# Environmental footing analysis as a tool for managing and sustaining economic resource development

# تحليل البصمة البيئية كأداة لإدارة واستدامة تنمية الموارد الاقتصادية

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**Abstract:**

The research aims to study the importance of natural ecosystems in modern thinking about sustainable strategic development appropriate and necessary to achieve the goals of sustainable development in the direction of formulating a clear environmental policy aimed at finding a vision that governs the path of developing resource use and optimizing its exploitation, and one of the most important conclusions is the existence of a direct relationship between the increase in the gross domestic product in Iraq during the period and the increase in carbon dioxide emissions, as the increase in output by 1% leads to an increase in these emissions by 1.22%, that is, by a greater percentage of the increase in output, which constitutes a clear danger to the environment, especially since the growth of the gross domestic product in Iraq depends largely on the production of crude oil

The most important recommendations are the development of environmental policies to reduce the regulatory burden on the economy and achieve the benefits of growth in terms of the general improvement of economic efficiency.

**Keywords**: environmental footprint, economic resource management, sustainability, Iraq .

**JEL Classification Codes : O1 , O18**

**ملخص:**

يهدف البحث الى دراسة اهمية الانظمة البيئية الطبيعية في التفكير الحديث حول التنمية المستدامة الاستراتيجية الملائمة والضرورية لتحقيق اهداف التنمية المستدامة باتجاه بلورة سياسة بيئية واضحة تهدف إلى ايجاد رؤية تحكم مسار تطوير استخدام الموارد واستغلالها بالشكل الأمثل، ومن أهم الاستنتاجات وجود علاقة طردية بين زيادة الناتج المحلي الإجمالي في العراق خلال المدة وزيادة انبعاثات غاز ثاني أوكسيد الكاربون اذ ان زيادة الناتج بنسبة 1% يؤدي الى زيادة هذه الانبعاثات بنسبة 1.22% أي بنسبة اكبر من زيادة الناتج مما يشكل خطراً واضحاً على البيئة خصوصاً ان نمو الناتج المحلي الإجمالي في العراق يعتمد وبشكل كبير على انتاج النفط الخام

أما أهم التوصيات فهي وضع سياسات بيئية من اجل تقليل العبء التنظيمي على الاقتصاد وتحقيق فوائد النمو من حيث التحسين العام للكفاءة الاقتصادية.

**الكلمات المفتاحية:** البصمة البيئية، إدارة الموارد الاقتصادية، الاستدامة، العراق.

**تصنيفات JEL** : **O1 , O18**

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**INTRODUCTION:**

The population is constantly increasing and this puts pressure on food and resources to sustain life, and thus this will lead to unconscious use of natural resources .From here it became necessary to know our environmental footprint to sustain our natural resources ،As human activities consume resources, produce waste, grow population, and increase global consumption Thus, measuring the ability of nature to meet these demands was a necessary necessity, and the environmental footprint appeared as one of the leading measures in the world for human demand on nature Environmental footprint accounting deals with whether the planet is sufficient to keep pace with the requirements of humanity, and the environmental footprint represents the productive area required to provide the renewable resources that humanity uses while absorbing its waste ،The productive area currently occupied by human infrastructure is also included, as the built land is not available for replenishment, and it now takes a year and six months to renew what we use per year. By measuring the population footprint - an individual, city, company, nation, or all of humanity - it is possible to assess human pressure on the planet to help manage human environmental assets more wisely and take personal and collective actions to support a world in which humanity lives within the boundaries of the Earth (Global Fingerprint Network, 2014)

- **Research problem:**

Q1: What are the philosophical and intellectual foundations of the concept of environmental footprint?

Q2: What effects can environmental pollution have on sustainable development?

Q3: Does carbon dioxide affect GDP, given that the relationship between them determines the relationship between economic resource management and environmental conservation?

- **Importance of research:**

The importance of research lies in the fact that it is the entrance to the management of natural ecosystems that includes the management of natural resources within ecological or natural obstacles in order to achieve social goals – economic for societies dependent on natural ecosystems. It is a holistic approach or method that covers the social, economic, and environmental characteristics of sustainability. The importance of research also includes measuring the relationship between CO2 and local products and establishing a principle for the conservation of the environment and the sustainable use and management of economic resources.

- **Research goals:**

The research aims to study the importance of natural ecosystems in modern thinking about sustainable strategic development appropriate and necessary to achieve sustainable development goals ،Therefore, one of the main objectives of this paper is to use the entrance to natural ecosystems in studying economic resource management and exploring the nature of the relationship between this new approach and sustainable development, which is a crucial entry point for achieving Sustainable development for human life and its continuity, and increased awareness of the need to rationalize the consumption of traditional energy sources in order to provide an opportunity for future generations to benefit from them, to find strong ways and strategies to transform into renewable energy economies.

- **Research methodology :**

The research adopted a descriptive approach (with the contents inductive and inferential) by dealing with tables and illustrations, leading to specific theoretical formulations, and in a standard manner.

**1- Ecological Foot Print**

It is an indicator to measure the impact of pressures on renewable resources and ecosystems because of human activities in the world or region (Production and Consumption). The average individual footprint increases as the pressures resulting from his activities increase, and the process of calculating the environmental footprint appeared in the early nineties as researchers at Columbia University began measuring the area of land required to supply the population with materials ،Based on geographically different consumption rates as well as measuring the area required to absorb their waste The emergence of this term was one of the results of the work of the Club of Rome, as at the same time that the Earth Summit was held in Priy Yu Deganero in 1992, an article on the environmental footprint and biological capacity of researcher William Ross was published with the researcher Matisse Wackernagel, where they released a book called Environmental Fingerprint and Reducing its Human Impact on Earth , The environmental footprint leads to the development and growth of mankind and pushes society to be fair in the distribution of resources, and achieving them will significantly reduce risks and environmental scarcity. (Muhammad, 2019, p. 276)

The concept is based on the fact that most environmental policies in the world have been concerned with working to reduce pollutant emissions from economic activities ،As for the environmental area, it means the area of the exploited land without causing final damage that cannot be fixed in its basic elements.

Thus, the concept of the environmental footprint is a summary of the total areas of land and water that each country has allocated to produce the consumed resources and at the same time the process of absorbing the waste resulting from the production process ،These areas that are included in the environmental footprint are divided into regions including: (Zarqoun, 2019, p. 208)

- arable land
- pasture

Forests

Oceans and Seas

The land covered in the different buildings

Land for plant growth

**1-1 Benefits of the environmental footprint**

Environmental footprint calculations reveal environmental risks and the balance between preserving and using natural resources and help to provide a framework as well as create the infrastructure necessary to assess ecosystem services ،Decision makers have used the amount of natural resources as a monitoring and evaluation mechanism (World, 2019, p. 22), and agriculture is the main theme of sustainability that contributes to one of the largest components of the population such as environmental footprint and biological capacity ، Population growth and the unsustainable use of natural resources put pressure on agricultural growth for these reasons. Countries recognize, understand, and interpret the environmental footprint in the context of sustainability, which is important for looking to the future

‹Therefore, environmental footprint assessment is a solution to sustainability problems. (Zarqoun, 2019, p. 25)

The footprint represents the biological potential of the Earth's biologically produced areas including ( forests, rangelands, farmlands and fisheries ) and can contribute to the absorption of much of the waste we produce, especially Carbon emissions.The biological capacity can be compared to the demand of humankind on the ground, and the environmental footprint includes the productive area required to provide the renewable resources that humanity uses and absorbs its waste ( Global Footprint Network, 2014 ).

The environmental footprint and biological capacity values are expressed in mutually exclusive units of the region needed to provide these ecosystem services annually, and sustainability means transferring and sustaining environmental quality to future generations by protecting nature and biodiversity without corruption in order to preserve diversity and productivity ( Galli 2013 ), and to carry out an analysis within this definition, that the demand for land sources has reached an unsustainable level since the mid-1970 Therefore, this trend cannot be maintained at the same pace, the matter will end with the available consumption rate sooner or later, either because of the conscious preference of people or because of natural deficiencies These facts have forced humans to find paths that enable them to live without destroying nature and without exceeding the limits of the ability to regenerate natural resources (World, 2019, p. 3). In order to stop the current unsustainable process on the ground, developing countries bear many responsibilities, which require renewing indicators of wealth, development, and success that are often determined by the national income of the individual in a manner that includes social and environmental factors The environmental footprint is one of the indicators such as the Human Development Index, Gini coefficient, and Living Planet Index ‹One of the most important problems that decision-makers must find an answer to is finding a way in which humans can live "within the limits of one world" while increasing the level of population and prosperity It requires an accurate description of the latter situation in order to stop the corruption of the natural environment and to create a better future compatible with nature. (World Wildlife Fund 2014)

The results of the environmental footprint in the service of humanity appear from providing justice in the use of natural and environmental resources, and this is important as an early warning of sustainability policies There are strategies for applying the environmental footprint to achieve sustainable development goals ‹including :

Involve public entities in the transformation process.

Diagnosing fingerprint in a specific sector contributes to making political decisions.

Promote integration of global ecological risks into economic transcendence.

To take a decision and develop impact assessments at the sector level to reduce the gap between awareness and implementation of solutions to bridge the gap to achieve sustainable development goals and align the human economy with the limited nature budget. (Al-Kad., 2015, p. 79).

**1-2 Environmental footprint as an indicator of sustainability**

The environmental footprint helps to demonstrate the concept of sustainability by communicating the volume of excessive use of nature by nature, resources, and ecosystem services. It also contributes to assessing the social and economic dimensions of sustainability.
Biological capacity and environmental footprint calculations document the supply and demand for natural resources and services based on historical data sets. They also document practices that reduce the ability of our ecosystems to provide them. These natural resources and services are not reflected in biological capacity only during the period in which productivity is reduced and human economies increase biological capacity In their current environment through the use of fertilizers and the improvement of technology, some of which are at a high cost, as societies were able to improve their economy and resources, however ، , The anthropogenic emission of carbon dioxide at faster rates than our ecosystems can do to damage carbon dioxide levels. (Galli, 2013, p. 15) .
The natural environment also plays an important role in supporting economic activity and its sustainability by the following:
1-2-1 Providing resources and raw materials such as water, wood, and minerals as inputs to produce goods and services, as is the case with services provided by ecosystems, including. carbon sequestration and purification of water, flood risk management, and nutrient recycling. Therefore, natural resources are vital to ensuring economic growth and development for the current and future generations.
Sustained economic growth will require an absolute separation from the production of goods and services from their environmental impacts, and this means sustainable consumption of environmental resources by improving resource efficiency or by adopting new technologies in production and product design.
1-2-2 The importance of technology and innovation in reducing environmental impacts, as it is a major factor in generating the level necessary for public and private investment in technology and infrastructure to facilitate the transition to low carbon growth and resource efficiency.
1-2 -3 The economic growth of developing countries also provided an opportunity to improve the quality of life of their citizens and to rise to meet the environmental challenges they face. Economic growth includes a mix of different types of capital to produce goods and services. These include:
Productive capital, such as machines, buildings, and roads.
Human capital, such as skills and knowledge.
1-2-4 Natural capital, for example, raw materials that we extract from the ground, carbon sequestration
Social capital, including institutions and ties within societies.

**1-3 Role of environmental policy in sustaining economic growth**

The development of environmental policies is extremely important in order to reduce the regulatory burden on the economy and achieve the benefits of growth in terms of the general improvement of economic efficiency, and in terms of securing long-term growth ،If it helps to increase prosperity and well-being by increasing income and improving health as well as education and quality of life, these policies are: (David Lin, 2015, p. 36).

1 -3-1 Investing in environmental research and development, public spending, and technology programs, such as developing flood infrastructure, and supporting low-carbon technologies such as electric cars ،providing information and other policies to address barriers to behavior change, such as policies that adopt resource efficiency measures that contribute to environmental and financial savings.

1-3-2 Directing policies that aim to properly price environmental resources, raising costs in the short term, in exchange for innovation and increasing efficiency in the use of resources that can stimulate environmental policy by providing greater certainty about the future policy environment

1-3- 3 Smart and cost-effective policy design can be used to further reduce any policy in the short term by comparing environmental policy with economic growth. This includes looking at the best mix of tools to achieve environmental goals, from pricing external factors for investment in technology and infrastructure.

**2- Development and the environment (theoretical analytical visions of the relationship between environmental and economic priorities)**

According to an analytical view of some scientists that the biosphere is supposed to be sustainable, and they are looking for how to protect biological and genetic diversity, and the dialectic is whether growth is required from the point of view of those interested in the environment Many scientists also affirm that lack of growth is not an appropriate solution, and that growth can help, even in part, to prevent environmental degradation ،So it is required as clean technologies such as solar or wind energy, but technologies, as well as growth that harms the environment, must be avoided that economists need more attention to environmental and ethical aspects ،Hence, the theories calling for the protection of the environment on the one hand and the other calling for economic priority on the other hand will be clarified, as follows: (Pillar, 2015, p. 64)

**2-1 Theories of environmental priority.** Studies are conflicting about the testing of environmental variables and the nature of their movement and their separation with economic variables, especially since the multiplicity of environmental dimensions and the complexity of their systems call for a balance between two options that are difficult to sacrifice:1) a good representation of the environmental dimension by engaging many of its variables, and this would lead to the weight of the model and the difficulty of solving it:2) adopting a holistic indicator of the environment that reduces its various dimensions ،And in it the network of environmental relations disappears in favor of obtaining a solvable model (Pillar, 2015, p. 165)

One of the theories and opinions that called for environmental priority is GAYA ( burgenmrier relative to James Lovelock, founder of this theory. This theory states that nature takes precedence over a person who is only a part of it. Nature was created to preserve itself and not to meet the needs of present and subsequent generations, as James Lovelock also sees that only environmental standards operate the relationship between the ocean and society without taking into account economic and social aspects. This is a weakness in this theory, and it aims to create fairness for non-human beings at the expense of man. As for the pessimistic theory (Shabani, 2004, pp. 64-65) : In ( 1798 ) Thomas Malths published a famous article on his principles on population ،He declared his disapproval of optimistic theories about the economic growth adopted by some philosophers of his time, such as French philosophers, including philosopher Nicholas de Condorce ،Those who believed that the human mind and technological development would solve all the economic problems and

obstacles facing economic growth in the future. On the contrary, Thomas Malths believed that the human race it continued to reproduce would face the problems of depleted natural resource limits, that this would lead to famines and stability in wage rates, and that technological development can lead to a short-term increase in the work of limited natural resources ‹And that long-term development can only occur when the human race increases at reasonable rates during periods of economic stability, while optimistic theory ( Shihab, 1988, 58 ): Some of the classical economists are less pessimistic like John Stuart Mill who saw that while limited or depleted natural resources could be a constraint on increasing production in the future ‹Those borders have not yet been reached, and no country in the world will reach them within the time frame of any of the existing industries ‹Stuart Mill based his principles on future development in the agricultural sector and on the role of social institutions in raising rates of economic well-being, all of which are factors that lead to a tendency to reduce population growth rates (Shabani, 2004, p. 66).

**2-2 Theories of economic priority.**

Highlighting sustainable development from an economic point of view requires distinguishing it from other relevant concepts: economic growth - sustainable economic growth, and economic development

Economic growth: increases per capita real GDP over time.

Economic development: This is a broader concept than the concept of economic growth. It includes the following of development :

- Improving the quality of life of the population, and increasing income becomes the main factor here
- Improving skills, knowledge, capabilities and options
- Improving civil rights and freedoms .

Environmental economists have drawn the attention of traditional economists to ideas related to growth in several ways including adding the value of environmental assets and the need to preserve and sustain them or integrate them into the economic dimension ‹The following are the most important of these theories calling for economic priority:

**2-2 -1The Rome Club's Growth Limits Theory**: Just nine years after the Brant and Morse study was announced, in 1972 the Club of Rome announced a report, "Limits of Growth". About nine million copies of this report have been sold and printed in 29 languages world wide

This report was prepared using advanced computer hardware and relied on a new method in modeling called "system analysis" (System Analysis).

This report presented a new model for predicting the future of development using five global variables, namely, population, food, manufacturing, depleted resources, and pollution .

The predictions reached in the report were overly pessimistic, as it predicted that the future rates of world population growth, food production, and the degree of industrialization would initially grow exponentially ‹It will only collapse in the next century .

This collapse will occur because the global economy has reached its natural limits through the use of depleted resources, agricultural production, and excessive pollution.

The report also predicted the depletion of approximately minerals before the end of this century, including petroleum, natural gas, copper, gold, lead, silver, zinc, and tin.

In the year ( 1972 ) The Club of Rome formulated a new theory known as "the theory of

growth limits", and the most important content of that theory was the following:

If current growth trends persist in both population, food production, and industrialization ، then depletion of depleted natural resources without change will reach the maximum limits for growth on the planet at some point within a hundred years at most .

This dangerous outcome can be avoided and a state of environmental balance and economic stability can be created if planning for a global balance is immediately started as soon as possible .

The content of this is that countries replace the goal of growth with another goal, which is the goal of balance in the use of natural resources, especially depleted ones, and this will only come by setting "limits for growth "

From the reality of the development of the world's population, as well as industrial production, whether at the level of each industrialized country separately or at the level of the industrial world as a whole Supporters, of the growth limits theory assert that both population and industrial production grow in Asia This distressing growth of industrial production explains the increasing capital accumulation in developed countries and the widening gap between them and developing countries .

However, the practical reality has subsequently proven the failure of these forecasts, and one of the most important signs of this is the high rates of oil production and reserves until the year (1974) ، However, discussions about environmental resources still adopt this approach to forecasting .(basend., 2000, p. 98)

**Many economists strongly objected to this theory and, criticized it, the most important of which are :**

The theory ignored the different regions, as it studied the whole world as if it were one region: therefore, the determinants of growth that apply to developed countries do not apply to developing and underdeveloped countries.

It was not based on specific statistical data because the owners of the theory relied on their personal intuition about their expectations for population growth that could be affected by other factors

The theory also ignored price systems and market economy movements, which could be considered an extension of Malts ideas.

**2-2-2 Market Modification Theory** (basend., 2000, pp. 99-100): Liberal economic theory holds that all phenomena that cannot be expressed critically in the market are neglected in the economic system.

In this sense, waste an natural resources that were seen as available and unlimited resources were treated.

Production is the transformation of natural resources into economic goods and waste. Likewise, consumption means not only the use of those goods but also their transformation into waste ،when waste was treated as a non-monetary phenomenon, the result was fatal errors in the functioning of the economic system.

The same applies to natural resources such as water and air which as we preceded and referred to were considered endless materials and therefore their economic value is non-existent, that is, they are external factors that cannot affect the course of the economic process.

However Marshall stressed that there are some external factors from the market that can affect in one way or another the performance of economic dealers and presented the concept of "external economy"

It is imperative to take natural resources into consideration in the economic process and address them as effective effects, thus requiring market adjustment.

**2-2-3 Theory of the introduction of Arthur Peugeot:** Peugeot suggested during the twenty years that the effects that occur outside the market because of the production and consumption of some resources, including environmental resources, through the application of some economic tools such as fees and aid, and these fees represent compensation paid Those responsible for the polluted waste they throw, such as used industrial water and other pollutants harmful to the environment, as it costs important amounts of money to treat them, and this assistance is allocated to pay the total works to beautify the ocean and the environment.

Economic models, for example, enable the determination of the optimum amount of fees to be paid by everyone who pollutes the atmosphere, and all amounts allocated by public authorities are directed toward their reuse to combat pollution ‹This was later known as carbon taxes which are still in force in many countries . (Lin, 2015, p. 58)

**2-2-4 Ronald Quas' property rights theory: criticizes** the optimal characteristic of the fees set by Peugeot and proposes a less strict solution to leave ample room for competition law, and proceeds from a review that environmental materials are not the property of anyone He says that if the property laws are clear, it is of economic benefit to compel polluters and their victims to continuously negotiate to reach an automatic agreement on the maximum level of pollution on both sides.

What is wrong with this theory is its over-reliance on the market as a mechanism for solving environmental problems caused by development processes.

We have seen in the previous review of theories that have paid attention to economic growth, that they make the environmental costs caused by production and consumption operations an economic value added to the value of those operations ‹Either it is added as a cost to the producer for the benefit of the consumer, and this may be in the form of taxes determined according to proposed models such as those proposed by Arthur Peugeot ‹Or controls and determinants of production and consumption processes that limit the damage achieved from those processes and thus are specific to economic growth or at the very least affect it as the theory of the Club of Rome, which was proposed according to a model that determines economic growth in a manner that does not cause the ecosystem to be depleted or collapsed. (David Lin, 2015, p. 32)

**2-2-5 Modeling environmental pollution.**

Studies have been conflicting about the testing of environmental variables and the nature of their movement, and their separation from economic variables, especially since the multiplicity of environmental dimensions and the complexity of their systems call for a balance between two options that are difficult to sacrifice one of them: As for the good representation of the environmental dimension by engaging many of its variables, and this would lead to the weight of the model and the difficulty of solving it, or adopting a holistic indicator of the environment that reduces its various dimensions In it, the Environmental

Relations Network disappears in favor of obtaining a solvable model ( recession 2015, 165 ).
Many authors have adopted a formula similar to that governing the dynamic of physical capital (i.e. the difference between extinction and investment) ، Considering that the change or growth in the quality of the environment is the difference between the ability of nature to regenerate and the level of pollution ،That is, the quality of the environment improves over time, the higher the capacity for regeneration and reproduction than pollutant emissions .
By approximately a year, approaches that have attempted to model environmental pollution can be classified into two types:
•Balance Approach: pollution balance increases with the net flow of pollutants, and decreases with the ability to represent and absorb nature. ( Van Marauijk ) and ( Van der Blog ) This trend, as they considered that pollution flows and their removal affect only the rate of growth of the quality of the environment and not its level.
•Flow approach: According to this approach, pollution is an inevitable product of economic activity that increases with its source of emission, whether it is production, consumption, or capital, as it decreases with the effectiveness of activities that eliminate pollution. ( Nancy Stoke ) and ( Ajayin and Hoyt ) have adopted such a formula in which a variable is used for the level of pollution of the technologies used, and thus their ability to harm the environment.
In general, the first approach is considered to be the most secure in the representation of the environmental index, given that it increases through the accumulation of waste and the multiplicity of environmental defects and through the model ability to test the short and long-term effects of economic growth on the environment. Here are some of the most important environmental models: (Zarqoun, 2019)

**2-2- 6 RBLO model :**

The RBLO model is known as ( AK ) relative to its semantic form. The RBLU model represents an improved version of the Harrod, Dumar, Frankel, and Romeo models .

Because of its simple and reduced nature, it has been widely used in many studies to test the effects of environmental policies on economic growth. This research, despite its different indicative formulas and the way it works, has reached a situation of conflict or inconsistency between the environment and economic growth, where the improvement in the quality of the environment is accompanied by a decline in growth rates, and vice versa. To overcome this situation, pollution control activities were included in the form of an environmental sector or technology at the end of the chain or others ،This research has shown that although the harmful effects of pollution are reduced by these activities, they create a crowding out effect on consumption and investment, and ultimately reduce the rate of economic growth ، However, this negative impact can be mitigated by taking into account the impact of productivity, as the improvement in the quality of the environment improves health and thus we improve productivity ( through low absenteeism rates, longevity ) ،Thus accelerating the pace of economic growth .

In the same context, when the linear technology of ( AK ) is replaced by a Cop Duklas exchange that contains in addition to private capital, it also contains the public spending of the product ( Barrow model ) (Moore, 2013, p. 3)

The concept of externalities is a basic reference for integrating the environmental body into theoretical economic models, as the interaction occurs between the negative externalities of

pollution, and the externalities that require public spending, which leads to slower economic growth and a lower level of pollution.

**2-2-7 Lucas model :**

Robert Lucas' article on human capital and its role in economic growth is one of the scientific works established theories of internal growth. This model is an extension and a qualitative addition to Manzar's work, Schultz, Baker ,and Ozawa. in contrast to its predecessor, it depends on two engines of growth that accumulate according to two different production functions: physical capital and human capital. It is preferable to accumulate the latter, which depends on the time allocated for formation, as well as on the effectiveness of the system,to achieve internal growth.

One of the first studies to be tested is the relationship between preference for environmental protection and economic growth using the analytical framework provided by the Lucas model. Among the studies presented by Grados, Smelder, Velika, Van Ojic, Van Weijenbergen, and others, the results of these studies varied due to the multiplicity of channels that were adopted to monitor the effects of environmental pollution on human capital ،Thus affecting economic growth.

These models are based on the different potential for substitution between the two engines of growth that make achieving a balanced, optimal, and sustainable path of growth, existing and possible, As the increase in pollution control expenditures reduces the social return of material capital and investment, and as a result the reduction of the ratio of physical capital to human capital in the production sector ،This makes the production process cleaner and more environmentally friendly, and as a result, the pace of economic growth is accelerated without its content being polluted .(M., 2013, p. 43)

**2-2-8 Aegean and Hoyt model:**

Through the Lucas model, human capital is a driving force for growth and an essential factor in protecting the environment. However, it is linked to the other engine, and for this reason many researchers have resorted to adopting a more flexible and richer method that benefits from the advantages of human capital, and avoids the restrictions imposed on its use, which is technological innovation as an engine of growth.

In view of the prominent role that technological innovation plays in the field of economic growth and environmental pollution, the framework on which it is based has been adopted to analyze various economic and environmental policies determine the conditions at which convergence occurs between development priorities and environmental protection considerations. Among the most important studies that fall within this context are Grimond, Hart, Ricky. This means that the environment is a set of external and internal conditions and influences, as for the environment as a science ،That is, ecology is (the science that studies the relationship of living organisms with the medium in which they live) and ecology aims to show the basic characteristics of life elements and their relationships with non-living elements. (Muhammad Salah Rajai, 2017, p. 2).

Whatever the difference between the results of these models, they generally share two main results:

The first result is that the possibility of achieving a – winning position between economic growth and environmental protection is more likely if technological progress is adopted as an engine of growth, compared to previous models ،This is a fact based on contemporary economic realities, as recent innovations in the field of technology, and in information technology in particular, created real wealth in the way of life, work, and ways of thinking, and enabled an unprecedented capital accumulation ،It also enabled the emergence of the intangible economy ( The weightless Economy ), in which pollution intensity decreases .

As for the second result, it is necessary for the state to intervene to correct the market failures resulting from the difference between the private cost and the social cost of pollution, especially since the environment suffers from the problem of the right to property and the overexploitation of resources ،The effect of externalities, leads to the deviation of optimum levels of growth from their competitive levels. In this context, an environmental tax can be imposed or applied or a pollution exchange created, which would push institutions to use pollution control activities, and engage in research and development to create clean and environmentally friendly technology. This environmental policy would also promote environmental awareness, and enhance the role of economic tools with standards and legislation that enable the integration of the environmental dimension into the economic account of both the producer and the consumer.

Economic growth may be endless as long as it is based on ideas, that do not recognize depletion. In this case, the economy is transformed from a material-based economy to an economy based on information or commodity – information, instead of the idea being incorporated into a material commodity ،It is incorporated into a non-material commodity, so the environment remains intact from pollution, The environmental drive and this by reducing the levels of carbon dioxide emissions in proportion to the expansion of generation capabilities, so the country will need green energy to generate electricity to reduce these emissions (Estebanian, 2018, pp. 20-21)

## 3- Characterization and evaluation of the standard model

To clarify the relationship between the environmental footprint and economic resources, a standard model characterization was used to reflect the effects of carbon dioxide emissions on GDP.

### 3-1 Data

Quarterly data for the period (2007-2018) on carbon dioxide emissions CO2 from the official website of the World Bank and quarterly data on the gross domestic product of the period of time from the statistical site For the Central Bank of Iraq, when the model was estimated for the above period at ( 48 ) watch ,

### 3-2 Formulation

The most acceptable model for clarifying the impact of GDP on carbon dioxide emissions is as follow:

LC02 = a + b LGDP + U1( 1 ) ---------

Whereas:

L: natural logarithm

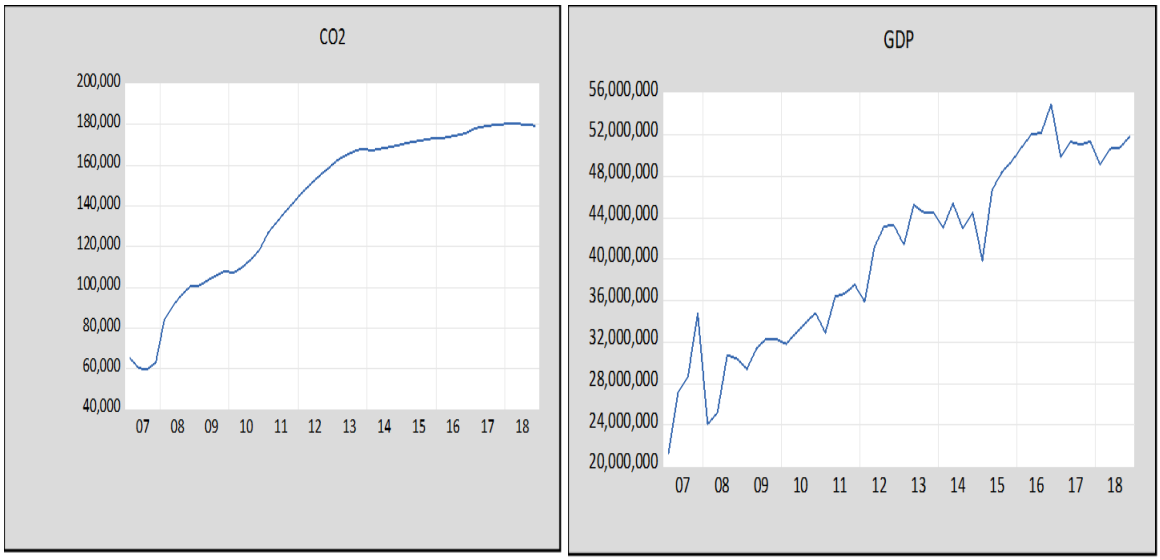
CO2: Carbon dioxide emission

GDP: GDP

b: Internal flexibility b > 1

U: Random variable

**( 1 )Time trend for search variables for 2007-2018**




**Source: From the researcher's work, based on the results of the statistical program, EViews12 .**

**3 -3Loot root test unit (Unit Root)**

Based on the expanded Dickie Fuller test (ADF) the stillness of the two search variables was tested and found to be at the level as shown in Table(2)

**Table (2) Results of the unit root test for the two variables studied for the period( 2007-2017)**

| Variable | Level P–VALUE | | |
|---|---|---|---|
| | Intercept | Trend and intercept | **Non** |
| *GDP* | 0.02 | 0.001 | −0.96 |
| $CO_2$ | 0.01 | 0.04 | 0.85 |

**Source: From the researcher's work, based on the results of the statistical program, Eviews 12**

**3-4 Estimating the model**

The model was estimated ,and the results are shown in the equation ( 2 ), from which it is clear that there is a direct relationship between the increase in GDP in Iraq during the period 2007-2018 and the increase in carbon dioxide emissions, as increasing this output by 1% increases these emissions by 1.22% is, a greater percentage of the increase in output, poses a clear danger to the environment, especially since the growth of GDP in Iraq depends largely on the production of crude oil, which in turn is not subject to environmental controls process of pollution and emission of gases accompany its extraction.

C02 = -9.56 + 1.22 GDP( 2) .....

P-value 0.0005 0.00001

R-squared 0.83

Prob ( F-statistic ) 0.000

The results of the statistical estimate show the morale of the GDP parameter in carbon dioxide emissions, as evidenced by the value of the p-value test, which was less than 5% It also turns out that the gross domestic product explains 83% from the emission of carbon dioxide in Iraq, as evidenced by the value of the R-squared parameter, which amounted to 0.83, as demonstrated by the value of Prob ( F-statistic ), the morale of the model as a whole, as its value was less than 5%

The second- degree tests, which are both the test of the existence of a self-link and the difference between the rest, showed that the model is free of these problems.

**3-5 Calling for adopting an environmental footprint initiative in Iraq**

Depends on two tracks - :

•Lighting Energy Efficiency Measures.

•Social and economic assessment of energy and water policies in Iraq.

It reduce carbon dioxide emissions by 30% by 2030 .Home electricity accounts 50% of the environmental footprint in Iraq .

Because of the dry and hot weather conditions in the summer of Iraq, a large amount of energy has been consumed to cool the buildings, and improper management of natural resources represented in a high environmental footprint of the individual since 2006. We find that 71% of the environmental footprint is due to the consumption of goods and services that release dense carbon emissions, especially energy, and to meet the demand for energy Iraq burns crude oil and gas and diesel fuel to generate electricity for local consumption, which prompted this towards calling for the adoption of the environmental footprint and green economy initiative, and there are important measures to address the environmental footprint, including:

•Establishing a unique partnership between the public and private sector and civil society that brings together the Ministry of Environment and Water – Environment Authority

•Establishing a federal steering committee from the energy and water sector to provide strategic direction, understand patterns of consumption of natural resources, and change societal awareness.

•Advocating for an environmental footprint initiative with academic experts to develop a fingerprint model that works as a decision support tool and targets the electricity and water sector, and the impact of carbon dioxide emissions until 2030.

## 4- Epilogue

### 4-1 Conclusions:

1- The existence of a direct relationship between the increase in the gross domestic product in Iraq during the period 2007-2018 and the increase in carbon dioxide emissions, as the increase in this output by 1% Increase these emissions by 1.22% That is, a greater percentage of the increase in output, which poses a clear danger to the environment, especially since the growth of GDP in Iraq depends largely on the production of crude oil, which in turn is not subject to environmental controls The process of pollution and emission of gases that accompany its extraction.

2- The second-degree tests, which are both tests of the existence of a self-link and the difference between the rest, showed that the model is free of these problems.

3- The development of environmental policies is extremely important in order to reduce the regulatory burden on the economy and achieve the benefits of growth in terms of the general improvement of economic efficiency, and in terms of securing long-term growth ،if it helps to increase prosperity and well-being by increasing income and improving health as well as education and quality of life.

5- Investing in environmental research and development, public spending, and technology programs, such as developing flood infrastructure, and supporting low-carbon technologies such as electric cars Providing information and other policies to

address barriers to behavior change, such as policies that adopt resource efficiency measures that contribute to environmental and financial savings.

6- Directing policies aimed at correctly pricing environmental resources, raising costs in the short term, in exchange for innovation and increasing efficiency in the use of resources that can stimulate environmental policy ،By providing greater certainty about the future policy environment

**4-2 Recommendations:**

1- Support innovation and transfer appropriate technology that has environmentally friendly characteristics and is commensurate with national needs.

2- Building the capabilities of its national owners to enable them to keep abreast of modern and environmentally friendly technical developments.

3- Strengthening the mechanisms of private sector participation in implementing the national contribution in a manner that ensures increased levels of ambition in the future.

4- Supporting the institutional structures working on climate change, in a way that contributes to enabling them to prepare and implement climate policies and make national decisions that agree with international requirements to ensure transparent implementation of this document.

5- Support work in reducing emissions from the various sectors that emit them and the various paths and technologies used in accordance with national needs and in a way that achieves balance.

6- Achieving sustainable energy development by increasing the efficiency of traditional energy sources currently used, preparing renewable sources for future generations, increasing the participation of renewable energy in providing energy, and participating in energy security ،Protecting the environment and mitigating climate change..

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