



Sustainability in industrial sites

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Abstract

Sustainability in industrial locational obstructs Industrial locations are considered one of the most important sources of pollution in the environment, so the research dealt with the concept of modern sustainability, which is expressed by the cost of environmental degradation (environmental costs) and how it affects the selection of the appropriate industrial site. To reduce the levels of increasing deterioration with economic, social, and environmental impact.

Keywords: Sustainability, Industrial Sites, Cost of Environmental Degradation

Introduction

The process of sustainable industrialization is one of the basic and difficult tasks undertaken by the planner, especially after entering its sustainability philosophy; this is for comprehensive studies of all factors affecting the selection of the appropriate industrial site, Which works to reduce many of the problems and the most important environmental problems that later turn into a financial cost called (the cost of environmental degradation), where the international forums and organizations working to reduce these costs and invest in the right industry, environment, and living organisms is working to address many of the problems, which lead to increased revenues of the state (GDP).

Research problem

The absence or weakness of the process of sustainable industrialization and reliance on the old signature mechanisms is led to increased levels of environmental degradation and increase its cost.

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Search task

The research aims to study the Gseba industrial area and its observance of the principles of sustainability, especially the concept of the cost of environmental degradation.

1. The Research Hypothesis

That attention to the environmental aspect, especially the concept of the cost of environmental degradation has a positive impact in achieving the sustainability of industrial sites.

Research Methodology

The research adopted the descriptive-analytical approach, as well as the field study of Gseba Industrial Area.

2. Sustainable Industrial Planning

The planning includes several specialties, each of which specializes in a specific aspect that is studied in detail; it's trying to arrange it according to a timetable to solve the problems faced by different periods, so it is known as:

“Planning the industrial sites in the region is to ensure the optimal exploitation of natural resources and achieve the spatial adequacy and economic efficiency of industrial activities established to ensure the increase and development of production in the region” [2].

The concept of industrial planning is including the study of the spatial dimension and the emergence of relations and linkages between economic actors as well putting modern factors which affect the process of selecting the appropriate industrial location, it should be in accordance with scientific studies, modern and suitable to the current reality in most aspects especially the environmental aspect because of the high levels of degradation , Thus, selecting a site according to outdated mechanisms is not appropriate, the project may be exposed to loss, therefore, the philosophy of sustainability came in its new concepts, which solve most of the problems experienced by the industries and by focusing on the factors that have been neglected previously, especially the modern factors such as technical and environmental factor to choose the appropriate location, The following figure shows the sustainable goals for the industrial planning and importance on the economic environmental and spatial dimension.

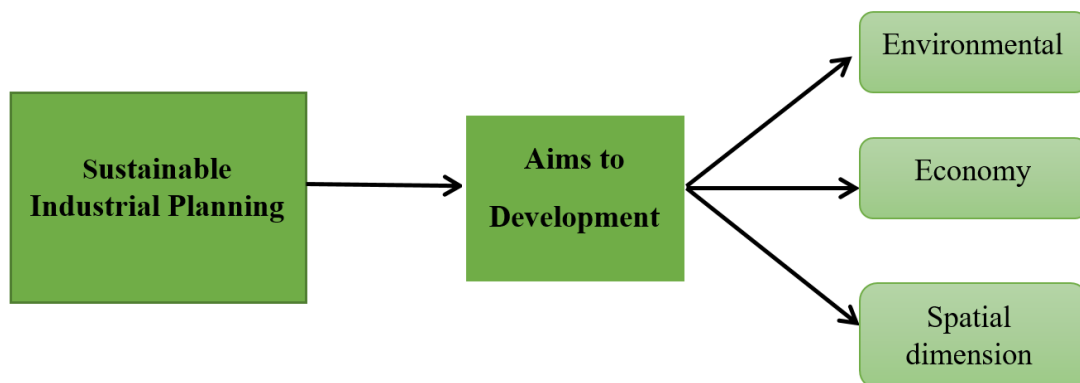


Figure 1: shows the sustainable goals for industrial planning on the spatial economic and environmental dimensions (3, 4)

3. The process of sustainable industrial location

The process of sustainable locating is based on the study of all factors affecting the choice of the industrial site through the preparation of studies of multi-faceted objective and comprehensive as well as the concentration on environmental standards in force the choice of an industrial site, According to the complexity of ecosystems and increasing degradation levels in the current environmental reality and line with environmental disasters at the local and regional levels, emphasis should be placed on environmental factors that have a significant impact on the conservation and conservation of natural resources, paying attention to the environmental factor reduce the costs of environmental and health deterioration and has a positive effect on economic and social factors.

The following figure shows all factors must be studied during the process of sustainable industrial location.

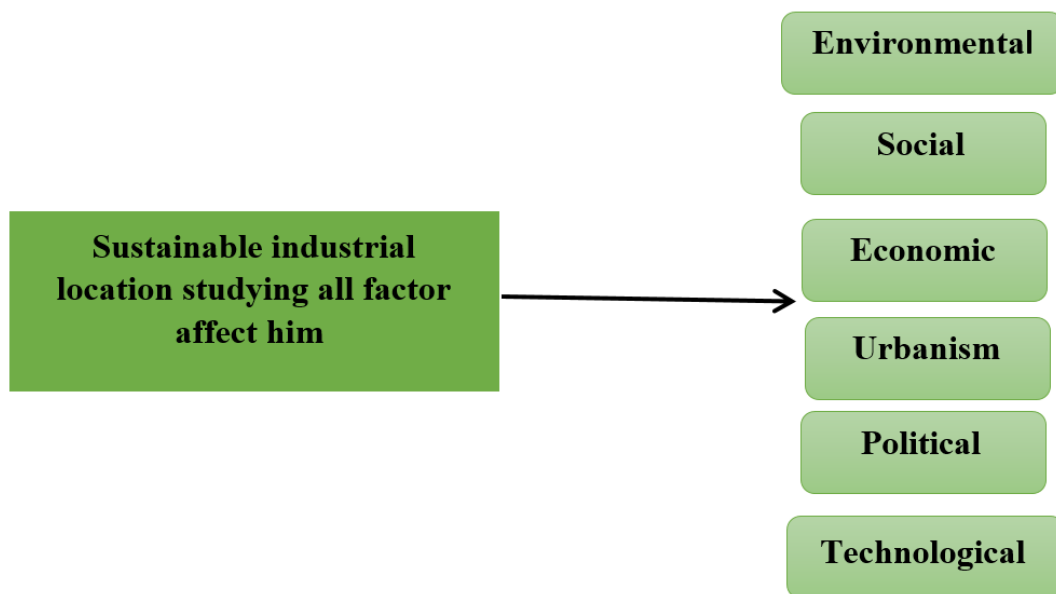


Figure 2: all Factors affecting sustainable industrial location (2)

3.1. Environmental factors

environmental returns resulting from work and the orientation towards the concept of sustainability are not limited to the surrounding environment only, but also have significant effects and economic returns resulting from the balance between natural resources and industry, where the principle of balance was able to achieve continuity of the production process with the help of clean technology, the following figure represents the axes that the Environmental factor dealt with in detail and accurately under a scientific and legal framework, as a shown in the figure below:

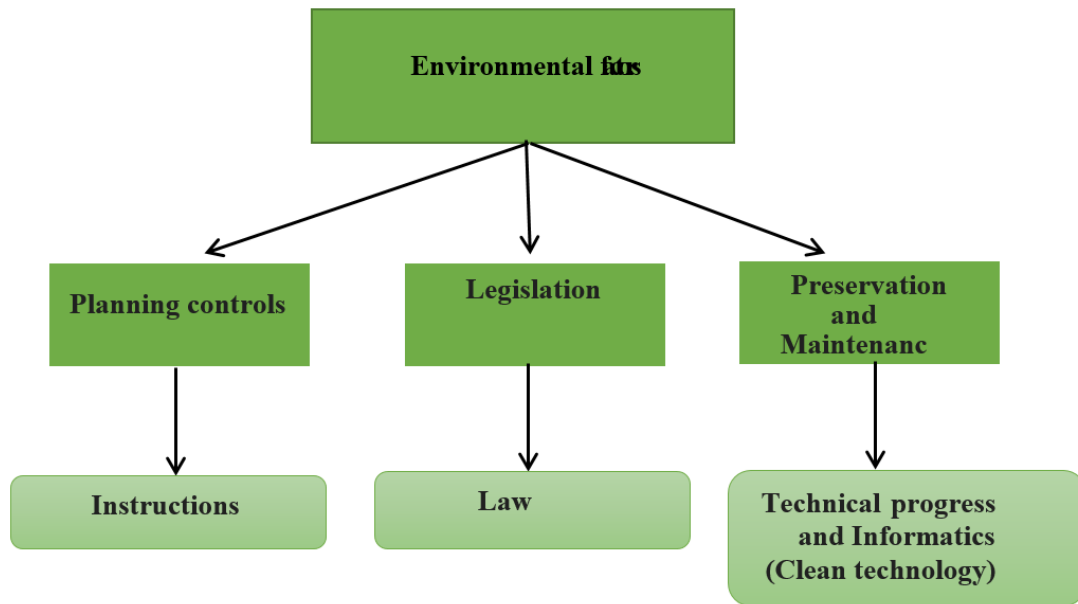


Figure 3: all a scientific and legal framework for Environmental factors (11,12)

3.1.1. Preservation and Maintenance (Technical Technical progress and Informatics)

The increase in the negative effects of environmental degradation on all aspects, especially the health and economic aspects, has set the alarm on the environment, Efforts have been made to harness this principle in the service of sustainability in a variety of ways, each of which needs to allocate financial resources for implementation, includes [10]:

A. Technical and informational progress (modern technology): includes

- Development of production systems.
- Liberalization of industrial placement processes.
- Achieving sustainable environmental industrial development.

B. Modern concepts (such as the costs of environmental degradation):

This mechanism has gained the greatest attention from international organizations, for its effectiveness at the industrial and environmental levels, For this mechanism to be effective, an international mechanism should be adopted to regulate its calculation. Investments in these costs are investments with good results for industry and natural resources Therefore, the World Bank organization's recommendations in its studies were based on steps that summarized the following: World Bank, Estimation the cost of environmental degradation [1].

- Study the reality of the environmental and industrial situation
- Conduct an environmental impact assessment process
- Determine the cost of environmental degradation
- Know the percentage and degree of deterioration

- Calculate the cost of deterioration through one method of calculation

The concept of cost of environmental degradation can be applied to the industrial site World bank, cost Assessment of environment degradation, [11]:

- During the feasibility study (economic/environmental) of the proposed industrial project
- In the event of the adoption of the process of sustainable industrial placement and the activation of its tools
- To complete what has been offered the study of the environmental impact assessment to convert the descriptive values that the evaluation addresses to values measured in the unit of money.

3.1.2. Law

It includes No. (37) For the year 2008, Law for the Protection and Improvement of the Environment No. (27) / Iraqi Ministry of Environment

3.1.3. Instructions

It includes No. (3) for the year 2011 For the establishment of projects / Iraqi Ministry of Environment.

4. The sustainable industrial sites

The concept of sustainability is one of the modern concepts that have been introduced recently because of its positive impact on the economy of any country. In fact, achieving sustainable industrial and environmental development leads to increased revenues of the state because the environment represents the most important income of production [5].

The efforts to activate the most important concepts of sustainability in a manner that works to improve environmental performance and the development of industrial production can be achieved through the activation of one of the most important tools of sustainability and the concept of the cost of environmental degradation on the proposed or existing industrial site, the concept of the cost of environmental degradation in general defines as: The costs of industrial enterprises to achieve three objectives: compliance with environmental laws in force, reducing emissions, reducing the negative effects on the internal and external environment [6], the following figure represents the Importance Ames The sustainable industrial sites :

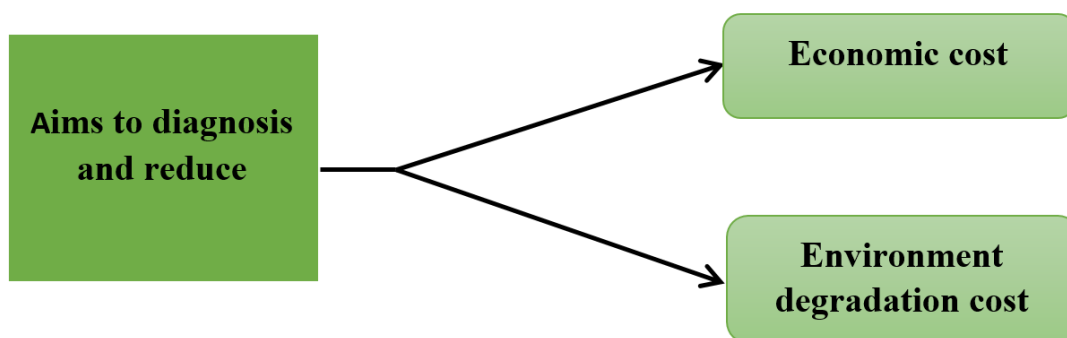


Figure 4: The sustainable industrial sites Ames (2)

5. An international experiment to measure the costs of environmental degradation

In a serious attempt by Britain to calculate Gross National Product (GNP), the results showed unrealistic values that were subsequently neglected because they did not take into consideration the economic welfare scale-index of Sustainable Economic Welfare- (ISEW), This measure works at the expense of state-based returns on projects that do not affect available environmental materials .When the account was recalculated and the ISEW scale was entered, the results were different and surprising, where it was found for the first time that the increase in average per capita was 230% and the second time (0.3%) after calculating the cost of environmental degradation for the same period. The above calculation demonstrates the importance of introducing the ISEW indicator for real economic growth by introducing the concept of sustainability and calculating the values of environmental degradation especially for industrial activities and their deduction from profits and employment in the process of conservation and maintenance. Thus, the process of industrial development at the expense of depleting the available environmental resources is an unsuccessful and planned development process that leads to an un-measured and possibly unclear loss in the country's economy whose negative effects are evident in the future, The figure below represents the comparison between the gross national product without and with the addition of the costs of environmental degradation [8] , The following figure represents the Importance Ames of the addition of environmental degradation costs for (GNP) :

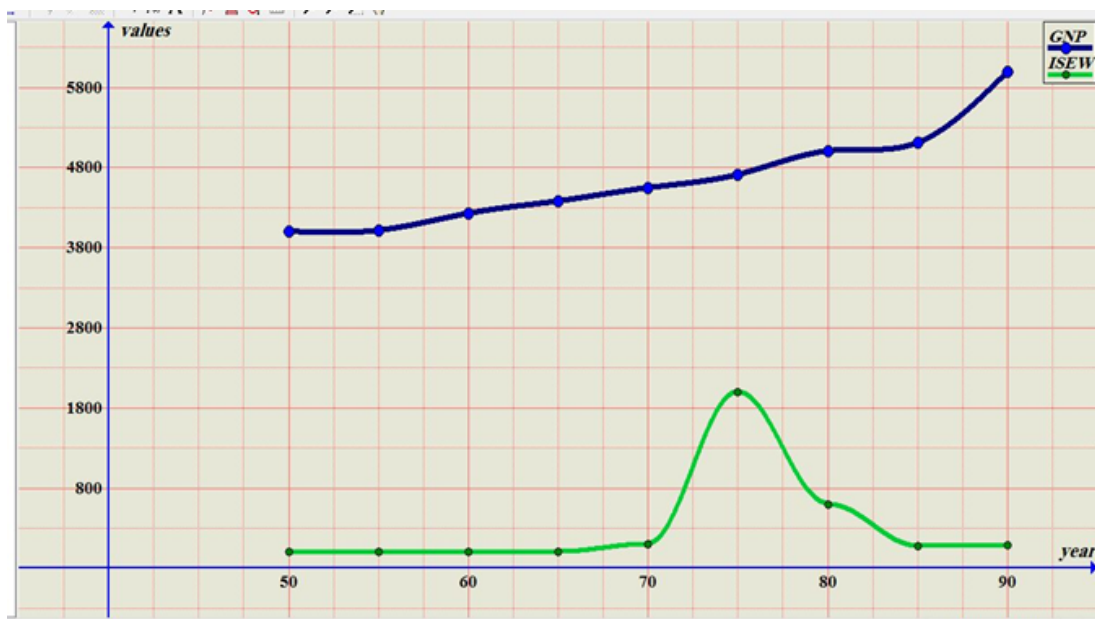


Figure 5: Gross national product without and with the addition of environmental degradation costs (8)

From the figure above:

- A. (1) Gross National Product GNP 1 represents the economic growth of Britain, which was at the expense of the depletion of natural resources.
- B. (2) (ISEW): represents the process of sustained economic growth
- C. The distance between GNP (1) and 2 (ISEW) represents the cost of environmental degradation caused by development processes that affecting the environment.

- D. Increasing industrial development processes, especially in the late 1970s and onward With the increase in deterioration costs.

6. Gseba – Brick Factory: a case study

- A. **Spatially:** A- Spatially: Maysan Governorate is located in the southeastern part of Iraq, and the study area is located in the southern part of it with an area of (20,000) acres dedicated to brick factories. There are 3 main roads linking it to the city center and other governorates, including Basra Road (15 km), Baghdad Road (345 km), and the Governorate Center (15 km) and it contains a group of internal roads linking it to other villages (Ministry of Industry and Minerals, Directorate-General for Industrial Development, unpublished technical reports).
- B. **Environmentally:** They have environmental characteristics that distinguish them from their peers, Characterized by high fertility with the center of the base and production capacity in addition to the existence of large drainage and other small supporting drainage. (Ministry of Industry and Minerals - Department of Environmental Development - Study on the brick factories in Iraq, 2017).
- C. **Industrially:** It has many plants with a total of (20) plants that can be increased, and its production capacity is (50 million bricks / year), and the amount of consumption of fuel oil (Fuel Oil) known as black oil is about 5,900,000 liters / month, and black oil is characterized by harmful emissions from The chimneys on the surrounding agricultural areas, the chimneys spread randomly to form the so-called (pollution area source), which is the main source of pollution in the area [15].

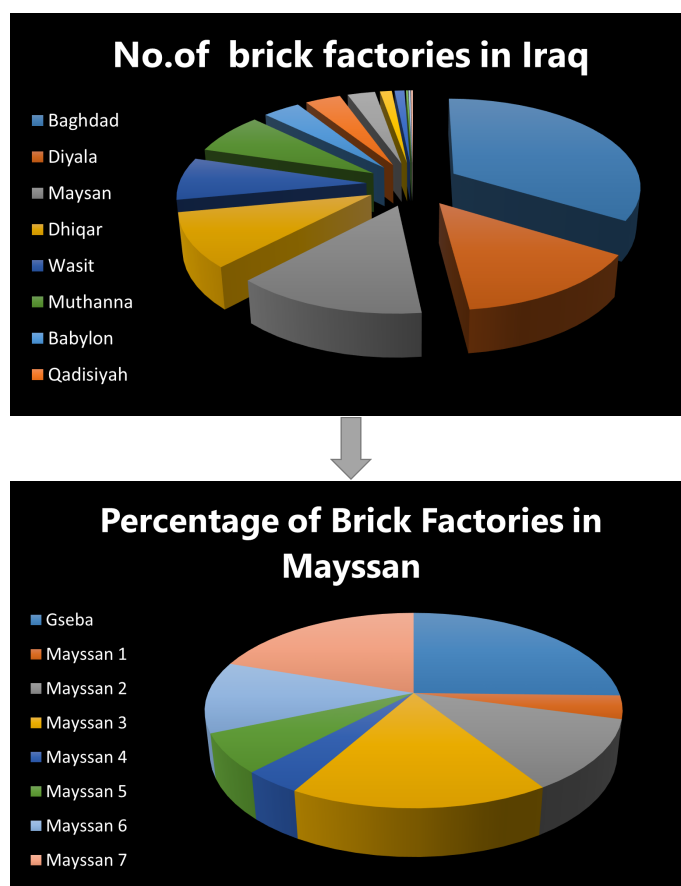


Figure 6: General Statistics for The brick factories in Iraq (17)

D. **Schematically:** The brick factories, built based on the classical industrial placement process, had a cumulative effect on the quality of the surrounding soils because of their negative emissions, which led to a decrease in vegetation density and production quantities (the map(1)), As one of the goals of environmental planning is to achieve sustainable industrial environmental development, the research focused on the need to introduce the concept of sustainability based on the principles of conservation and maintenance to this industrial site by applying the concept of the cost of environmental degradation. This section will highlight how to achieve sustainability in industrial sites and apply one of the important tools in them and give results quantitatively measured in the unit of money, The following Map represents Gseba study area.



Figure 7: Map Case study Gseba Industrial Area

6.1. *Environmental impact assessment on Gseba Industrial Area*

The assessment process is one of the basic tools for sustainability that precedes the process of calculating the environmental costs, because of the comprehensive assessment of the economic, social, and environmental aspects, after determining the source of the underlying deterioration (chimneys of brick factories) and determining the cumulative effect on surrounding environmental quality, The digital matrix used on the study area suffers from air pollution to a large extent due to the emissions of polluting factories, which negatively affected the density of vegetation cover and the fertility of the land, which affected the quantities of agricultural production (yield), the direct method will be show for the assessment process as shown in the table 1:

Table 1: Environmental impact assessment using the direct method method

Impact The effected Element	Emissions	Liquid Waste	Solid Waste	Noise	The most influential factor
Air quality	Big	-	Middle	Small	Environmental
Climate Factors	Big	-	-	-	Environmental
Density of vegetation and fertility factors	Big	-	Small	Small	Environmental - Economic
Building constructions and the metal surfaces	Big	-	-	-	Economic
The aesthetic factor of the area	Big	-	Middle	-	Environmental – Economic -Social
Public health, comfort, and daily life	Big	-	-	Small	Social Economic-
Soil and groundwater	Big	Small	Middle	-	Environmental – Economic
Work Environment (Workers Health)	Big	-	-	Big	Social – Economic
Land and property prices in the region	Big	-	-	-	Economic

6.2. Process of calculating the cost of environmental degradation:

This is the fundamental step of calculating the cost of environmental degradation because it includes mathematical processes that convert the values of degradation from descriptive or numerical to quantified values measured in the unit of money, this step is structured depending on available data, and based on which the method of change in productivity was used.

- A. The calculated cost type: It is a direct cost resulting from the impact of chimneys on the surrounding fertile soil.
- B. Degree of deterioration: by degrees of degradation headquarters of the World Bank will use the rates of deterioration on the planned headquarters to obtain degrees of real deterioration of the study area as shown in table 2.
- C. Degree of deterioration: Depending on the format used by the World Bank and issued by the Food and Agriculture Organization (FAO), the degree of deterioration is determined.
- D. Calculating: the cost of environmental degradation by Productivity Change Method: This method is one of the common sustainability tools, as it is based on a logic that is easy to understand and explain, by means of changes in one of the soil indices, such as a crop that can quantify the state of deterioration, A mathematical equations, are formulated by the researcher depending on the available data , below Mathematical equations by Productivity Change Method will be used in study area data :
- Total Production (kg) = Cultivated area (Dunams) x Number of palms (palm/dunams) x Production (kg/ palm)
 - Loss . Production (kg) = Total Production (2010) - Total Production (2015).
 - cost of environmental degradation (Iraqi dinar) = Loss . Production (kg) x Assume the dates price during (time) approximately in (Iraqi dinar/kg)

Table 2: Calculation of the cost of environmental degradation for case study by Productivity Change Method

Year	Year	Number of palms (palm/dunams)	Production (kg/ palm)	Total Production (kg)	Loss in Production (kg)	cost of envi- ronmental degradation (Iraqi dinar)	GDP 10 ⁹ (\$)	Degree of deteriora- tion
2010	2010	25	160	6,000,000	276,000	276,000,000	138.517	High
2015	2015	24	159	5,724,000	273,000	546,000,000	166.602	High
2020	2020	23	158	5,451,000			167.224	High
Assume the dates price during (2010-2015) approximately (1000 Iraqi dinar /kg) And the dates price during (2015-2020) approximately (2000 Iraqi dinar/kg)								

Through above Table No. 2

1. The annual environmental degradation costs of the palm groves surrounding the study area for the period (2010-2015) are equivalent to (55,200,000) For the period (2015-2020), it is equivalent to (109,200,000), and this is not a small value for an average industrial complex.
2. Increasing degraded areas and production losses with an increase in the cumulative effects resulting from factory emissions and brick quarries .

3. The study area constitutes (3%) of the total brick factories used for fuel oil, so the effect of these factors is large in relation to the values of GDP.
4. The GDP values are false because they did not take into account the costs of environmental degradation on the resources surrounding the farming area, especially the fertility of the land.
5. You must achieve environmental and economic success to achieve well-being.
6. The establishment of the industrial site according to the old mechanisms is not compatible with the current environmental situation, which causes great losses to the environment and living organisms. Therefore, industrial sustainability must be adopted in the selection of sites to achieve economic, environmental and social benefits

Summary:

1. Sustainability focuses on factors that were previously neglected, especially the environmental factor of greater cost nowadays, in an effort to reduce environmental pollution and the continuation of the industry. The concept of sustainability came to industrial sites .
2. A weak process of conducting cognitive and applied studies working to raise awareness in a necessity application of modern environmental concepts in all aspects, especially the industrial aspect thereof.
3. Sustainability has done one of its tools, represented by the costs of environmental degradation is to improve environmental performance and develop production processes to ensure the preservation of the environment of employees and the surrounding environment, which works to increase and enhance the revenues of the State
4. The mechanism of environmental degradation is summarized in five steps. The last step involves calculating and transferring the effect from its descriptive form to its quantitative formula by means of mathematical relations formulated according to the basic principles or principles developed by the chosen method. The World Bank has noted the adoption of simple relationships in view of the vulnerability of the environmental database.
5. The Gseba region was characterized by its fertility and its high production capacity. Due to the accumulated pollution of the bricks, the levels of attrition increased, which negatively affected the quantities of production and the density of the vegetation. Therefore, the GDP of this site is not true because it neglected the sustainability of the surrounding environmental resources
6. 6- The establishment of the industrial site according to the old mechanisms is not commensurate with the current environmental situation, which results in large material losses that may cause a clear imbalance in the state's revenues and may lead to the suspension of work there.
7. To avoid the occurrence of environmental disasters and to advance the current environmental reality and for the continued establishment of industries, it is necessary to move towards the establishment of sustainable industrial sites that work to create a balance between the economy and the environment.

Recommendations:

1. Activating the process of selecting an industrial site in accordance with the concepts and mechanisms of sustainability in line with the current environmental and economic situation.
2. Activating the most important tools of sustainability represented by the cost of environmental degradation at an early stage in the proposed industrial sites, to achieve investments that are beneficial to both the environment and the industry, which will enhance the revenues of the State.
3. Work on developing both the environmental and industrial aspects and achieving balance by working towards sustainability, due to their impact on the values of the gross domestic product
4. To encourage the activation and spread of the concept of the cost of environmental degradation in the industrial sites through the mediation of tax exemptions and many other privileges.
5. The process of calculating the cost of environmental degradation should be based on a robust mechanism that will give real results reflecting the reality of the World Bank organization, for subsequent adoption and development.
6. To establish a strong and real environmental database at the local and regional levels, with the need to emphasize the provision of qualifications to researchers, to form specialized employees working to activate the concepts of modern sustainability in all sectors.
7. The rehabilitation of the Gseba plant should be rehabilitated as it is built at the expense of depleting the surrounding environment (soil) and its survival, in this case, gives an indication of the necessity of stopping the production of bricks to avoid an environmental disaster.

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