ISSN: 2790-5306 (Print), 2790-5314 (Online)
IRAQI JOURNAL OF AGRICULTURAL RESEARCH - Ministry of Agriculture
Available online at: www.ijarmoa.gov.iq
VOL. 29 NO. (2) 2025
IJAR
IRAQI JOURNAL OF AGRICULTURAL RESEARCH

STUDYING THE ASSESSMENT OF THE ENVIRONMENTAL IMPACT OF THE TABLE EGG PRODUCTION PROJECT IN NINEVEH GOVERNORATE*

Rahma Taher Mahmoud Al-Ahmad[1]
:Rahma.22agp84@student.uomosul.edu.iq

Iman Younis Mahmoud Al-Najjar[1]
Eman.younis75@uomosul.edu.iq

ABSTRACT

The number of large-scale poultry and livestock projects that rely on intensive breeding methods has grown significantly. These projects generate various types of waste and unwanted by-products, such as chicken manure, wastewater from cleaning and purification processes, and dead poultry. If not properly managed, these by-products can become serious sources of environmental pollution. Therefore, it is essential to conduct environmental impact assessments prior to implementing such projects. These studies are now a key requirement for investment projects across various sectors, as they help evaluate potential environmental effects in advance and recommend appropriate measures to reduce negative impacts. This ensures both environmental protection and the success of the projects. In this context, the environmental impact of a table egg production project was examined by identifying the main operational characteristics and potential sources of pollution at each stage. Field analysis was carried out to assess the project's environmental effects, and a solid waste treatment unit was proposed to process chicken manure. The study concluded with several recommendations, including the adoption of methods to reduce environmental harm by utilizing waste treatment systems, and turning waste into resources to protect and sustain natural ecosystems**.**

Keywords: table eggs, methane gas, poultry waste, environmental pollution.

INTRODUCTION

The environmental assessment process is considered an important tool of the integrated environmental management tools and the optimal use of available resources to ensure sustainable economic development, to meet the current needs and at the

* A part of M.Sc. thesis for the first author.

[1] College of Agricultural, University of Mosul, Nineveh, Iraq.

- **Received:** May 20, 2025.
- **Accepted**: May 28, 2025.
- **Available online**: December 30, 2025.

same time, protecting the environment for future generations. The development of livestock production projects, including poultry industry projects, has become one of the projects with a negative environmental impact due to the harmful waste generated due to their production activities because the wastes are a serious threat to the public health. Therefore, the environmental evaluation is considered as one of the vital tools used for the environmental evaluation of these projects to preserve the natural resources and public health although economic development is tightly related with the concept of the environment, due to the high costs the state incur in terms of the mistaken use of the environment and the absence of awareness for the investment decision makers and this represents a burden on the state economy. The objective of this study is to evaluate the environmental impact of a table egg production project by identifying pollution sources throughout all stages of the project. It aims to assess the effects on both economic and social aspects and determine the appropriate measures to mitigate negative impacts.

Poultry farming is an economic activity that significantly affects the environment due to the waste it generates, which contributes to global environmental issues such as climate change and global warming. The main problem addressed in this research is that table egg production produces waste such as carbon dioxide and methane emissions, water and soil contaminants, and solid waste like eggshells—that can have serious environmental consequences if not properly managed. Poor waste management that neglects environmental considerations can lead to major environmental damage. This study is important because evaluating the environmental impact of egg production projects is essential to support sustainable development, reduce environmental hazards, and enhance the efficiency of resource use. It also contributes to promoting sustainable agricultural practices and protecting the environment for future generations, This research is based on the central hypothesis that a comprehensive evaluation of the environmental impact of table egg production projects, accompanied by the implementation of appropriate environmental measures to reduce waste and emissions, will contribute to minimizing potential environmental harm and enhancing the environmental, social, and economic dimensions of sustainability, thereby supporting the achievement of sustainable development.

MATERIALS AND METHODOLOGY

Steps of evaluating the project's environmental impact

The project evaluation study is performed in a way that reflects the reality of the project through several major steps, which are:

1- Studying the location of the project.
2- The virtual age of the project.
3- The possibility of dividing the potential impacts of the project.
4- The environmental classification of the project.
5- The description of the project area.

In this project the wastes of poultry and the solid and liquid wastes resulting from the operation of the project will be collected and taken to the chicken dung processing unit to produce the methane gas and the high quality bio fertilizer and liquid fertilizer that will be used as fertilizer in agriculture.

Image 1: The aerial photograph of the proposed project location for table eggs production, AL-Hamdaneyyah District, Nineveh Governorate.

Description of the project, the nature of its operation and the production capacity:

A brief about the project

*** Location of the project**

The proposed project is located in Nineveh Governorate, AL–Hamdaneyyah District, to the southeast of Nineveh at the highway of Al–Hamdaneyyah-Nimrud, 19 kilometers from Mosul. The project is located 6 kilometers to the East of Tigris River and 5 kilometers from AL-Hamdaneyyah District. The land of the project is far away from the residential compound and there are no fisheries in the area. The Map in image (1) illustrates the geographical location of the project.

Land of the project (Determining the size of the project)

The proposed project will be constructed on a land with an area of (96) donums in accordance with the size of the virtual production of table eggs in Nineveh Governorate.

Twenty-two (22) donums of the land were allocated to the management building, services and facilities of the project including the hatching halls, closed breeding and production halls of the hatching chickens, water tanks, dung management unit that includes the anaerobic digestion system that process the wastes that produces methane gas, biofertilizer, liquid fertilizer in addition to the hall of drying the biological fertilizer to obtain high quality solid fertilizer that is used in agriculture as an organic fertilizer. The wastes from chickens are collected from the breeding and production halls to be processed using aerobic fermentation, which is a suitable method for producing high quantities, which assists in evaluating the potential environmental impact of the project and certain steps to mitigate any damage.

* The nature of the activity and the production capacity.
* The production plan of the project.
* Evaluating the environmental impact of the project

In light of studying the evaluation of the environmental impact of the proposed project, it is necessary to identify the distinguishing features of the project through several considerations, which are:

*** The field analysis of the environmental impacts related to the construction of the table eggs production project**

To conduct the evaluation of the environmental impact of the project, this emands identifying the potential negative environmental impact of the project and analyzing the impacts on the air, surface water and groundwater qualities in addition to the animal and plant environment, the residential compounds and the means used to mitigate these potential effects of the project.

Amongst the undesired environmental impacts resulting from the livestock projects are the pollution of air, water and soil, noise and temperature [7] in addition to the bad odors, carbon dioxide and methane gases emission when processing the animal wastes.

There are also, potential disadvantages of the project that result from several types of wastes that are produced when operating the project, including:

1- Organic wastes: They are represented by the chicken dung, which is rich in protein.

- Feathers, which can be used in the manufacturing of fertilizers or fodder after processing.
- Corpse of the dead chicken.
- Waste water used for cleaning the halls and production tools and equipment.
- The remains of the dropped unconsumed fodder.
- Broken eggs unsuitable for human consumption.
- The shell of eggs after hatching.

2- Inorganic wastes (the wastes of operations), which are:

* Carboards of packing and packaging.

* The damaged breeding cages.

3- Noise and vibrations: This type of projects doesn't produce a significant impact in terms of noise.

So, these wastes can have a great deal of negative environmental impacts, most prominent of which are: the emission of odors and gases represented by carbon dioxide, methane, ammonia and Nitron oxide that have an effect on the climatic changes represented by the global warming phenomenon in addition to the odors coming from the waste of the chickens and the fodder[8].

4- The huge quantities of water consumed for drinking and cleaning and this represents a challenge to the water resources in the area of the project.

5- The pollution of the groundwater due to the leaking of the liquid wastes and they also lead to the decrease of soil fertility.

6- Using the materials for packing and packaging leads to the accumulation of the solid waste.

The comprehensive analysis of the most prominent negative environmental effects when the project is operational:

From studying the stage of table eggs production of this project, many wastes result and there are three stages according to the stages of eggs production [4], which are:

1- First stage (the hatching stage): This stage has the wastes of the hatchery that negatively affect the environment if they are not dealt with correctly. It includes:

- One-day old male chicks
- The carboard used for packing and packaging.
- Damaged and unfertile and broken eggs.

- Undeveloped dead embryos.
- The shells of eggs after hatching.

2- The second stage (breeding stage): The period of breeding from 1 day age to 17 weeks, and in this stage, wastes are produced due to the breeding of the poultry in the halls, and these wastes can be categorized as follows:

***** Dung (Droppings), which is considered one of the organic wastes and it represents the biggest part of the waste. The wastes resulting from the breeding stage are estimated at 1175 tons/month.

***** Dead birds, with a percentage of (2%) of the chicks (364114 chicks per batch) throughout the period of age from one day to seventeen weeks.

2- The third stage (Production stage): The waste of chickens in the stage of production is from the age of 18 weeks to the age of 100 weeks, and it includes a set of wastes that result from the breeding of hatching chickens during their production lifecycle and can be classified into types that are:

* Dung (droppings) of the chickens: It is the most prominent waste in the projects of poultry, and the waste in this stage is estimated to be (1353 ton/month).

*Wastes that result from the dead birds with a death rate of (8%) during the production stage.

Processing the solid, liquid wastes and odor and gases resulting from the project

1- Processing the chicken dung to get the methane gas (biogas) through anaerobic digestion and this is performed in closed that are void of oxygen through the fermentation, the anaerobic bacteria transform the biomaterial into a biogas that contains the methane and carbon dioxide[5]. This leads to decreasing the gases emitted and saves energy because the methane is used to generate electricity or can be used as a gas for cooking. This operation is repeated as a sustainable solution derived from the chicken dung that is biologically decomposed. So, it can be transformed from a problem to the environment into an important economic resource in addition to getting rid of odors, protection against diseases and improvement of the quality[1].

The hatching chicken dung in the proposed project results from the breeding the production stages in the waste processing unit to produce the methane gas and the solid and liquid fertilizers. The period of the production cycle is 25 days, i.e. with an average of 12 cycles per a year. So, 50548 kg of methane is produced in the breeding stage and the solid biofertilizer is produced throughout the breeding stage is 470 tons. As for the production stage, 53400 kg of methane is produced and the quantity of the biofertilizer produced during the breeding stage was 470000 liters and 340000 liters during the stages of breeding and production respectively.

The dung processing began by collecting the solid wastes from the chicken hutches and then they are transferred to the waste store to be processed at the processing unit to obtain the biogas (the methane), bio fertilizer and the liquid fertilizer.

2- Processing the wastes and the odor emitted from the chicken hutches due to the processes of digestion and the odors from the dung and it is got rid of it through cleaning the ground of the halls periodically to ensure that no accumulation can take place and also filters are applied to the exhaust fans.

3- Processing the liquid wastes resulting from the hatching of chickens like the dung and the cleaning materials. Liquid wastes might also include the antibiotics used to treat the birds and that is performed by blocking the discharge of these wastes into the natural channels or water pools and the groundwater wells. The ground of the halls should be dry-cleaned before washing it with water and antiseptics to limit the

reproduction of germs and the spread of odors and then the water of washing is discharged into a ground reservoir with a tightly-sealed cover to prevent the emission of odors [9].

4- Processing the wastes of chickens (feathers, broken eggs, wings of dead chickens, infertile eggs and egg shells after hatching and moving them to other places and centers to be used for manufacturing concentrated proteins or organic fertilizers instead of casting them away [6].

5- The wastes of the packing and packaging cardboard materials are processed by sending them to be recycled and the number of packets resulting from the hatching for each batch is 2326 packets.

6- Dealing with the noise pollution resulting from the operation of power generators that are considered one of the environmental pollution sources and that is done through installing these generators in a special room that is equipped with a silencer. Also, the machines should be equipped with an insulating material and the walls of the generators room should be designed in a practical way that insulate the noise.

Methodology and Data Surces

The researcher used the descriptive and quantitative methods in addition to the feasibility study of processing the organic wastes of the chicken dung in the two stages of breeding and production. The research data was obtained from the questionnaire and the field visits of the similar projects that use the same processing of the wastes that are represented by the dung. The most important standards used in this research to study the feasibility of the project and to measure the economic impact are:

1- Net Present Value

It represents the net value of cash flows of the project and it stands for the difference between the present value of the cash flows that will be achieved during the project lifespan and the cost of investment in the beginning of the project age. The net present value is determined by subtracting the present value of the external cash flows from the present value of the internal cash flows and it is expressed as follows [3]:

$$NAV = B_n - C_n = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+r)^n}$$

That means that: NPV = the present value of the total benefits – the present value of the total costs.

This standard is used for the differentiation between the projects.

2- Profitability index standard B/C

The profitability index is defined as the standard that is sometimes called the average return/cost, i.e., the present value of the incoming cash flows on the outgoing cash flows. The present value of the incoming cash flows is calculated by the same method of the net present value, whether these flows were equal or not and the project is approved only if the result was more than integer one [2].

3- Internal Return Rate

The internal return rate is known as the average discount that makes the net present values of the project equals zero. It is also defined as the price of the discount at which the value of the incoming cash flows (benefits) is equal to the outgoing cash flows (costs). The investment project is approved when the internal return is larger

than the cost. The following equation can be applied to obtain the average internal return as follows [10]:

$$IRR = r_1 + \left[(r_2 - r_1) * \left(\frac{NAV_1}{(NAV_1) + (NAV_2)}\right)\right]$$

RESULTS AND DISCUSSION

The financial analysis of the environmental impact

The financial analysis targets the negative impact of the project of table eggs production on the environment and identifying the return it accomplishes from the return of the chicken wastes based on the dominant prices in the market for the year 2025 with the costs of the wastes and these costs involve the processing unit as shown in table (1) and then conducting the financial analysis of the project using the temporal preference standards at the discount price of (15%).

Table 1: Data of the financial analysis of the environmental impact at the discount prices 15% and 20%

data / year	Total costs (Iraqi Dinars)	Current value of the total costs with the discount price (15%)	Current value of the total costs with the discount price (20%)	Total profits (Iraqi Dinars)	Current value of the total profits with the discount price (15%)	Current value of the total profits with the discount price (20%)
2026	1,495,237,000	1,299,360,953	1,245,532,421		-	-
2027	564,143,000	426,492,108	391,515,242	3,000,005,000	2,268,003,780	2,082,003,470
2028	860,513,000	565,357,041	497,376,514	4,394,415,000	2,887,130,655	2,539,971,870
2029	711,288,000	406,145,448	342,840,816	3,351,768,000	1,913,859,528	1,615,552,176
2030	860,512,000	427,674,464	345,065,312	4,394,415,000	2,184,024,255	1,762,160,415
2031	790,013,000	341,285,616	264,654,355	3,904,901,000	1,686,917,232	1,308,141,835
2032	781,788,000	293,170,500	218,900,640	3,843,442,000	1,441,290,750	1,076,163,760
2033	860,513,000	279,666,725	199,639,016	4,394,415,000	1,428,184,875	1,019,504,280
2034	719,513,000	204,341,692	138,866,009	3,413,227,000	969,356,468	658,752,811
2035	852,288,000	210,515,136	989,506,368	4,089,279,000	1,010,051,913	4,747,652,919
2036	860,513,000	184,149,782	115,308,742	4,394,415,000	940,404,810	588,851,610
2037	711,288,000	132,299,568	79,664,256	3,351,768,000	623,428,848	375,398,016
2038	860,513,000	139,403,106	80,027,709	4,394,415,000	711,895,230	408,680,595
2039	719,513,000	101,451,333	56,122,014	4,150,738,000	585,254,058	323,757,564
2040	746,538,000	91,077,636	48,524,970	3,597,605,000	438,907,810	233,844,325
2041	1,060,152,016	113,436,266	57,248,209	2,234,512,000	239,092,784	120,663,648
Total	13,454,325,016	5,215,827,374	5,070,792,593	56,909,320,000	19,327,802,996	18,861,099,294

Source: Prepared by the researcher.

The net present value (NPV)

1- The net present value at the discount price (15%) was (14,111,975,622) Iraqi Dinars. From the result of the financial analysis of the environmental impact it was clear that the project achieves a positive financial value, i.e., the project is profitable at the discount price of (15%).

2- Ration of the profit to the cost

In the financial analysis of the environmental impact, it was evident that the B/C ratio was (3.7) Iraqi Dinars at the discount price (15%) and thus a financial profitability is achieved for the production life of the project.

4- Internal return rate IRR

The financial analysis of the project showed that the internal return rate was (17.53%) at the discount prices 15% and 20% and this shows that the project has a benefit value of (7.53%) and this means that the project is capable of protecting the environment and covering all the costs of the processing unit and also achieve a financial profitability.

Conclusions

1- Through conducting the cost analysis and return, i.e., what is related to the project waste processing unit and the negative impacts of the project on the environment, which is a method to evaluate the environmental impacts, comparing the costs of the project including the costs of the processing unit that processes the chicken dung and the advantages of this unit.

2- From the analysis results, it is evident that the project is capable of tackiling the negative impacts on the environment to increase the advantages throughout the lifespan of the project.

3- Through the environmental impact of the proposed project and the methods used to mitigate the expected negative impacts, the project was classified within the grey list as it is capable of dealing with the negative impacts with investment costs that are less than the predicted returns to protect the environment from such impacts.

4- The proposed project is considered one of the projects that contribute to achieving certain purposes of sustainable development and consolidating sustainable agriculture addition to the necessity to take the suitable actions to confront the climate change and its consequences (the global warming).

Recommendations

1- One of the key components in evaluating the environmental impacts of the project is conducting a cost-benefit analysis that incorporates environmental considerations, in order to ensure a comprehensive assessment of the project's sustainability and long-term viability.

2- It is necessary to process the wastes resulting from the table eggs production project to preserve the environment and not make use of the wastes economically to maximize the advantage and to create job opportunities to the individuals of the society.

3- Submitting the environmental impact report of the project to the Directorate of Environment, which clearly presents the study conducted to evaluate the environmental impacts of the proposed project. This report will support the decision-making process regarding approval, rejection, or the partial or complete

redesign of the project to reduce negative environmental impacts through the use of appropriate technologies.

3- Encouraging developmental projects that contribute to achieving sustainable development.

REFERENCES

1- 1A. M. King'ori, A (2011). Review of the Uses of Poultry Eggshells and Shell Membranes, International Journal of Poultry Science,10(11):908-912. https://www.researchgate.net/publication/279557572_A_Review_of_the_uses_of_poultry_eggshells_and_shell_membranes

2- Ayab B. M. (2003). Risk Analysis in Engineering and Economics, Chapmpan and Hall; CRC, Florida, USA.

3- Dofasco, R. (2004). Quantitative methods for Investment Analysis; CFA, Institate, USA.

4- Farmer, A. M. (1993). The effects of dust on vegetation review. Environmental Pollution Journal, 79(1):63-75 https://doi.org/10.101610269-7491(93)90179-R

5- Jurgutis, L.; A. Slepetiene; J. Volungevicius and K. Amaleviciute-Volunge (2020). Biogas Production From Chicken Manure at Different Organic Loading Rates in A Mesophilic Full Scale Anaerobic Digestion Plant. Biomass & Bioenergy, 141(105693),105693.

6- Kalbasi, A.; S. Mukhtar; S. E. Hawkins and B. W. Auvermann (2006). Design, Utilization, Biosecurity, Environmental and Economic Considerations of Carcass Composting. Compost Science & Utilization, 14(2):90–102.

7- Muhammad, Abu Al-Qasim Muhammad (2005). Environmental Management Systems, Assiut Journal of Environmental Studies, Issue No. 26

8- University of Maryland (2006). Broller Production and the Environment. College Park, MD, USA, College of Agriculture and Natural Resources, University of Maryland. https://doi.org/10.1021/ef500262m

9- Zhang, T.; Y. Yang; L. Liu; Y. Han; G. Ren and G. Yang (2014). Improved Biogas Production from Chicken Manure Anaerobic Digestion Using Cereal Residues as Co-Substrates. Energy & Fuels: An American Chemical Society Journal, 28(4):2490–2495. https://doi.org/10.1021/ef500262m

10 Joo, J. H. (2019). Yoon, H.H. A General Guideline for Economic Feasibility Analyses for Public Investment in Seoul; Seoul Institute: Seoul, Korea.

11- https://www.hyline.com, Hy- Line lactational Genetic company

ISSN: 2790-5306 (Print), 2790-5314(Online)
مجلة الزراعة العراقية البحثية - وزارة الزراعة
متاح على الانترنت: www.ijarmoa.gov.iq
مجلد29 العدد (2) 2025
IJAR
IRAQI JOURNAL OF AGRICULTURAL RESEARCH

دراسة تقييم الأثر البيئي لمشروع إنتاج بيض المائدة في محافظة نينوى*

رحمة طاهر محمود الاحمد[1] ايمان يونس محمود النجار[1]
Rahma.22agp84@student.uomosul.edu.iq Eman.younis75@uomosul.edu.iq
:

الملخص

شهدت مشاريع الدواجن والانتاج الحيواني الضخمة التي تعتمد على اساليب التربية المكثفة، ومن المعروف ان لهذه المشاريع مجموعة من النفايات والمخلفات غير المرغوبة، مثل روث الدجاج، ومياه التنظيف والمعالجة، وجثث الدواجن النافقة، والتي قد تمثل مصدراً كبيراً للتلوث البيئي في حال عدم إدارتها بشكل سليم. ولهذا السبب، أصبح من الضروري إجراء دراسات لتقويم الأثر البيئي قبل تنفيذ هذه المشاريع. وقد أدرجت دراسات تقويم الأثر البيئي ضمن المتطلبات الأساسي للمشاريع الاستثمارية في مختلف المجالات، بهدف تحليل الآثار البيئية المحتملة مسبقًا واتخاذ التدابير الوقائية اللازمة لتقليل الأضرار، وضمان حماية البيئة ومواردها، وتحقيق نجاح المشروع في الوقت نفسه. وفي هذا الإطار، تم تحليل الخصائص الرئيسة لمشروع إنتاج بيض المائدة لتحديد مصادر التلوث في مراحله كافة، واتخاذ الإجراءات المناسبة للتعامل مع الآثار البيئية السلبية والحد منها قدر الإمكان. وقد أُجري تحليل ميداني لتأثير المشروع في البيئة، وتم اقتراح وحدة لمعالجة النفايات الصلبة لمعالجة روث الدجاج. واختتمت الدراسة بعدد من التوصيات، من بينها ضرورة تحديد الوسائل الكفيلة بتقليل الأثر البيئي السلبي في المشروع، من خلال استخدام وحدة معالجة المخلفات، والاستفادة منها في الحفاظ على الموارد الطبيعية وتحقيق استدامتها.

الكلمات الدالة: بيض المائدة، غاز الميثان، مخلفات الدواجن، التلوث البيئي.

* جزء من رسالة ماجستير للباحث الأول.

[1] جامعة الموصل، كلية الزراعة والغابات، نينوى، العراق.

- **تاريخ تسلم البحث:** 20/ايار/ 2025.
- **تاريخ قبول البحث:** 28/ايار/2025.
- **متاح على الانترنت:** 30/كانون اول/2025.