in the paradigm of ecological economy, service is not only the result of human activity, but also the result of the functioning (operation) of environmental systems, that makes a radical correction in the interpretation of the concepts of "services".

Different interpretations of ecosystem services and functions are currently available in the literature. In particular, according to R. Haines-Young, [22, p. 81] environmental function of ecosystems is the ability or potential to provide services due to its structural properties or the processes it supports. The service is

a contribution to the welfare of a person who carries out biotic and abiotic components of ecosystems together and directly; "end product" of nature. That is, functions turn into services when there is a beneficiary. Eliminating the difficulties of methodological and operational nature, due to the use of the concept of "benefit", in the reports TEEV [25] proposed to interpret the environmental function as a part of the interaction between the structure and processes that provide the ability of the ecosystem to provide goods and services (p. 247). Service – as a direct or indirect contribution of ecosystems to people's welfare. The synonym of the concept of "services and benefits of ecosystems" (p. 248).

In this regard, the service provider, as a special product (the cost of which is identified by a particular activity or by of the impact on the consumer's service) is not a business entity, and an element of natural capital is an ecosystem with an organically integrated person and the environment. The result of the production / consumption of ecosystem services is a change in the welfare of a person.

Certainly, ecosystems and their services cannot be considered as a traditional object of economic relations, since a person is a subject of economic relations, and at the same time a "manipulator and inhabitant of ecosystems" [23] is an integral part of their sociocultural elements, which eliminates the postulate "out of presence", destroys the contrast between the object and subject, reveals their dynamic interaction and coevolution [5, 6, 13, 14]. In the context of changing the scientific paradigm, it is obvious and necessary to change the economic paradigm, expand the subject space to take into account the value of natural and social capital, which ultimately reflects the formation of paradigms of the ecological and institutional economics.

Main part

Actualization of the issues of accumulation and utilization of waste of various origin and hazardous groups is increasingly globalized, especially due to the creation of substances and components of xenobiotics. Waste synthetic inherent varied influence, not only as the accumulation content, but also as components that can potentially be included in the cycle of substances. Theoretical methodological bases of waste management are based on the fundamental provisions, which are based on the basic laws and principles of ecology [9]. The laws of ecology generalized by B.Commoner clearly reflect the essence of the relationship between man and nature.

"*Nature knows best*" – calls for extreme caution, since the substances formed by nature can be "disposed" by it (circular motion), instead created by a person – are mostly accumulated and cannot be included in natural processes of assimilation of substances and energy.

"Everything is connected with everything" – draws attention to the general connection of processes and phenomena in nature and in its content is close to the law of the internal dynamic equilibrium of the natural system. The law of homeostasis is one of the most important in nature management, its extrapolation helps to understand that in the case of even insignificant interferences in the natural environment, ecosystems, such as cybernetic systems, are capable of self-regulation and recovery (elastic and resistant ecosystem resistance), but if these interventions exceed certain limits and can no longer "extinguish" in the chain of ecosystem hierarchy, they lead to violations of the assimilation and energy processes of the biosphere.

"Nothing is given for nothing" – concerns the issues generalized in the laws of internal dynamic equilibrium, the constancy by V.I. Vernadsky and the development of the natural system at the expense of the environment. In addition, this law resonates with the law of limited natural resources – all natural resources (and conditions) of the Earth are exhaustive. The law is based on the fact that, since the planet is naturally restricted to an entire, there can be no endless parts on it. However, the restrictions imposed by the energy itself of the biosphere, anthropogenic change beyond the permissible limits of the 1% rule, are not subject to serious constraints. The artificial introduction of energy into the biosphere has now reached magnitudes close to the limit.

Any human activity generates waste. This axiom is implemented in the inability to ensure the absence of waste and to develop non-waste environmentally friendly technologies, that is why it is now necessary to maximize waste treatment. *The law of invincibility of the side effects of production (economy)*: in any economic cycle waste and side effects that are not subject to repair are generated, they can only be transferred from one physical-chemical form to another or moved within the space. The basis of this law is the laws of conservation of mass and energy. This law can be supplemented by *the law of the constancy of the amount of waste in technological chains.* Thus, this law focuses on the development of technologies for handling industrial, construction waste and solid waste. With regard to solid waste, this law indicates, first of all, for processing, and its economic component is determined by the rule *"ecologically friendly – economically*": the ecological addressing of management issues gives the maximum economic effect. This rule is confirmed by the practice of solid waste management: recycling (rational system of collecting and processing of components of solid waste in products with consumer value), as a method of processing of solid waste is the most environmentally friendly (burning, dumping).

Ukraine is not the only state in Europe facing the problem of solid waste management. The problem of waste disposal should be considered as one of the main. The amount of solid waste generation in Ukraine in 2016 amounted to 49 million $m^3 \approx 11$ million tons, i.e. 250–300 kg per person [15]. Every year, there is a lot of garbage, which far exceeds the rate of utilization [16]. Thus, in 2016, only 5.8% of the generated solid waste was recycled, including 2.71% burned, 3.09% directed to waste recycling complexes and ≈ 0.003% – composted.

There is an extremely unsatisfactory situation in the field of waste management in Ukraine, in particular regarding the provision of their collection, processing and utilization, involvement of secondary resources into economic circulation. We lose a significant resource potential, and at the same time we are making worse the environmental situation that is so unfavorable. Meanwhile, according to European practice, the scope of the involvement of waste in economic circulation, becomes a large-scale industry, which involves hundreds of thousands of workers and where significant revenues are generated. In many countries, the share of this sphere in the formation of GDP is approaching 1%.

According to Art. 32 of the Law of Ukraine "On Waste" dated on 01.01.2018 disposal of untreated domestic waste is prohibited. Effective waste management makes them a source of income for the state or for private entrepreneurs, as shown by the experience of Germany and other countries. According to V.M. Boronos [2] environmental compatibility in waste management is not only in eliminating them as polluting the ecosystem substances, but in turning them into a source of secondary

raw materials – receiving energy from waste incineration or biogas storage at landfills. Perspective is the receipt of secondary raw materials and composting of organic waste, which significantly increases the environmental friendliness of their use. A priority method for the conversion of waste into secondary resources should be the method of their recovery, that is, collection, sorting, preparation of waste of various types for their re-processing [12].

The term "recycling resources" includes separate groups of domestic and industrial waste, which at a certain time can be reused for economic purposes. At the same time, the level of recycling varies considerably between countries. The most effective is the recycling of old cars, which reaches 87% in Germany, Belgium, Lithuania and Bulgaria. Germany, the Netherlands and France are characterized by the highest level of recycling and have a steady trend of transition from burning waste to their recycling. Recycling of waste is mainly done by private companies, which are rather high-profitable and do not need state subsidies [18]. If the plant recycles waste, its profits consist of the waste collection and the sale of recycled materials to producers. If the plant burns waste, then its revenues are a charge for waste collection and further disposal, while a portion of the sorted waste can be sold. Some countries deliberately buy waste abroad for processing and use. Somewhere, waste even became a tight resource, for example, Sweden imported it from Germany and Norway to use for electricity generation. Thus, in this country, they produce enough energy to provide 17% of residential buildings [19]. In the EU, there is an annual growth of 7.5% in the average annual rate of employment in the area of recycling, respectively, an increase of 12.8% of those employed in the eco-industry. The EU is gradually building a so-called "recycling society" based on the concept of "three Rs" (Reduce, Reuse, Recycle) – reducing the amount of waste generated for disposal, recycling waste parts, recycling waste and transforming them in secondary raw materials [20].

EU countries are moving to the concept of a closed-loop economy, which involves replacing the traditional linear economic system of production and consumption with regenerative one. In countries such as Switzerland, Germany, the Netherlands, Sweden, Belgium and Norway, waste disposal as a waste management method is not used at all, predominantly the methods for the return of raw materials or energy prevail. The EU waste management approach is in the line with the Framework Directive 2008/98 / EC on waste and the new EU Directive 2018/851, which has been amended since May 30, 2018. The result of the implementation – for landfill, no more than 5% of domestic waste, 40% goes to recycling, 15% – for composting and 40% is burned down at TPP– on SDW with the use of thermal and electric energy. This corresponds to the first law of thermodynamics: any changes in the isolated system leave its total energy constant, or in all macroscopic processes, energy is not created and does not disappear, but only passes from one form to another. For example, in the Netherlands, up to 60% of waste was disposed of and disintegrated with the recovery of raw materials, and 40% was burned with energy recovery. In general, the market for waste-to-energy is growing and in 2016 it was about $14 million. However, the construction of a TPP on SDW is usually carried out with a significant share of investment by energy companies, despite the interest of leading energy companies in this type of alternative fuel, is increasing significantly around the world, especially in Japan, where 79% of solid waste is utilized at the TPP on SDW.

For Ukraine, the use of solid domestic waste (SDW) as an alternative fuel also becomes a priority [Pavlyuk]. This is especially true for populated areas, the primary task of which is finding the simplest, economically feasible way to completely eliminate waste with the development of the maximum amount of heat and electricity. This is the approach that was introduced at the "Energy" waste burning plant. Implementation of the European approach to the use of the energy potential of municipal solid waste in Ukraine is reflected in the National Waste Management Strategy in Ukraine until 2030, according to which, by 2023, 15 TPP on SDW plants will be built in Ukraine, and by 2030 – 20 TPP on SDW.

The principle *"Not All Being Enough"* (B. Commoner), shows that there is the existence of a source of all forms of competition, rivalry and antagonism in nature and society. The essential difference between competition in nature and society lies in the fact that in nature, as a result of competition, the best is left, and in human society, this is not guaranteed, but rather the other way round. The principle shows the source of competition and, in our case, states the objective presence of entrepreneurship in the field of handling of industrial, construction and solid domestic waste.

The production of energy from municipal waste burning in the EU reached 16.4 thousand tons of oil equivalent [8]. In Estonia, Eesti Energia's waste recycling plant transforms ≈ 82% of the energy contained in the waste into electricity and heat, which allows saving 70 million cubic meters of natural gas per year [19]. According to experts, recycling revenue in the EU amounted to 33.5 billion euros, and the share of recycling revenue accounted for 10% of the income of the eco sector of 28 EU member states. The most profitable materials for processing are iron, steel, paper and precious metals. Also, interregional trade in secondary raw materials in the EU is increasing every year. Export of secondary raw materials brings not only additional revenues to the budget, but also contribute to the reduction of the balance of payments deficiency [8].

Sweden imports (deliberately purchasing garbage for its processing and use) from Germany and Norway to use for electricity generation. In this country, they produce enough energy to provide 17% of residential buildings [19]. Scientists at the University of Linnaeus offer an interesting method for completing the life cycle of landfills. On the restored territory, a local recreation park was created. Ideas make popular innovative technology for balanced development of the territory and new thinking [24].

In Estonia, a waste recycling plant, using up-to-date and environmentally-friendly combustion technology, generates about 82% of the energy contained in garbage in electricity and heat, which can save 70 million cubic meters of natural gas annually [19].

It is known that the functioning of ecosystems has general laws of thermodynamics. The principle of *"energy conductivity":* the flows of energy, matter and information in an integral system are of a transverse nature, otherwise the system will not have the properties of unity. Due to the principle of "energy conductivity", the integrity of groups and biocenoses has arisen and remained. But the through-flow energy, passing through the trophic levels of biocenosis, gradually fades. The minimum percentage of energy transfer to maintain the integrity of groups and biocenoses is 10% (R. Lindemann's rule). At present, mankind produces such a bunch of pollutants, including those that do not have natural analogues, which the reductants are not able to "re do" (B. Commoner's law "*Nature knows best*"). This leads to their accumulation and is one of the reasons for the current environmental crisis.

The economic standardization of the SDW collection system is necessary, since it is the most expensive component. In addition, it is necessary to mark out solid waste by the amount of heat, morphology, humidity. For example, the morphology of agricultural waste: vegetable origin – 57%, excrement, urea and manure – 37%, animal origin and mixed food waste – 6%.

Latvia is actively implementing the concept of balanced development in the field of waste management, by creating an effective organizational and economic mechanism for attracting waste into economic circulation, introducing new technologies for utilization of resource essential waste, stimulating environmental investments, etc. For example, on the suburb of Riga there is a huge dump was turned into the Getlini Environmental Test Site (http://www.getlini.lv/en/). Getliņi Environmental Site is one of the main producers of green energy in Latvia. The source of energy is the gas that forms as a result of decay of waste in the biodegradation cells.

The wastes are placed in airtight biochemicals (biodegradation cells), where neither air nor rainwater penetrates. The gas formed in the cells is discharged into a power unit where it is burned and converted into electrical and thermal energy, and all waste water is collected and treated. Due to this, the impact of waste on the environment is minimized, the level of "greenhouse effect" is reduced and simultaneously the so-called "green energy" is carried out. Biodegradation cells consist of four main elements: a waterproofing base, a system for collecting and cleaning infiltrates, a gas collection system (with or without infiltrate recirculation, the main component of the system are not vertical but horizontal gas wells), coverage of filled cells / deposit locations. Gathering and combustion of methane in gas engines and the generation of electricity is not only a commercial measure that helps to finance the protection of the environment, but is itself a measure of protection of the atmosphere. Before supplying to the power unit, the gas is cleared of H_2S, Cl, F, siloxanes and volatile organic compounds (VOCs). In recent years, net methane (CH_4) has been extracted – 7 844 760 cubic meters of gas, corresponding to 78 011 000 kWh of energy. Thermal energy is used to provide economic needs for Getlini: heating, water heating, reactor water purification equipment and pool to collect infiltration and recirculation. The extracted gas energy is converted into electro- (40%) and thermal (46%) energy.

SIA Getliņi EKO – is a unique example of environmental work in several directions: heat is used for heating greenhouses (area – 3625 sq. m, height – 5.5 m). It is planned to grow 165 tons of tomatoes per year, and on the reclaimed waste mountain of 20 hectares area the herd of sheep performs the role of "lawn mowers" and reserves the green area of the landfill (mineral fertilizers and pesticides are not used in the pasture, 50-cm layer of clay and 20-centimeter layer of soil protects the grass from the harmful effects of waste). Heat is a byproduct of the process of combustion of the environmentally hazardous methane gas during electricity generation.

Several schemes for the processing of wood raw materials have already been developed and implemented. Among them there are also quite effective ones, which are based on the deep chemical processing of wood greens, bark, sawdust, shavings of coniferous and deciduous breeds. Known developments for obtaining chlorophyll-carotene mass, chlorophyllin sodium, rye, insecticides, fodder products, etc. At present, such types of recycling of secondary waste wood – processing of cubic remnants into coniferous extract, spent raw materials – in feed meal, production of

fibreboard and particle board, and carbonaceous plastics, biofuels. At present, a small part is used as a fuel for the heating of industrial and residential buildings, and the main part is exported to landfills. During such "burial" the wood begins to decompose with greenhouse gas emissions, as well as injecting insects. And this in its turn can become a source of illness. Another type of fuel production from the waste products of the woodworking industry is granulation. Granules can be made of both pure wood and a mixture of wood and bark, are marketable. In general, under the conditions of a developed system of biomass collection and utilization, traditional fuel can be saved to a large extent, as well as reducing the load on the natural environment.

Law of biosphere reversibility (P. Dansereau): the biosphere after the influence completion must seek to conquer the "lost positions", that is, to preserve (restore) its environmental balance and stability. Thus, abandoned agricultural fields gradually (by succession) return to the state of wildlife. However, the natural regenerative potential (energy of retention) is not infinite, it is close to the energy of elimination created by mankind, which is confirmed by the Law of Irreversibility of the interaction of the "man-biosphere" system: a part of the renewable natural resources (animals, plants) may become irreversible. Thus, uncontrolled hunting for a Steller's sea cow led to its extinction as a biological species. The same thing happened with many other species of animals and plants. In total, over the past 400 years, more than 160 species of mammals and birds have been extinct.

Simultaneously with the changes in the relationship between man and nature there are changes in nature and in the forms of economy. *The law of inverse relations – man and the biosphere* (P. Dansereau): a change in the natural environment caused by human activities, "returns" and has undesirable consequences that affect the economy, social life and health of people. For example, the continuous felling of forests in ancient Mesopotamia led to catastrophic changes in the climate, in arid zones – to desertification of large areas; construction of the Aswan Dam (Egypt) – to salinization of soils, sharp reduction of fishing in the Nile penetration zone in the Mediterranean, eutrophication of the Aswan Reservoir; global pollution of the atmosphere – to the occurrence of the greenhouse effect, the formation of acid rain, etc.

Conclusions

Implementation of the provisions of the National Strategy on SDW use as an alternative fuel will reduce the consumption of natural gas for generating energy for the population needs. By turning waste into valuable raw materials and materials, recycling allows to save on natural resources, create new jobs and thus reduce the unemployment rate in the country, and reproduce competitive production. The sector of recycling of secondary resources creates a social effect – contributes to the creation of new jobs. The recycling industry generates demand for low, medium and highly skilled labor.

The technology of waste sorting and processing allows to set up a profitable business, provide return to the commodity turnover of secondary resources (paper, cardboard, ferrous and nonferrous metals, plastics, glass), reduce the amount of landfills, simplify the storage of waste, which makes it possible to create a resource-efficient, competitive economy.

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КОНЦЕПТУАЛІЗАЦІЯ ЛАТЕНТНИХ ЕКОСИСТЕМНИХ ПОСЛУГ

Анотація. Технологія сортування і переробки сміття дозволяє побудувати рентабельний бізнес, забезпечити повернення в товарний оборот вторинних ресурсів, скоротити кількість сміттєзвалищ і полігонів, спростити складування сміття, що дає можливість створити ресурсоефективну, конкурентоспроможну економіку. Шляхом перетворення відходів у сировину та матеріали, ресайклінг дозволяє економити на природних ресурсах, створювати нові робочі місця і цим самим зменшувати рівень безробіття в країні, відтворювати конкурентоспроможне виробництво. Галузь переробки вторинних ресурсів має соціальний ефект – сприяє створенню нових робочих місць. Галузь ресайклінгу формує попит на низько-, середньо- і висококваліфіковану робочу силу.

Ключові слова: екосистемні послуги; ресайклінг; вторинна сировина

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