

Green Enterprise Logistics Management System in Circular Economy

Viktoriia Bozhanova

Department of Management, Project Management and Logistics,
Prydniprovsk State Academy of Civil Engineering and Architecture, Dnepropetrovsk, Ukraine.
E-mail: bozhanova.viktoriia@pgasa.dp.ua

Petro Korenyuk

Department of Management of Organizations and Administration,
Dniprovsk State Technical University, Kamianske, Ukraine.
E-mail: korenyukp@gmail.com

Oleksandr Lozovskyi

Vinnitsia Institute of Trade and Economics,
State University of Trade and Economics, Vinnitsia, Ukraine.
E-mail: o.lozovskyi@ukr.net

Svetlana Belous-Sergeeva

Department of Economic Theory and Entrepreneurship,
Priazovskyistate Technical University, Mariupol, Ukraine.
E-mail: beloussergeeva75@gmail.com

Olha Bielienskova

Department of Construction Economics,
Kyiv National University of Construction and Architecture, Kyiv, Ukraine.
E-mail: bielienskova.oiu@knuba.edu.ua

Viktor Koval

National Academy of Sciences of Ukraine, Kyiv, Ukraine.
Corresponding author: victor-koval@ukr.net

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Abstract

The article is devoted to the study of green enterprise logistics management and the circular economy incentives used for the implementation of green environmental projects in the countries of the European Union and Ukraine. The article develops methodological approaches and practical recommendations to improve the management system of the enterprise that collects garbage and makes preparations for garbage cardboard and paper recycling. Such system is based on the principles of "green logistics", taking into account the competitive environment on Ukrainian market. The objectives of the study are the following: elaboration of methodological approaches to the formation of prospects for the development of an enterprise operating in a highly competitive environment; implementation of the strategy of searching and entering new markets for the purchase of raw materials that requires the improvement of the enterprise management system in the context of "green logistics". A qualitative assessment of the effectiveness of the implementation of the principles of "green logistics" at the enterprise taking into account the economic, social and environmental effects has been carried out in this research. The system for the enterprise management based on the principles of "green logistics" has been proposed. It is recommended to be used at any enterprise that practices the appropriate type of activities (collecting, pressing and preparing cardboard and paper, as well as high-pressure plastic for processing). This approach of the sustainable development of the municipal solid waste treatment industry can be transferred to the country's entire economy.

Keywords- Environmental management, Sustainable development, Municipal solid waste, Social utility function.

1. Introduction

Today, one of the major global problems for humanity is to preserve the environment ecologically clean, utilizing a variety of products after processing and life wastage, according to the established international requirements. The topical issue of the garbage treatment is one of the priority directions for the development of Ukraine and attracts the attention of medium- and large-sized business entrepreneurs. This is confirmed by readiness of developed countries to invest public funds in future ecological measures of enterprises, which sort and process garbage. The possibility of re-using garbage treatment products is a sufficiently profitable business, which involves a series of technological operations: collection, transportation, sorting of garbage by type, chemical composition and hazard categories, and processing of municipal solid waste (MSW) prepared in a gasifier to extract synthesis gas and purify it, to obtain water vapor, hot water or electricity, as well as to obtain pyrolysis oil and accessory chemical substances with the consistent sale to consumers. Over 11-13 million tons of municipal solid waste are produced in Ukraine each year (Cabinet of Ministers of Ukraine, 2017). More than 95% of such waste are directed to disposal sites and landfills. More than 15% of waste disposal facilities are overloaded and do not meet sanitary standards. Opportunities for extending disposal sites available are significantly limited. In Ukraine, tons of valuable stock and raw materials are lost on landfills; upon that, 40% of them are accounted for by municipal solid waste. Lack of processing results in a lost profit of about UAH 5 billion annually (Turilova, 2015).

The Eurostat data informs about the following: in 28 countries – European Union (EU) Member States, in 2014 the total amount of waste averaged 4.931 tons per capita. In 2014, 47.4% of waste got to landfills across 28 EU-countries on average (Ford-Alexandraki, 2018). In 2019, the total municipal waste generated in the EU-27 was 225 million tons. As a result, in the EU-27 on average, for 2019-2020, there was more than 500 kg of household waste per person. The share of municipal waste recycled overall rose to 47% (Xenellis, 2020). According to the State Statistics Service of Ukraine, the calculations have been made to compare to the Eurostat data, and the following evidence has been received. The total waste amount in 2014 averaged 8.256 tons per capita. In 2014, 57.4% of waste got to landfills in Ukraine on average. For the period of 2014-2018, the generation of the total municipal waste conversely increased by 1,109 million tons, or 10.31%, from 10748 million tons (236.6 kg per capita) in 2014 up to 11857 million tons (279.7 kg per capita) in 2018 (Prokopenko, 2019).

Regarding the level of contamination in Ukrainian Regions, in 2017, the dirtiest one was Dnipropetrovsk Region, followed by Donetsk Region, Kyiv City, Kyiv and Kirovohrad Regions. The criteria for this assessment were the following indicators: the number of pollutants discharged into the atmosphere, generation of waste of I-IV hazard classes, volume of polluted wastewater, expected life duration for both genders at birth in the previous year 2016, number of patients firstly diagnosed with malignant tumors, growth /reduction of pollutants for the period of 2014-2017, and results of the poll, in which ecologists had to assess, according to a 5-point grading scale, chances for improving the environmental situation in the region over the coming years (Baturin et al., 2019). The centralized system in Ukraine for its sorting and processing does not operate on the market. Only commercial enterprises forming oligopoly on this market are engaged in it, which is not profitable for the population. Waste such as paper and cardboard, polyethylene and alike is incinerated by inhabitants of rural areas on their own private land plots, which pollutes air damaging the environment in that way (Ada, Sagnak, Mangla, Kazancoglu, 2021). Unauthorized landfills are a source of the “landfill gas” that increases the greenhouse effect.

The objectives of the study are: development of methodological approaches to the formation of prospects for the development of an enterprise operating in a highly competitive environment; the implementation of the strategy of searching for and entering new markets for the purchase of raw materials requires improvement of the enterprise management system in the context of “green logistics”.

The main objects of “green logistics”: material flows (including flows of waste and secondary resources for processing), as well as information and financial flows with equal importance of each of them (including service flow, which can be both in material form and in the form of information, labor costs).

The main research questions are: what are the methodological approaches and practical recommendations for the development of “green logistics”, taking into account the competitive environment of Ukraine, at enterprises practicing waste management (collection, sorting, pressing), based on the principles? What are the main directions for improvement of the enterprise management system through a combination of economic effects from transport and warehouse logistics?

The study defines the principles of “green logistics” in the enterprise management system in order to obtain economic, social and environmental effects from production, transport and warehouse logistics. Section 2 of the article is devoted to a literature review both in the study of the environmental component of logistics systems and analysis of methods, functions and principles of logistics that are used in the management of socio-economic systems. Section 3 illustrates the study consisting of a comparative characteristic of MSW processing indicators. Section 4 of the article is aimed at reviewing the main results of the study on improving the enterprise management system in the waste paper recycling market (case of “Ukrmetpolimer” LLC), based on: an analysis of the waste paper recycling market; drawing up routes along which the enterprise will collect waste paper, taking into account the number of inhabitants, the standard of MSW, distance and potential collection volumes. Section 5 contains assessment of the effectiveness of improving the enterprise management system based on studying the impact of company’s economic performance before and after implementation of “green logistics” project. Chapter 6 includes the conclusions and main results of the study, as well as the prospects for integrating and coordinating environmental, social and economic aspects for environmentally oriented logistics management not only for the enterprise, but also for the region.

2. Literature Review

Traditionally, the term “green logistics” is commonly referred to as logistics, which is based on resource-saving and environmentally sound processes and technologies. Some scientists call the environmental direction of logistics eco-logistics, which emphasizes the environmental orientation of the science of logistics that creates the integrated eco-logistical system. Thus, the scientific work of Murphy, Poist and Braunschweig (1996) is dedicated to the in-depth analysis of scientific comparative views of the leading environmental progressives, moderates and conservatives, in reference to the concept of the term “green logistics”. Smirnov (2004) considers “green logistics” from the point of view of ensuring the ecological security of a separate system for both the whole society and an individual consumer. According to Mikhno et al. (2021) the term “green logistics” contains a set of logistic approaches to the optimization of the movement of material flows (in particular, streams of waste and secondary resources for processing), vehicles, as well as natural, financial, information, energetic and human resources, with the use of

advanced technologies in the process of transportation to create an environment, in which needs of the population are met, the effectiveness of the farm production is raised, and the condition for minimizing negative effects of the anthropogenic intervention in the ecosystem is achieved.

Scientific works are devoted to the implementation of the principles of “green logistics” in the environment, development of the enterprise management system, matters of garbage treatment: Gurch, Khmara (2014) researched the program and principles of “green logistics”, as well as project to introduce resource-saving technologies based on the processing of solid polymer production and household waste in Ukraine; Larina, Pilyushenko, Amitan (2003) in their research considered the methods, functions and principles of logistics, which are used in the management of socio-economic systems.

The Rio Declaration on Environment and Development (1992) contains 27 principles of the ecological and correct behavior of world society, as of today, it is signed by 178 states (United Nations, 1993). According to this Declaration, the “Green Logistics” Program contains two principles.

The first principle is that of circulation: substances taken from the environment must be used in the light of the sustainable development requirement, i.e. repeatedly, or processed in other materials or energy, or sent to waste with the minimal additional consumption of resources and without harm to the environment. The second principle is the principle of replacement: less effective products, technologies and methods are replaced with more effective ones since the appearance of the latter. According to this principle, “green logistics” involves determining the consumer’s transport needs, offering alternative logistics schemes and appropriate vehicles, on the basis of applying the latest technical and technological solutions.

Maschak (2011) is also devoted to the issues of implementing environmental measures into the logistics activity of enterprises at the strategic level. The research (Margita Belonizhka, 2014) is also devoted to the particularity of introducing the principles of “green logistics” in transnational corporations and studies of the level of the logistics development based on the integral indicator of its efficiency. Following the introduction of the European Union’s Directive on product packaging, companies have increased the use of re-sealable receptacles, equipment for processing of waste of the production and logistics activities, as well as have implemented the management systems of the package circulation (Fernier, Sparks, McKinnon, 2010). The questions of waste management in the context of green logistics as part of a sustainable development were considered by many scientists (Cherrett, Maynard, McLeod, Hickford, 2010; Mikelsone et al, 2021).

European companies: IKEA (a transnational Swedish corporation for the production of quick-assembly furniture, kitchen appliances and home accessories) and Wärtsilä Oyj Abp (Finish public engineering company that manufactures machinery and other equipment for power stations operating on gas, oil and other raw materials) (Nylund, 2012). These companies use in packing cardboard materials that can be processed up to 6-8 times. IKEA also puts more emphasis on if the shipper is considered Green.

In Ukraine the collection and preparation for processing of waste from plastic and paper/cardboard are of the oligopoly nature: packaging waste suppliers in cities have the rigidly established partnership between them and set a fixed price in coordination with each other. The

works of the leading experts-founders are devoted to competition issues. The research on strategies and competition contains the theoretical basics and practical recommendations for conducting economic activities on local and international markets (Porter, 2005). Being guided by these formulations of Aaker (1995), practicing entrepreneurs will be able to properly understand the dynamic environment, develop forward-looking and creative approaches that are appropriate to conditions with changes, which the firm faces, and create strategies based on sustainable competitive advantages. All these approaches help entrepreneurs adapt to market trends.

But, despite an extensive study of green logistics issues, the problems of logistics and transportation, waste processing of cardboard and paper, remain unaddressed, which increases the environmental degradation. For the state, this problem is of low priority; local authorities are obliged to organize many points of collection and utilization of garbage. But, the centralized system for its sorting and processing does not operate on the market. In addition, the problem of analyzing competitive conditions in the logistics market in the field of collection, sorting and preparation of waste for processing is understudied, which mainly concerns cities, but in rural areas these problems are poorly covered, and as a result, unauthorized garbage dumps are formed, which are a source of “landfill gas”, which increases the greenhouse effect.

However, up to date, there are methodical approaches and practical recommendations missing in regard to the solution of an issue connected with the work of companies operating on the market of collection and preparation for garbage treatment on the oligopoly market of Ukraine.

The main difference from previous studies lies in the study of the social, economic and environmental component and analysis of relationship between the benefits of the company and the costs of the logistics activities of enterprises associated with the full cycle of MSW processing (case of waste paper), as well as to justify the transformation of the main directions for ensuring the development of a circular economy based on the construction of logistics solid domestic waste systems as an activity to manage the flow of processed raw materials.

3. Comparative Characteristics of the Indicators of Processing MSW

The possibility for re-using municipal waste turns waste processing into a very profitable business. The developed countries have long been addressing this issue: a number of special waste containers, each being intended for a specific type of garbage, is installed in European cities. In recent decades, many European countries have substantially reduced the share of MSW disposal, that was achieved through the combination of re-using materials with recycling, including the receipt of compost, and with the thermal treatment – incineration, which in most cases involves using energy (Germany, Belgium, Austria). These countries have almost completely abandoned waste disposal, and have used all possible methods of waste treatment. As of 2017, there were 6 thousand units of disposal sites and landfills in Ukraine, with a total area of over 9 thousand hectares; upon that, only one incineration plant and several dozen of sorting lines, in which the efficiency of selecting secondary materials does not exceed 20% by weight, operate. Annually, 9-12 million tons of MSW falls into disposal sites and unauthorized landfills, clogging the environment of Ukraine (World Bank, 2021; Matveyev, Geletukha, 2019).

According to the National Waste Management Strategy in Ukraine until 2030 (Cabinet of Ministers of Ukraine, 2017), the absence of an efficient packaging waste collection system annually leads to the loss. As a consequence, the deterioration of the environmental situation takes place. According to the (Matveyev, Geletukha, 2019) in Ukraine the annual rate of the

MSW generation is 0.35 t/person; the average value of the share of cardboard and paper in the morphological composition of MSW is 8,6%, or 30,1 kg per person on average.

In “green logistics”, the consideration of product or waste flows, or logistics operations and processes only as a management object is rather narrow and limits the scope of application of the environmentally-oriented logistics management mechanism (the ecological information and environmental payments are an important feature of the environmentally-oriented logistics system for the implementation of planning and modeling processes, as well as evaluation of its effectiveness). For this very reason, the goal of “green logistics” is to integrate and coordinate environmental, social and economic aspects within the regional logistics system, with the aim of the environmentally-oriented logistics management of the region’s development.

The direct observation allowed to establish the following. Within the limits of the Ukrainian cities, the problem of MSW collection is handled relatively well, but then the garbage is taken out to unauthorized landfills. There, MSW decomposes in nature for a long time, polluting the environment. In suburban settlements, the situation is converse: MSW is incinerated on private land plots, which is not lawful and pollutes the environment to the greater extent with harmful carbon monoxide that eventually causes bronchopulmonary and cancer diseases of people. This is because of the fact that almost half of residents do not conclude a contract with the garbage collection enterprise for various reasons: low income, specific mentality, and personal reasons.

Residents, who burn the garbage, believe that this is the simplest and cheapest way to dispose it rather than to conclude a contract with the garbage collection enterprise. The majority part of retirees lives below the poverty line (Kramar, 2019).

4. Results and Discussion

The development of methodical approaches and practical recommendations to improve the Enterprise Management System in Limited Liability Company (LLC), implementing principles of “green logistics”, was performed for “Ukrmetpolimer” LLC (Dnipro, Ukraine). This Company is an operator of municipal solid waste collection, its sorting, preparation for recycling and supply to the plants that process recyclable materials on the market: cardboard and paper.

The suppliers of “Ukrmetpolimer” LLC’s recyclable materials are networks of food retailers of Dnipro City and other cities of Dnipropetrovsk Region: Kamianske, Novomoskovsk, Pershotravensk, Pavlohrad, Marhanets and Nikopol. The Company operates 8 units of transport. However, all transport is used under a hiring contract. The characteristic of vehicles is as follows: TATA LPT 613 cargo onboard; the cargo capacity is 4 tons; the number is 3 pieces; and GAS 330202, cargo onboard; the cargo capacity is 1.5 tons; the number is 5 pieces. After collecting, sorting, processing, pressing and shipment to the warehouse of cardboard and paper in the bales, they are sent to the processing plants: LLC TPG “Albatros” (Dnipro, Ukraine) and Rubizhne Cardboard Mill (Rubizhne, Ukraine). The cost of such supplies is paid by these processing plants. The competitors of “Ukrmetpolimer” LLC in Dnipro City are: CJSC “Dneprovforma”, “Vtorma-2” LLC, “DVR” LLC, and “UVR Group” LLC. In this market segment, the level of competition is high; therefore, “Ukrmetpolimer” LLC should offer suppliers the high purchase prices for recyclable materials. In addition, this Company has the opportunity to increase production volumes: the production equipment and warehouse premises are not even half put to operation.

Methodical approaches to improving the Enterprise Management System, which practices the collection and preparation for garbage treatment of cardboard and paper recyclables, based on the principles of “green logistics”, taking into account the competitive environment on the Ukrainian market, can be formulated as follows (Grigorak et al., 2014).

One of the methodical approaches for the formation of the perspective development of the company, which works in the conditions of severe competition, is the strategy of finding and entering new markets of the purchase of raw materials that have been mastered a little. It is of great importance to implement an anti-crisis strategy for the company’s development by enterprises, when appropriate investment decision is attractive to entrepreneurs. That is, the factor of investment attractiveness of any managerial decision becomes important for the formation of an anti-crisis strategy.

In order to implement the strategy for finding and entering new markets purchasing raw materials, it is necessary to improve the Enterprise Management System, which will include two directions: introducing principles of “green logistics” that will expand its purchasing logistics and allow involving production and warehouse logistics to the greater extent, through the high discharge capacity of production and warehouse areas. Practical recommendations to improve the Enterprise Management System of “Ukrmetpolimer” LLC, which practices the collection and preparation for garbage treatment of cardboard and paper recyclables, based on the principles of “green logistics”, taking into account the competitive environment on the Ukrainian market, can be formulated as follows.

1. Given the great competition on the market of garbage treatment, it is proposed to enter new markets to obtain recyclables – scrap paper: its collection in rural areas across districts of Dnipropetrovsk Region. Residents of villages will separately collect cardboard and paper and receive money from “Ukrmetpolimer” LLC in the same way they receive food retailers in cities. And, it is suggested to enter into long-term contracts for purchasing raw materials with new suppliers at collecting points organized for cardboard and paper.
2. To arrange routes, along which the company will collect cardboard and paper taking into account the number of inhabitants in villages and MSW standard in the form of cardboard and paper per person, using the online services Google Maps and DELLA.ua, which will enable us to get information about the distance and potential volumes of scrap paper collection. To conclude contracts with carriers that will collect raw materials from the population, make settlements with it and supply them for sorting and further processing. To check the adequacy of the production equipment for processing, and to purchase the additional one according to the market supply potential. To prove the efficiency of improving the Enterprise Management System. Let us arrange the projected routes for receiving points of cardboard and paper using online services (sites) Google Maps (the residential places of Dnipropetrovsk Region located on/near the chosen major highways and having a large number of residents have been selected) and DELLA.ua (the travel routes have been determined and as a result, the distances that a 20-ton truck must cover, as well as the duration of its passage along the projected routes, have been obtained).

In Table 1, the total population quantity by routes, and the annual /monthly potential volume of cardboard and paper that can be collected, have been calculated; also, there has been calculated the approximate number of trips. The costs for conclusion of contracts for the organization of cardboard and paper collecting points (stores and population) is Ukrainian hryvnia (UAH) 10

thousand. The investment costs for purchase of PRESONA LP 100 automatic press for scrap paper is UAH 66 thousand. Total investment is UAH 76 thousand.

Table 1. Calculation of route parameters and needs for the number of trips.

Routes	Distance, km	Trip time	Population quantity by routes in 2020, persons	Total waste volumes per annual, kg
Route 1	268	6 h 6 m	33010	993602
Route 2	537	8 h 19 m	22833	687263
Route 3	516	9 h 10 m	332699	10014240,8
Route 4	714	11 h 54 m	17866	537772
Route 5	100	1 h 2 m	30724	924792
Route 6	108	2 h 22 m	11865	357143
Route 7	378	6 h 25 m	31891	959926
Route 8	257	4 h 35 m	41048	1235537
Route 9	377	6 h 31 m	18399	553825
Route 10	385	7 h 04 m	22958	691030
Route 11	155	3 h 19 m	32877	989608
Total annual amount of paper and cardboard, tons				17944,739

Source: The authors' calculation

To compile Table 1, data on the number of inhabitants in settlements along the compiled routes were used. Also, the norm of municipal solid waste (MSW) from paper and cardboard per 1 person was applied, equal to 30.1 kg / person in year. Thus, the weight of MSW was obtained along the routes for the year and for the month. Discharge capacity of the press at the place of production (not activated) is 500 tons /month. Total potential weight per month is 1495.395 tons (Table 2).

Table 2. Forecast of the number of trips by routes per month.

Route numbers	Potential weight of cargo per month, tons	Actual amount of waste collected, taking into account the press discharge capacity at the enterprise, tons	Estimated number of trips by 5-ton truck, taking into account the press discharge capacity at the enterprise	Actual number of trips by 5-ton truck, taking into account the press discharge capacity at the enterprise
1	82.800	27.685	5.54	6
2	57.272	19.149	3.83	4
3	834.520	279.030	55.81	11
4	44.814	14.984	3.00	3
5	77.066	25.768	5.15	5
6	29.762	9.951	1.99	2
7	79.994	26.747	5.35	6
8	102.961	34.426	6.89	7
9	46.152	15.431	3.09	3
10	57.586	19.254	3.85	4
11	82.467	27.574	5.51	6
Total	1495.395	500		57

Source: The authors' calculation

Difference between the potential weight for processing and discharge capacity of the press is 2.991 times. Then number of possible trips by 5-ton trucks per month is 100. The results of Table 1 are divided by 12 months and we get the potential weight of the cargo per month. The actual amount of waste collected, taking into account the throughput of the press at the enterprise, will be equal to: the potential weight of the cargo per month divided by the difference (in relative terms) between the potential weight for processing and the throughput of the press. We divide the resulting value by 5 tons (potential load) and get the estimated number of trips by a truck with a capacity of 5 tons, taking into account the throughput of the press at the enterprise.

The forecast of total costs for purchasing cardboard and paper per 1 month is summarized in Table 3.

Table 3. Forecast of total costs for purchasing cardboard and paper per 1 month.

Route number	Weight of cargo in trucks, tons	Purchase cost of recyclable materials (cardboard, paper), UAH /ton	Total costs for the purchase of recyclable materials per month, UAH thousand
1	27.685	2000	55.370
2	19.149	2000	38.299
3	279.030	2000	558.060
4	14.984	2000	29.968
5	25.768	2000	51.536
6	9.951	2000	19.902
7	26.747	2000	53.493
8	34.426	2000	68.852
9	15.431	2000	30.863
10	19.254	2000	38.509
11	27.574	2000	55.148

Source: The authors' calculation

The calculation of total annual costs for the purchase and transportation of raw materials is made in Table 4. Each route has its own length, complexity of the terrain, traffic congestion depending on the time of day. Such a multitude of influencing factors is quite difficult to take into account. Therefore, the payment for the services of the forwarder was accepted.

Table 4. Total annual costs for the purchase and transportation of raw materials.

Route number	Distance by routes, km	Value of transportation of the 1-ton weight by car with a capacity of up to 5 tons for 1 km, UAH	Value of carrying cargo for 1 carriage, UAH	Planned number of carriages per month	Value of carrying cargo by car with a capacity of up to 5 tons, UAH thousand	Payment for the freight forwarder's services for 1 trip, UAH thousand	Total costs for all trips, UAH thousand	
							Per month	Per year
1	268	11.58	3103.44	6	18.621	0.6	22.221	266.648
2	537		6218.46	4	24.874		24.874	298.486
3	516		5975.28	11	65.728		65.728	788.737
4	714		8268.12	3	24.804		24.804	297.652
5	100		1158	5	5.790		5.790	69.480
6	108		1250.64	2	2.501		2.501	30.015
7	378		4377.24	6	26.263		26.263	315.161
8	257		2976.06	7	20.832		20.832	249.989
9	377		4365.66	3	13.097		13.097	157.164
10	385		4458.3	4	17.833		17.833	213.998
11	155		1794.9	6	10.769		10.769	129.233
Total			43946.1		231.112		234.712	2816.563

Source: The authors' calculation

Thus, total costs for sorting and preparation of recyclables for their treatment in order to deliver them to processing plants is UAH 2816.6 thousand. Weight of scrap paper compressed is 6000 tons. Cost of accepting 1 ton of scrap paper by processing plants is UAH 3.7 per kg. Then total annual net income is UAH 222000 thousand per year. The cash flow plan-balance and

Calculation of the net present value and payback period from the implementation of the proposed measures is compiled in Table 5. At the beginning, the entrepreneur does not have funds, but he attracts a loan for an entrepreneurial idea. Further, this loan (which then goes immediately to purchase the necessary equipment) and net income from the sale of paper and cardboard to processing plants act as positive cash flows. Negative cash flows are the costs of the entrepreneur for the purchase of raw materials, transportation, etc., calculated above. After compiling positive and negative cash flows, the final cash flow is calculated. The balance at the end of the year is equal to the balance at the beginning of the next period. Net profit is calculated based on the norms of the current legislation and discounted, the size of the corresponding rate of which is based on the average discount rate, which is considered as the real interest rate of return on financial transactions in the region under consideration. Any financial institution can be an investor, the loan amount is not large, so this issue is too simple and will not significantly affect the final result.

The economic performances of the company's activities before and after implementing the proposed measures are given in Figure 1. The calculation of the proportion of transportation costs in net sales revenue is made in Table 6.

Table 5. Cash Flow Plan-Balance and Calculation of the net present value and payback period from the implementation of the proposed measures, UAH thousand.

№	Indicator Name	Years of the predictive analysis				
		1	2	3	4	5
1	<i>Cash at the beginning of the year</i>	0	13509.462	27094.924	40680.385	54265.847
2	Net income from the sale of scrap paper to processing plants	22200	22200	22200	22200	22200
3	Internal loan from the company	76				
4	Total proceeds	22276	22200	22200	22200	22200
5	Investment costs	76				
6	Operating expenses	5632.364	5632.364	5632.364	5632.364	5632.364
7	Income tax (proceeds –operating expenses)*0,18	2982.175	2982.175	2982.175	2982.175	2982.175
8	Company's Loan Repayment	76				
9	Total costs	8766.538	8614.538	8614.538	8614.538	8614.538
10	<i>Cash at the end of the period</i>	13509.462	27094.924	40680.385	54265.847	67851.309
11	Sales Profit (proceeds –operating expenses)	16567.636	16567.636	16567.636	16567.636	16567.636
12	Net income (Sales Profit - Income Tax – Loan Repayment)	13509.462	13585.462	13585.462	13585.462	13585.462
13	Discounted net profit value*	11566.320	9958.381	8526.011	7299.667	6249.715
14	Discounted value of investments	65.068				
15	Net Present Value (NPV), UAH thousand	43535.024				
16	Payback period - First year	11501.252				

* - The rationale for choosing the discount rate based on bank deposit rates for legal entities in Dnipro City as at 01.01.2021 is average deposit rate of following deposit rates of banks: deposit "Reliable fixed-term" of the Bank "Credit Dnipro" is 17%, deposit "Deposit line" of the Bank "Universal bank" is 18%, deposit "Deposit line" of the Bank "Radabank" is 17%, deposit "Fixed-term" of the Bank "MTB Bank" is 16%, deposit "Classic" of the Bank "Bank Vostok" is 16%. As a result, average deposit rate is 16,8%

Source: The authors' calculation

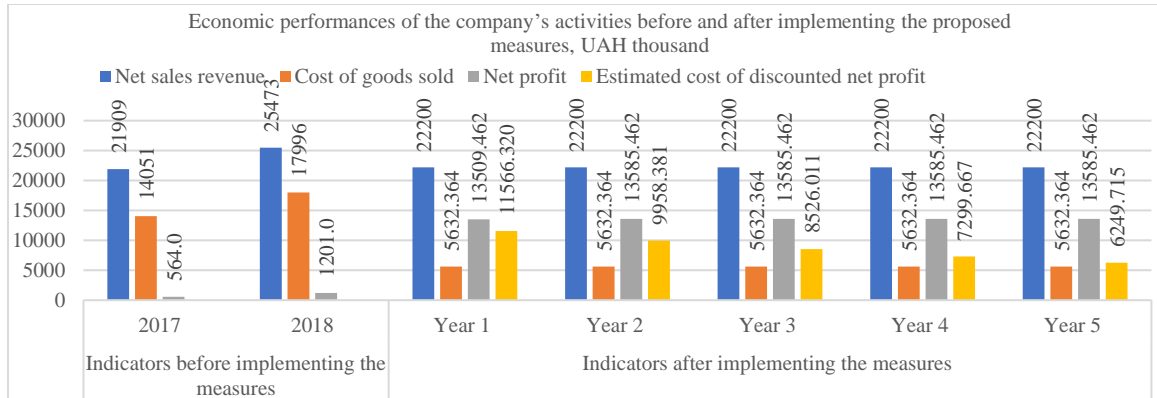


Figure 1. Economic performances of the company's activities before and after implementing the proposed measures, UAH thousand (Net sales revenue, Cost of goods sold, Net profit and Estimated cost of discounted net profit).

Table 6. Calculation of the proportion of transportation costs in net sales revenue, %.

Indicator Name	Before implementing the measures		After implementing the measures				
	2019	2020	1	2	3	4	5
Transportation costs	3123	2695	5511.564	5511.564	5511.564	5511.564	5511.564
Net sales revenue	21909	25473	22200	22200	22200	22200	22200
Transportation costs in net sales revenue, %	14.25	10.58	24.83	24.83	24.83	24.83	24.83

Source: The authors' calculation

5. The Economic Performances of the Company's Activities Before and After Implementing

Further, it is necessary to calculate the utilization performance indicators of the main warehouse space. We use the following indicators, as they are appropriate to achieve the purpose of this work. This group of indicators may include: the utilization coefficient of the warehouse space; the average load-bearing capacity per 1 sq.m of usable space; and the load intensity. The utilization coefficient of the warehouse space K_f represents the ratio of loading (usable) space to the total warehouse space:

$$K_f = \frac{F_k}{F_t} \tag{1}$$

The average load-bearing capacity per 1 sq. m of usable space shows what amount of cargo is simultaneously located on each square meter of the usable warehouse space:

$$\delta = \frac{Z_{max}}{F} \tag{2}$$

where δ – the load-bearing capacity per 1 sq.m of usable space, tons/sq.m; Z_{max} – the amount of the one-time stored cargo, or the maximum stock of materials stored at the warehouse, tons; F – the area occupied by the cargo stored (stacks, racks), m^2 .

The load intensity per 1 sq.m of the total warehouse space, M , during a year is determined by:

$$M = \frac{Q_f}{F_t} \quad (3)$$

where Q_f — the annual warehouse cargo-turnover, tons.

The load intensity coefficient makes it possible to compare the use of warehouse facilities and their discharge capacity for the period considered. The final calculations are made in Table 7.

Table 7. Utilization performance indicators of the main warehouse space.

Indicator Name	Before taking measures		After taking measures, forecast years				
	2019	2020	1	2	3	4	5
Total warehouse space, sq.m	750	750	750	750	750	750	750
Usable warehouse space, sq.m	550	550	550	550	550	550	550
Utilization coefficient of the warehouse space	0.73	0.73	0.73	0.73	0.73	0.73	0.73
Annual warehouse cargo-turnover, tons	475	527	17944.7	17944.7	17944.7	17944.7	17944.7
Average load-bearing capacity per 1 sq.m of usable area, tons/sq.m	0.864	0.958	32.63	32.63	32.63	32.63	32.63
Load intensity per 1 sq.m of the total warehouse space, tons/sq.m	0.63	0.70	23.93	23.93	23.93	23.93	23.93

Source: The authors' calculation

When calculating transportation costs as percentage, the share of the transport component increases in net income from scrap paper realized in the future, which shows that after the proposed measures, the efficiency of the logistics system decreases. But, this again testifies to the fact that implementing “green logistics” at the enterprise is rather of social nature than of economic one, despite the fact that net income is growing. However, in using the performance indicators of the warehouse operation estimate, it can be seen that, nevertheless, the developed logistics system is more efficient than that existing at the enterprise. The implementation of the proposed methodical approaches and practical recommendations, the utilization performance indicators of the warehouse have dramatically increased by almost 2.83 times. The proposed measures as a whole have the great economic, social and environmental effects (Table 8).

Table 8. Qualitative assessment of the effectiveness from implementing the principles of “green logistics”.

Effects of implementing the principles of “green logistics” at the enterprise		
Economic effect	Social effect	Environmental effect
<ul style="list-style-type: none"> • GRP growth in absolute terms and per capita as a result of the development of environmental services in the field of MSW treatment; • increase in income of regional and local budgets through income taxes, and assets involved in new waste sorting and recycling operations; • introduction of low-waste technologies and saving of resources; • vacation of lands from waste disposal facilities for the development of agriculture and recreation; • generation of electricity and heat through the use of alternative energy sources. 	<ul style="list-style-type: none"> • creating new jobsites and reducing the level of unemployment; • urban and rural cleanup; • reducing the sickness level; • raising the population's awareness; • fostering a caring attitude towards nature; • creating jobsites in the field of MSW treatment. 	<ul style="list-style-type: none"> • prevention of pollution of the atmosphere, soil and groundwater; • biodiversity conservation and environmental protection; • reduction of greenhouse gas emissions, namely landfill gas; • saving of exhaustive energy resources and development of using alternative sources; • promoting formation of more environmentally sound image of cities and regions, especially in border areas.

Source: The authors' development

6. Conclusions and Future Prospects

The proposed measures are already paid off during the first year of their introducing and have a positive impact on the operation of the enterprise, as well as on the state of the environmental ecology. These measures can be introduced into the work of any enterprise that practices the appropriate type of activities (collecting, pressing and preparing cardboard and paper, as well as high-pressure plastic, for processing). The study offered methodological approaches and practical recommendations to improve the management system of the enterprise that collects garbage and makes preparations for garbage cardboard and paper recycling. Such system is based on the principles of “green logistics”, taking into account the competitive environment on Ukrainian market. The effectiveness of the proposed system for the enterprise management based on the principles of “green logistics” has been proven.

In the future, “green logistics” will no longer be considered as a separate process, but will become a vital component of integration and coordination of environmental, social and economic aspects within the regional logistics system for environmentally oriented logistics management of the region. It also requires further research to improve the activities of the enterprises in the field of processing and sorting, not only through private investment, but also through public funding, as the number of waste processing enterprises does not correspond to the required number.

Abbreviations

MSW= Municipal Solid Waste
EU= European Union
LLC= Limited Liability Company
UAH= Ukrainian Hryvnia

Conflict of Interest

The authors confirm that there is no conflict of interest to declare for this publication.

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