Waste Recycling as a Starting Point
Economic Growth of Russia

L Filimonova¹, E Matys¹, N Skvortsova²
¹PhD in Economics, Associate Professor of the Department of construction management, housing and community services, Industrial University of Tyumen, 2, Lunacharskiy Str., Tyumen, 625000, Russia
²Doctor of economics, professor of the chair of economics in construction, Industrial University of Tyumen, 2, Lunacharskiy Str., Tyumen, 625000, Russia

E-mail: Filimonovala@tyuiu.ru

Abstract. The food program of the Russian Federation contributed to the widespread launch of poultry enterprises, due to which at the present stage the food market is fully provided with poultry products of Russian manufacturers. But, there have been and remain problems with the processing of poultry manure, as a result of which poultry enterprises incur losses in the form of fines for unauthorized storage of poultry waste on land plots not intended for this. Besides the economic threat, chicken droppings are also an environmental threat. The authors of the article formulated the primary measures to solve the listed problems. The principal distinctive feature of the work is the investigated schemes of utilization and processing of organic waste according to the experience of foreign and domestic practitioners. These iterations make it possible to explain the choice of a management decision by the management of the poultry farm in response to the corresponding challenge of the external environment: low value of added value in the production of main types of products; fines for unauthorized storage of waste; reputational local risks of the company associated with production factors of impact on the environment and others. Among such measures, the authors include recycling of poultry waste (chicken droppings) with justification of options for processing and disposal of waste. The alternative approach allows timely flexible response to emerging challenges of the internal and external environment and deterioration of key indicators of business activity of an enterprise - a taxpayer in the region.

1. Introduction
This analytical study is aimed at substantiating the need for recycling (processing) of poultry waste in the formation of a comfortable environment in the territories adjacent to poultry enterprises. The principles of a comfortable living environment are based on the principles of technospheric safety. The authors of the article emphasize the priority directions in the management of the investment portfolio on the basis of operating narrowly specific enterprises. The vector of the declared directions is aimed at increasing the business activity of such enterprises with high technosphere risks due to the modernization of production and diversification of the production program. When preparing this publication, the authors of the article studied domestic and foreign experience in processing poultry waste; the legal framework governing the operational stage of the project for the processing of poultry waste has been systematized; a business plan and design estimates for the construction of a plant for
processing poultry biowaste have been developed according to the following sources [1-12]. The results of the work done by the authors of the article correspond to the positions of the "Concept of long-term socio-economic development of the Tyumen region until 2020 and for the future until 2030"[13]. The package of investment documentation developed by the authors of the article allows potential investors to answer key questions. The authors of the article have worked out the conditions under which the investment portfolio will provide: increasing the competitiveness of products of the agro-industrial complex; sustainable development of rural areas; employment and improving the standard of living of the rural population; conservation and reproduction of natural resources (recycling); increasing the productivity of the main types of agricultural crops, poultry productivity; increasing the levels of consumption of the main types of agricultural products and food, their availability and environmental safety for the population; improvement of working conditions and employment of the rural population; increasing the role of management factors, informatization and science in the sustainable development of the territory.

2. Literature review
The theoretical and methodological basis of this study was the fundamental and applied scientific works of domestic and foreign authors [7, 11, 13-14] in the field of ecology, technosphere safety, investment theory and statistics. To substantiate the research results, elements of resource and system approaches, planning and budgeting methods, economic and mathematical modeling and statistical methods were used. Summing up the results of the study of theoretical and practical material on the available printed and electronic resources, we can conclude that it is advisable to conduct appropriate research in the field of finding a comprehensive solution to the problems of creating a comfortable environment in the territories adjacent to poultry enterprises.

Figure 1. Shows the main requirements for the feedstock and recycled products of poultry waste.

| Raw materials                                         | Product of production activity                        |
|--------------------------------------------------------|-------------------------------------------------------|
| Chicken droppings                                      | Biohumus                                              |
| GOST 31461-2012                                        | GOST R 56004-2014                                     |
| Poultry litter. Raw materials for the production of    | Organic fertilizers.                                  |
| organic fertilizers. Specifications                     | Vermicompost.                                        |
|                                                        | Specifications                                        |
| GOST 33830-2016                                        | GOST R 53790-2010                                     |
| Organic fertilizers based on animal waste. Specifications| Non-traditional technologies. Energy of biowaste.    |
|                                                        | Terms and definitions                                 |
|                                                        | Veterinary and sanitary norms and requirements        |
|                                                        | for the quality of feed for unproductive animals.     |
|                                                        | Norms and requirements                                |
| GOST 33830-2016                                        | GOST 33830-2011                                      |
| Organic fertilizers based on animal waste. Specifications| Industrial buildings. Updated edition of SNiP 31-03-2001 (with Amendments N 1, 2) |

In domestic and foreign specialized literature, sufficient attention is paid to the issues of a systematic approach to determining the level of technosphere safety of a territory, which is emphasized by the high level of publication activity of this block of bibliographic citation bases. The high level of discussion activity around the raised problem is aggravated by the problem of choosing a method for solving this problem. All market participants strive to minimize operating and investment costs in traditional markets and especially when entering new territories. Most of the authors -
theorists agree on the need for a comprehensive solution to the problems of creating a comfortable environment in the region where businesses operate with high technospheric risks. According to the Concept of long-term socio-economic development of the Tyumen region until 2020 and in the long term until 2030, the main goal of the policy in the field of rational use of natural resources and ecology is to improve the quality of the natural environment and the ecological conditions of human life.

The launch of recycling in the processing of poultry waste, corresponding to [12], will contribute to the achievement of the set goal [11], solving the following main tasks: reducing the negative impact of economic activities on the environment; provision of authorized waste disposal and recycling; ensuring the treatment of municipal wastewater in settlements; preservation of biological and landscape diversity (reduction of the territories where chicken manure is stored).

3. Results of approbation

The basis for the development of a design solution for the launch of recycling of poultry waste was the information that the Borovskaya Poultry Farm has problems with the processing of chicken manure, as a result of which the enterprise incurs losses in the form of fines for unauthorized storage of waste on land plots not intended for this [16,17]. Besides the economic threat, chicken droppings are also an environmental threat. With the entry into force of the Federal Law of 21.07.2014 No. 219-FL "On Amendments to the Federal Law" On Environmental Protection "at such large enterprises as" Borovskaya poultry farm "without taking measures. aimed at solving the problems of recycling and disposal of waste, losses will only grow. And due to the fact that the poultry farm is undergoing large-scale modernization and increasing production, this problem described above will only get worse.

In addition to the negative impact on the production process and on the profit of poultry farms, a large amount of poultry manure, if properly processed, can be profitable. The construction of a plant for processing poultry manure will not only help poultry farms, in particular the Borovskaya poultry farm, to solve the environmental problem and prevent the imposition of fines, but also bring additional profit. After all, from poultry manure it is possible to obtain alternative energy sources - heat, biogas, and mineral fertilizer - vermicompost. One of the most common and most effective modern energy and resource-saving methods for processing organic waste is the technology of their anaerobic digestion in digesters (reactors) or anaerobic columns to produce biogas. Partially the energy obtained as a result of biogas processing is used to maintain the process (up to 15–20% in winter). Bacteria convert biomass into methane at temperatures above 25 C [7].

The biogas production method is based on the intensive decomposition of organic matter using special coenzymes and conditions. Liquid and solid fractions of chicken manure are fed into the reactor, where they are fermented and mixed. At the exit, a substrate disinfected from helminths is obtained for further processing into fertilizer and biogas. This technology for processing poultry manure provides for several stages: transportation of manure to the processing site, purification of raw materials from large inorganic particles, grinding and homogenization of the material, preparation of incoming raw materials in terms of humidity and temperature, raw materials entering the digester, then anaerobic digestion will be carried out, purification of the produced biogas from impurities (moisture, carbon dioxide), transportation of biogas to consumers, if necessary - its storage in a special tank (gas holder), subsequent processing of the substrate formed after anaerobic fermentation using vermicultivation.

Vermicultivation is a method of producing vermicompost by processing organic waste, in particular chicken droppings with an earthworm. The resulting organic fertilizer is biologically active and environmentally friendly, as it is based on the natural process of organic processing. Unlike the simple and most common fertilizer - manure, soil microflora is more present in biohumus, which is necessary to reduce the number of harmful soil microorganisms and to accelerate the development of plant root systems. The need to use vermicompost at the initial stages of plant development is due to the ability of this mineral fertilizer to structure the soil and retain moisture. Also, the advantage of using vermicompost is a much smaller amount required for fertilizing the soil, it is about 10-15 times lower than that of manure, but at the same time the effectiveness of the action of micronutrients is 3-4
times longer. The increase in the yield of agricultural crops when using vermicompost is on average 20-50%. From one ton of chicken manure with the help of the Prospector's worm, an average of half a ton of vermicompost is produced. It can be implemented both for private farms and for large agricultural enterprises engaged in sowing grain crops, growing vegetables, etc. as a complex fertilizer. It is proved that the use of biohumus increases the productivity of agricultural crops and can be the basis for "green farming".

Due to the fact that from 01.01.2020 the Federal Law "On organic products and on amendments to certain legislative acts of the Russian Federation" dated 03.08.2018 No. 280 comes into force, producers of agricultural products, raw materials and food will be more focused on organic fertilizers. The essence of the law is that certain requirements must be met in the production of organic products. In particular, this is the isolation of production, bans on the use of mineral fertilizers, chemical treatment against pests (except for those permitted by the standards in the production of organic products), methods of genetic engineering, hydroponics, on the use of PVC for packaging, consumer and transport containers. Confirmation of the conformity of organic production in the form of voluntary certification will be required. Then it will be possible to mark it accordingly. Special product labeling will attract the end consumers of the product. A Unified State Register of Organic Producers will be formed.

Organic products are organic agricultural products, raw materials and food. An exception will be considered perfumery and cosmetic products, medicines, seeds of forest plants, hunting products, fish products (except for aquaculture products).

The main product of recycling poultry waste - chicken manure, will be organic fertilizer - vermicompost. Vermicompost (vermicompost) is a high molecular weight organic compound that includes a cyclic structure and aliphatic chains resulting from the processing of organic substances by worms (manure, straw, leaves, remains of silage, hay, food waste, fruit and vegetable industry, utilities, poultry droppings) and isolated into the environment from the alimentary tract of worms [9]. The use of this organic fertilizer has a beneficial effect on the productivity of cultivated plants. An additional product will be the mass of the worm processed into a feed additive. After preliminary preparation, the biomass of the worm is used as feed for cattle, pigs, poultry, pond fish, and fur animals in the amount necessary to meet the requirements of animals for protein. As a result of field studies, the authors of the article confirmed the hypothesis of an increase in the digestibility of compound feed, as a result of which an increase in the egg production of chickens was noted, animal meat significantly increases its quality, and the survival rate of young animals increases. The biomass of the worm is rich in amino acids, including lysine and melonin, many enzymes, vitamins and trace elements.

As an experiment to get acquainted with the life of the Prospector worm, one family was bought in October 2019 (Figure 2). The miners were packed together with the substrate (not fully recycled organic waste) in a perforated bag. In the "house" (a container with perforation and a lid), conditions were created for them as close as possible to industrial ones: humidity normal for the life of the worm; organic waste (potato peels, banana peels, apple cores). In the first 2 months, the conditions of existence were violated (low temperature, high humidity and an incorrect ratio of the constituent parts of the substrate) and part of the family died. With the elimination of errors in the conditions of detention, the number of working individuals was restored to the original number. At the moment, after 1.5 years, the experiment is successfully continuing, the livestock is growing, the number of "houses" has increased to 3. To create a full-cycle pilot plant, it is planned to launch a mini-tent using broiler chicken manure as a feedstock.

It is worth noting that this two-stage technology is suitable for processing waste not only from poultry farming, but also from other livestock complexes, since chicken manure is the most aggressive, and when processing it, we can say with confidence that any other organic waste of enterprises can be processed. It is also possible to recycle not only industrial organic waste, but also household waste after sorting.
Also, with anaerobic digestion, the inclusion of a digester (reactor) or an anaerobic column in the process of processing chicken manure, it will be possible to obtain another product of processing chicken manure - biogas. This technology has a number of advantages over traditional methods of composting and aerobic processing: during aerobic waste treatment, excess activated sludge is formed, into which up to 50% of the total energy of the original organic matter is transferred, while in anaerobic processes up to 90-95% of the total energy of the substrate is accumulated in the form of biogas (methane), which makes it an energy carrier suitable for use in generating electricity and heat. The methane released in the bioreactor can operate a boiler house in winter, and an engine with a generator can also work, which will generate electricity needed by the poultry farm. The same methane can be used to refuel cars and tractors equipped with gas equipment. When a digester is included in the process of processing poultry manure, the problem of environmental protection is solved - contamination of air, soil and water masses with pathogenic and opportunistic pathogens is prevented.

Based on the research data, it can be concluded that the location of a plant for processing poultry manure is possible only on the territories of Industrial Parks: there is a possibility of buying out the leased land plot; it is permissible to locate enterprises, structures and other objects of hazard class III; IV; V (according to [8] FKKO code 11271101333 fresh chicken droppings - III class - Moderately hazardous waste. Violate the environment, but recovery lasts about 10 years); availability of communal resources (electric power, gas, water supply and sewerage).

4. Conclusion

The agro-industrial complex of the Tyumen Region is one of the largest producers of agricultural products in the Urals Federal District. Agriculture is one of the priority areas in the development of the economy of the Tyumen region, in this regard, the governor of the Tyumen region, Alexander Moor, declared 2020 the year of rural entrepreneurship. The launch of a design solution for the processing of poultry waste will solve the following priority tasks for the Tyumen region:

- improvement of the ecological situation, due to the introduction of a new mechanism for processing waste of the III hazard class (bird droppings), without storage on open land plots. Thanks to the introduction of secondary processing of poultry manure, contamination of air, soil and water masses with pathogenic and opportunistic pathogens will be prevented;
- increasing the economic efficiency of the poultry farm through the introduction of waste recycling and diversification of the production process;
- the appearance on the market of an affordable environmentally friendly organic fertilizer - vermicompost, the use of which is much more effective in solving problems of increasing crop yields than manure - a more common fertilizer.

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