

The Impact of Environmental Levies on Environmental Costs in Industrial Enterprises – A Field Study of Selected Enterprises in the Belassel and SidiKhatab Industrial Zones, Relizane Province.

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Abstract:

This study explores how environmental taxation influences environmental costs in industrial enterprises, focusing on establishments in the industrial zones of Belassel and SidiKhatab, Relizane province. It examines how government-imposed tax mechanisms shape industrial activities to mitigate environmental harm. The research also investigates the responsiveness of enterprises to such taxation and its effects on their environmental costs.

The findings reveal that environmental taxes raise costs for enterprises due to the financial burdens of compliance. However, environmental incentives reduce these costs by promoting the adoption of eco-friendly technologies. Moreover, strong tax oversight enhances adherence to environmental standards, minimizing expenses related to violations and fines.

Keywords: Environmental levy, Environmental costs, Environmental taxes, Environmental incentives, Tax control.

Jel Classification Codes: H23, Q58, Q51, Q52.

1. INTRODUCTION

Environmental taxation is one of the main tools used by governments to balance economic development with environmental conservation. Amid increasing environmental challenges, such as climate change and pollution, it has become imperative to develop effective environmental policies that enhance industrial performance and reduce the negative environmental impact of their activities.

Environmental taxation aims to achieve two main objectives: reducing environmental harm through taxes that compel enterprises to lower their harmful emissions and promoting sustainable practices, by offering incentives encouraging companies to adopt environmentally friendly technologies.

Despite the critical importance of these policies, their actual impact on environmental costs in industrial enterprises remains a subject requiring in-depth analysis.

This study examines the impact of environmental taxation on environmental costs in industrial enterprises through a field study conducted in the Belassel and SidiKhatab industrial zones in Relizane Province. It aims to analyze how environmental taxation mechanisms imposed by the state affect industrial activities, explore the extent to which enterprises comply with these policies, and evaluate their impact on environmental costs. By exploring this relationship, the study seeks to provide valuable insights to improve environmental taxation policies and enhance the balance between economic and environmental goals.

Research Problem:

In light of countries' efforts to balance industrial development with environmental protection, environmental taxation emerges as a crucial tool for influencing the behavior of industrial enterprises. However, the impact of environmental taxation on environmental costs in Algeria remains unclear. While taxes may increase environmental costs for enterprises, incentives could potentially reduce these costs. Accordingly, the study seeks to address the following question:

To what extent does environmental taxation affect environmental costs in industrial companies in Algeria?

Main Hypothesis:

Based on the above problem and an initial analysis of the topic, the following main hypothesis is proposed:

There is a statistically significant effect of environmental taxation (taxes, incentives, control) on environmental costs.

Sub-hypotheses:

- a. There is a statistically significant effect of environmental taxes imposed on increasing environmental costs in industrial establishments.
- b. There is a statistically significant effect of environmental incentives in reducing environmental costs for industrial establishments.
- c. There is a statistically significant effect of effective tax control in reducing environmental costs by enhancing compliance with environmental standards.

Significance of the Study:

This study highlights a vital topic related to environmental taxation as a financial tool aimed at achieving sustainable development. It is among the few studies examining the impact of environmental taxation on environmental costs in industrial enterprises in Algeria, giving it both scientific and practical value. By conducting field analyses in two major industrial zones, this study will provide results to assist decision-makers and legislators in improving environmental taxation policies and supporting the transition of enterprises towards more sustainable environmental practices.

Research Gap:

Many previous studies have dealt with environmental taxation as an independent variable and many other variables as dependent variables such as sustainable development, green innovation, and many others, where environmental costs were dealt with as an intermediary variable. The most important of these studies are the following:

- (Bistra, 2023) Tax Audit and Taxation in the Paradigm of Sustainable Development: The Impact on Economic, Social and Environmental Development, where she relied on a comparative analysis of different tax systems and case studies to evaluate their efficiency in promoting sustainability, revealing that well-designed tax systems have an economic and environmental impact represented in encouraging green investments and reducing polluting activities, a social impact, as integrating the principles of corporate social responsibility into tax policies enhances justice and transparency in financial management.

- (Umar, Subhani, Muhammad Nouman, Seemab, & Seemab, 2023) The study evaluates the impact of the environmental tax rate and the legal corporate tax rate on polluting emissions in major industrial economies between 2000 and 2019. The researchers found that increasing the environmental tax rate significantly reduces polluting emissions by stimulating sustainable activities while increasing the legal corporate tax rate increases emissions due to reducing the ability of companies to invest in green technology. The study also recommends using environmental taxes as a tool to reduce pollution while controlling corporate taxes to avoid unintended negative effects.

- The study of (KHADIR & RAGAA, 2023) focused on the role of environmental taxation in protecting the environment in Algeria, highlighting taxation as an incentive and deterrent mechanism, and the importance of tax incentives in encouraging institutions to adopt sustainable environmental policies, and fees and fines as means of deterring polluting activities. It addressed the generation of financial resources allocated to address environmental damage, stressing the need to enhance institutional awareness and improve policy implementation to achieve sustainable development goals.

- The study of (Errekabi, Ghafouri, & Hamdan, 2023) addressed the mechanisms of taxation and incentives to encourage institutions to invest in clean energy and use environmentally friendly technologies. The results highlighted that financial incentives and environmental taxes play a major role in reducing pollution and enhancing competitive advantage for institutions

committed to the environment, which contributes to improving the quality of the urban environment sustainably.

Despite the remarkable development in the literature on environmental taxation and its effects in developed countries, these studies are still weak in the Algerian context, especially in industrial establishments located in rural industrial areas such as Belassel and SidiKhatab.

Previous studies often focus on major economies or on environmental taxation applications in countries with an advanced environmental legislative structure, which leaves a clear gap in terms of analyzing the effectiveness of these mechanisms in developing countries or less developed countries in terms of environmental legislation.

Also, there are not enough studies on the impact of environmental taxation on environmental costs (as a dependent variable) of industrial establishments in Algeria in general, especially those located in rural industrial areas, which makes this study necessary to provide a deeper understanding of this relationship in this distinctive local context..

2. Environmental Taxation and Environmental Costs

Through this axis, we will discuss the most prominent concepts related to the keywords, aiming to standardize terminology and establish a foundation for the fieldwork. Environmental taxation and environmental costs are among the most important concepts:

2.1 Environmental Taxation

Environmental taxation serves as a financial tool to influence economic activity and the behavior of economic agents, encouraging them to consider the environmental damage caused by their activities while formulating strategies, though approaches may vary, the objective remains consistent, as elaborated in the following points:

2.1.1 Concept of Environmental Taxation

Before defining environmental taxation, we can define taxation in general as an important economic derivative that reflects the economic and social structure of the development of society, as it is a financial and intervention tool that has multiple effects at the macro and micro levels(Berrahmoun, 2019, pp. 135-136). It is also defined as all the compulsory deductions imposed by the state, which include royalties, fees, and taxes(Mherzi, 2013, p. 217). Meanwhile, the Organization for Economic Co-operation and Development (OECD) defines “environmental taxation” as “including fees and taxes imposed on products that cause harm to the environment” (Errekabi, Ghafouri, & Hamdan, 2023, p. 121), and the Committee on Accounts and Environmental Economy defined it as “taxation that includes taxes and fees imposed on products, services, equipment and other elements that affect the environment” (Commission for Accounts and Environmental Economics, 2003, p. 12), and it is also defined as “a set of taxes imposed on goods and services whose use affects the environment, and these include taxes on emissions and polluting products, fees imposed on environmental services, in addition to Energy and transportation fees(BENECHIKH, 2011-2012, p. 09). It has another definition: “Environmental taxation includes environmental taxation, green fees, ocean taxation, ocean taxation or green tax, all of which refer to a single and single tool. It is an emerging form of taxation that aims to protect the environment and natural resources by reducing their degradation and

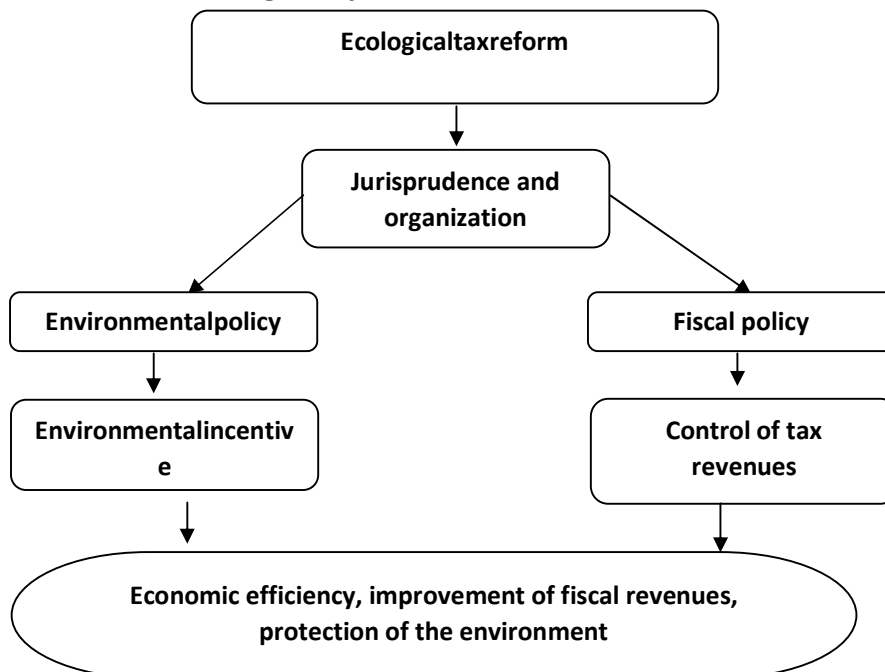
overexploitation”(Ministry of Finance, General Directorate of Taxes, 2023)

Through the definitions of environmental taxation that have been addressed, we can say that “environmental taxation is a tax imposed by governments on activities or products that harm the environment, intending to reduce negative impacts on the environment and promote more sustainable practices.

2.1.2 Objectives of environmental taxation:

The objectives of environmental taxation are not limited to the financial objective (as a supporter of the public treasury) but extend to contributing to addressing environmental problems, protecting them for current and future generations, and promoting sustainable development, and the following figure shows this(MAMMERI & MOURI, 2022, p. 235):

Fig. 1.Objectives and features of environmental taxes



Source: (MAMMERI & MOURI, 2022, p. 235)

We can summarize the other objectives of environmental taxation as follows (Berrahmoun, 2019, pp. 139-140):

- Reducing environmental pollution: through punitive measures included in environmental taxation, such as financial fines or criminal penalties imposed on violators of environmental protection rules.

- Correcting market shortcomings: legal procedures alone have become insufficient to deter violators, in addition to the weakness and scarcity of financial resources allocated to environmental protection

- Reducing pollution: Environmental taxes motivate individuals and companies to reduce the level of pollution resulting from their activities.

- Ensuring a healthy environment: Environmental taxes seek to achieve a healthy environment for all, as determined by legislation, laws, and international agreements.

- Establishing a culture of environmental conservation: Environmental taxes aim to promote

a culture of environmental conservation among individuals and communities on a global level.

- Protecting the environment from harmful activities: Environmental taxes contribute to protecting the environment from the negative effects of local and global human activities.
- Achieving sustainable development: Environmental taxes contribute to achieving rapid development that benefits society and the environment jointly.
- Encouraging proper waste disposal: Environmental taxes motivate individuals and companies not to store private and hazardous industrial waste improperly.
- Reducing polluting activities: Environmental taxes aim to reduce activities that cause pollution, as these activities have become environmentally costly.

2.1.3 Environmental taxation tools:

Environmental taxation includes a set of taxes and fees imposed on polluters, in addition to exemptions and incentives granted to individuals and companies that adopt environmentally friendly technologies in their activities:

2.1.3.1 Environmental taxes:

Environmental taxes were introduced in 1920 by economist Arthur Pigou, based on the "polluter pays principle" through his book "Economics of Welfare", as they mainly aimed to integrate external effects into production costs and force those who caused them to bear their costs, so it is considered a market-based tool.

The environmental tax is defined as: "mandatory deductions made by the state without compensation, calculated on a container representing a special environmental interest" (KADDI, 2011, p. 164). It is also defined as: "obligating the taxpayer to pay a specific cash amount to the state treasury in a mandatory manner and without compensation, to protect the environment" or "mandatory deduction paid by the individual as a contribution to covering public costs and burdens, taking into account that environmental protection is part of these burdens"(ABDELBAKI, 2010, p. 86). It includes the following forms(BENECHIKH, 2011-2012, pp. 28-29-30):

- **Tax on products:** It is a tool used by the state to impose taxes, whether based on value or quality, on production in production units whose activity is related to environmental pollution and causing social damage. These taxes aim to reduce the volume of pollutants to socially acceptable levels. The environmental tax on products is mainly used to correct external effects, rather than to reduce pollution.
- **Tax on polluting emissions:** It is a cash deduction proportional to the size of actual or estimated emissions released into the air, water, or land. According to this tax, producers bear the costs of environmental pollution, which prompts them to reduce these emissions by searching for appropriate ways to reduce them to acceptable levels.
- **Waste tax:** It is a cash deduction imposed on each unit of waste disposed of in the environment, and imposing this tax results in forcing the producer to pay an additional cost that includes the cost of waste disposal or the cost of treating it, which will encourage him to control the level of waste accompanying production so as not to bear the additional cost represented by the tax.

2.1.3.2 Environmental fees

Fees on imported or locally produced polluting materials are considered a means of protecting the environment. In addition to its deterrent aspects, it constitutes a source of public funding for the preservation of nature and human health. Below we mention some of its different types according to the Algerian legislator (Ministry of Finance, General Directorate of Taxes, 2023)

Environmental fees are usually fees imposed on the use of natural resources or to obtain the right to dispose of pollutants (SIJBREN, 2005, p. 126). Environmental fees are defined as: "They are mandatory financial deductions imposed by the state on polluters and anyone who causes damage to the environment. These deductions include two main aspects: a deterrent aspect and an incentive aspect, to reduce the phenomenon of environmental pollution and mitigate its effects" (SIJBREN, 2005, p. 127). Its forms are as follows (Ministry of Finance, General Directorate of Taxes, 2023):

- The tax on polluting and environmentally hazardous activities:

Established by Article 117 of the Finance Law of 1992, this tax is applied to the activities whose list is attached to Executive Decree No. 09-336 dated October 20, 2009, which specified the activities subject to the tax on polluting and environmentally hazardous activities and the multiplier factor.

- Fees related to atmospheric pollution:

• Fee on petroleum products:

Established under Article 82 of the Finance Law of 1996, this fee is applied to petroleum products and similar products, imported or obtained in Algeria. This fee is applied according to the following products and rates: (Article 24 of the 2020 Supplementary Finance Law.)

Table 1. Fee on petroleum products

Tariff Code	Material Description	Tax (DZD)
M.27. 10	Premium Gasoline	1600 .00
M.27. 10	Regular Gasoline	1700 .00
M.27. 10	Unleaded Gasoline	1700 .00
M.27. 10	Diesel (GasOil)	900. 00
M.27. 10	Liquefied Petroleum Gas (LPG)	

Source: (Ministry of Finance, General Directorate of Taxes, 2023)

• Fee on fuel:

Established under Article 38 of the Finance Law of 2002 The fuel tax is applied to premium gasoline, regular leaded gasoline, and gas oil, and is applied as follows (Article 55 of the 2007 Finance Law):

Table 2. Fuel tax

Material Description	Tax (DZD/L)
Premium Gasoline / Regular Gasoline (with lead)	0.10 DZD/L
Diesel (Gas Oil)	0.30 DZD/L

Source:(Ministry of Finance, General Directorate of Taxes, 2023)

• **Tax on plastic bags:**

The tax on plastic bags is deducted from national production by the tax authorities when the ready-to-use product leaves the factory and is directed to the commercial cycle, and upon import by the customs administration authorities when the ready-to-use product enters the national territory (Article 4 of Executive Decree No. 9-87 of February 17, 2009), and the tax is set at 200 DZD/per kilogram (Article 94 of the 2020 Finance Law)

• **Tax on imported or locally manufactured oils, greases, and grease preparations:**

Established by Article 61 of the 2005 Finance Law, this tax applies to products included in the list attached to Executive Decree No. 07-118 of April 21, 2007, except greases, this fee is set at 37,000 DZD per ton imported or manufactured within the national territory and resulting from the use of used oils.

• **Fee on new imported rubber tires:**

Subject to the fee on new imported rubber tires, rubber tires intended for light and heavy vehicles, their weight requires the following conditions:

- Light vehicles: from 3 kg to 15 kg.
- Heavy vehicles: more than 15 kg

The amount of the fee is set as follows:

- ✓ 750 DZD for each tire intended for heavy vehicles.
- ✓ 450 DZD for each tire intended for light vehicles.

- **Incentive fees:**

• **Non-storage of industrial waste:**

This fee was stipulated in Article 203 of the Finance Law of 2002 and was legislated to encourage the non-storage of hazardous industrial waste and special waste.

It is set at 30,000 DZD per ton of stored special and/or hazardous industrial waste (Article 89 of the 2020 Code of Civil Procedure).

• **Non-storage of waste related to treatment activities in hospitals and medical clinics:**

Healthcare waste means: "waste resulting from diagnosis, monitoring, preventive or curative treatment in the field of human and veterinary medicine" (Law No. 19/01 relating to waste management and control of its disposal).

It is set at 60,000 DZD per ton and the weight is set according to the treatment capacities and patterns in each institution concerned or by direct measurement (Article 90 of the 2020 Code of Civil Procedure).

2.2 Environmental costs

Several definitions address the concept of environmental costs, depending on the angle from which the definition author views environmental costs. The US Environmental Protection Agency (USEPA) defined it as “four categories of traditional costs, potential costs, emergency costs, relationship costs, and the like” (Song, Jiang, Zhang, & Lui, 2018, p. 03), and the ESCWA organization affiliated with the United Nations defined it as “costs associated with the actual or potential degradation of natural assets as a result of economic activities. Such costs can be viewed from two angles, i.e. (a) as costs that arise or in other words are associated with economic units that actually or potentially cause environmental degradation as a result of their activities, or (b) as actual costs, which are borne by economic units regardless of whether they have caused environmental impacts (Economic and Social Information Management and Policy Analysis / Statistical Department, Studies in Methods, Environmental Statistics Terminology Dictionary, Series and Volumes., 1997), and the Society of Certified Public Accountants defined it as “including costs associated with measures taken or required to manage the environmental impacts resulting from an activity The institution, in addition to other costs imposed by the institution's environmental objectives and requirements(LABIDI, 2009/2010, p. 89) , and from the above it can be said that environmental costs are the expenses incurred by institutions as a result of the impact of their activities on the environment. These costs include what is spent to comply with environmental legislation, such as the costs of waste treatment, reducing harmful emissions, and switching to clean energy sources, in addition to the costs associated with penalties and fines that may be imposed by authorities due to breaches of environmental standards. Environmental costs may also include lost opportunities as a result of stopping or disrupting production due to environmental issues.

2.2.1 Types of environmental costs:

There are several types of costs, including:

- **Preventive costs:** These are the expenses that companies allocate to avoid or reduce pollution before it occurs. These costs include investing in environmentally friendly technologies, developing sustainable products, and improving processes to reduce the environmental impact, such as using renewable energy or recycling technologies (Study Group of Environmental System , - Developing an Environmental System Japan Agenc, 2000, p. 20).

- **Corrective or remedial costs:** These are the costs associated with repairing environmental damage resulting from the organization's activities. These can include remediation of contaminated soil or water, rehabilitation of damaged environmental sites, and implementation of measures to address harmful emissions.(LABIDI, 2009/2010, p. 90)

- **Operating costs:** These are the expenses associated with operating and maintaining environmental systems within the organization. These include operating waste treatment plants, emission control systems, and ongoing spending on pollution reduction technologies

- **Social costs:** These are the indirect costs borne by communities as a result of the environmental impacts of industrial activities, such as health deterioration or loss of natural

resources (Study Group of Environmental System ,- Developing an Environmental System Japan Agenc, 2000, pp. 11-14)

• **Legal costs:** These include fines and financial penalties imposed by government agencies on organizations for non-compliance with environmental laws and regulations. It also includes legal defense costs in the event of environmental lawsuits(LABIDI, 2009/2010, p. 91) .

2.2.2 Objectives of environmental costs:

The objectives of environmental costs are as follows(KAWAKEB & MUKDAD, 2023, p. 204) :

- ✓ Environmental costs enable the analysis of the negative impact of operational processes on the environment, in addition to programs related to protecting these resources, with the determination of their budgets and their impact on profitability, and the discovery of new ways to reduce negative environmental impacts.
- ✓ Including environmental costs in annual reports contributes to supporting the competent authorities in the state in developing long-term plans for managing natural resources and providing reports on environmental indicators for various regions to control pollution factors.
- ✓ Management, through a periodic review of environmental costs, helps uncover shortcomings in accounting programs, which enables economic units to measure environmental revenues and benefits more accurately.
- ✓ When investing in shares of economic units, environmental information provides decision-makers with a vision of the most efficient areas in combating pollution and avoids neglecting environmental pollution costs when preparing financial statements.
- ✓ Disclosure of environmental costs provides economic units with information about the nature of the activity, environmental legislation, required capital estimates, and the actual effects of compliance with regulations, in addition to compliance costs and their impact on the financial position, liquidity, and equity.

2.3. The relationship between environmental collection and environmental costs

The relationship between environmental costs and environmental collection is evident in the impact of the elements of the latter on the size of environmental costs and can be explained as follows

2.3.1 The impact of environmental taxes: This is through:

Reducing pollution: When companies face high environmental taxes due to their emissions or waste, they are more motivated to look for ways to reduce these costs, such as investing in clean technology or improving production efficiency. These efforts can lead to reducing environmental costs by reducing pollution and greenhouse gas emissions.

Changing corporate behavior: Environmental taxes may lead to a change in corporate behavior, making them adopt more sustainable practices. This can reduce environmental costs such as pollution treatment or cleaning costs...etc.

High initial costs: Companies may face high initial costs to invest in new technologies or to restructure their operations to be more sustainable. But in the long run, these investments can be profitable by reducing environmental taxes and improving efficiency(AZZI & SALMI, 2016, p. 149) .

2.3.2 The impact of environmental incentives: This is done by:

Encouraging innovation and investment: Incentives can motivate companies to adopt clean technology, such as renewable energy or low-emission production technologies(Umar, Subhani, Muhammad Nouman, Seemab, & Seemab, 2023, p. 6243). These innovations can reduce environmental costs by reducing pollution and improving resource use(FENDIS, 2016, p. 158).

Increasing efficiency: Incentives can help companies improve their resource efficiency, reducing waste and associated costs(KERDOUDI & BOUSELMA, 2018, p. 83).

Initial costs: Sometimes, qualifying for incentives may require large initial investments, such as purchasing new equipment or modifying processes. These costs can be high, but incentives may reduce these costs in the long run (KHADIR & RAGAA, 2023, pp. 966-967):

2.3.3 The impact of tax control: This is represented in:

Reducing violations: Strict control helps reduce environmental violations, which reduces environmental damage and lowers environmental costs associated with repair and compensation for damages.

Enhancing compliance: When companies know they are under continuous monitoring, they tend to improve their environmental practices to avoid fines and penalties, reducing environmental costs.

Compliance costs: Environmental control requires companies to adhere to standards and regulations, which may require allocating additional resources for internal auditing, documentation, and continuous improvement of operations (Bistra, 2023, pp. 150-152).

3. Field study:

3.1 Study sample:

The study was conducted on a facilitated random sample consisting of 60 individuals distributed to industrial establishments in the Belassal and SidiKhatab regions. The printed questionnaire was chosen to collect information, where 35 valid answers were obtained to complete the work, as shown in the following table:

Table 3. Questionnaire Distribution and AnalysisStatus

Category	Questionnaires	Percentage
Distributed	60	100%
Retrieved	40	66.66%
Canceled	5	8.33%
Valid for Analysis	35	58.33%

The following table shows us the personal characteristics of the study sample individuals, which were distributed as follows:

Table 4. Distribution of study sample individuals according to personal and functional characteristics

Personal and functional variables		Frequency	Percentage
Gender	Male	25	71.4
	Female	10	28.6
	Total	35	100,0
Age	from 20 years to less than 30 years	06	17.1
	From 30 years to 40 years	21	60.0
	More than 40 years	08	22.9
	Total	35	100,0
Educational Level	Bachelor's	20	57.1
	Master's	14	40.0
	Doctorate	01	2.9
	Total	35	100,0
Experience	From 01 to less than 05 years	08	22.9
	From 05 years to less than 10 years	14	40.0
	10 years and more	13	37.1
	Total	35	100,0

Source: Prepared by the researchers based on the (SPSS) program.

The table shows that most of the respondents are males, the majority of them are between 30 and 40 years old, all of them have at least a bachelor's degree and most of them have more than five years of experience, which enables them to answer the questionnaire efficiently.

3.2 Testing the validity and reliability of the study data:

Second, the reliability of the questionnaire: The Alpha Cronbach scale was used to determine the degree of reliability of the questionnaire in obtaining the necessary data.

Table No. (05): Cronbach's Alpha to measure the stability of the questionnaire axes

Variables		Statement numbers	Cronbach's alpha coefficient
Independent variable: environmental taxation		From 01 to 27	0.873
Dimensions	Environmental Taxe	From 01 to 08	0.757
	Environmental Incentives	From 09 to 16	0.720
	Tax Control	From 17 to 27	0.789
Dependent Variable: Environmental Costs		From 1 to 09	0.704

Source: Prepared by the researcher based on the (spss.) program.

It is clear from the table above that the stability coefficient values are high, as the first axis came with a coefficient of (0.873), while the stability coefficient of the second axis came with a value of (0.704), which indicates that the study tool enjoys a high degree of stability.

3.3 Displaying and analysis of the results of the statements related to the environmental taxation axis

This axis was divided into three dimensions. We will study each dimension separately:

3.3.1 Environmental taxes dimension:

Through the following table, we present the results of the sample members' responses to the dimension paragraphs:

Table 6. Responses of the study sample members to the statements that measure the dimension of environmental taxes

Statement number	Statement	Arithmetic mean	Standard deviation	Rank	Degree of adoption
1	The institution is informed and aware of the laws and regulations related to environmental taxes	4,46	0,886	1	Very high
2	The institution is aware of the environmental taxes imposed on it	4,29	0,893	2	Very high
3	There is a high level of awareness among employees in the institution about the importance of environmental taxes	3,63	1,087	7	High
4	There is justice in the distribution of	3,29	0,860	8	High

	environmental taxes among different industries				
5	Environmental taxes affect production costs in the institution	3,97	0,857	3	High
6	Environmental taxes affect investment decisions in your institution	3,71	0,893	5	High
7	Current environmental taxes are sufficient to reduce environmental pollution	3,71	1,045	6	High
8	Environmental taxes motivate your organization to adopt environmentally friendly practices	3,83	1,043	4	High
Environmental taxes dimension		3.86	0.95	/	High

Source: Prepared by the researcher based on the (spss.) program.

The table indicates a high awareness of environmental taxes in organizations, as the overall average reached (3.86), the highest levels of adoption were shown in statements (1) and (2) with averages of (4.46) and (4.29) respectively, reflecting the strength of awareness of the laws and taxes imposed. In contrast, statement (4) obtained the lowest average (3.29), indicating that respondents feel that there is a lack of justice in the distribution of taxes between industries, and it was also shown that taxes affect production costs (3.97) and motivate environmental practices (3.83). However, it appears that there is a need to raise employees' awareness of the importance of environmental taxes (3.63) and to work on enhancing the effectiveness of environmental policies, including taxes, to reduce pollution (3.71).

3.3.2 Tax incentives dimension:

Through the following table, we present the results of the sample members' responses to the paragraphs of the dimension:

Table 7. Responses of the study sample members to the statements that measure the tax incentives dimension

Statement number	Statement	Arithmetic mean	Standard deviation	Rank	Degree of adoption
9	The institution is informed and aware of the laws and regulations related to environmental incentives	3,66	0,968	4	High
10	The effectiveness of environmental incentives is high compared to environmental taxes	3,37	1,060	6	High
11	There are obstacles that the institution faces in benefiting from environmental incentives	3,71	0,926	3	High
12	Environmental incentives lead to reducing production costs	3,57	1,145	6	High

13	Environmental incentives affect the decisions of senior management in the institution	3,77	1,031	2	High
14	Environmental incentives lead to Increasing investment in clean technology in the organization	4,11	0,676	1	High
15	The organization receives incentives or financial support to adopt environmentally friendly practices	3,11	1,132	7	High
16	you believe that current environmental incentives are sufficient to achieve the transition to environmentally friendly practices	3,57	1,092	5	High
tax incentives dimension		3,61	1,00	/	High

Source: Prepared by the researcher based on the (SPSS) program.

The table indicates the effectiveness of environmental incentives in reducing environmental costs in industrial establishments was relatively high, with the overall average reaching (3.61), with participants' opinions varying on various aspects. The highest average was recorded by statement (14) at (4.11), reflecting the role of incentives in promoting investment in clean technology, while statement (15) received the lowest average (3.11), indicating the lack of direct financial support received by establishments. It was also found that incentives significantly affect senior management decisions (3.77) and reduce production costs (3.57), but there are obstacles to benefiting from them (3.71), which indicates the need to improve policies to maximize the impact.

3.3.3 Tax control dimension:

Through the following table, we present the results of the sample members' responses to the dimension paragraphs:

Table 8. Responses of the study sample members to the statements that measure the tax control dimension

Statement number	Statement	Arithmetic mean	Standard deviation	Rank	Degree of adoption
17	The current tax control system is effective in detecting tax evasion	3,89	,932	4	High
18	There is a need to improve the technology used in tax control operations	4,26	,611	1	Very high
19	The available human resources are sufficient to carry out tax control operations effectively	3,83	0,857	5	High
20	The tax control procedures are transparent and fair	3,51	0,853	11	High
21	The penalties imposed on tax violators are sufficient to deter tax evasion	3,51	1,095	12	High

22	I am satisfied with the Speed of response of competent authorities in handling tax cases	3,54	1,010	10	High
23	Lack of resources is a major challenge in tax control operations	4,09	0,742	3	High
24	Tax control operations reports are accurate and reliable	3,71	0,860	8	High
25	The use of modern technology contributes to improving the effectiveness of tax control	4,20	0,677	2	Very high
26	Tax control deals fairly with all taxpayers	3,60	0,847	9	High
27	You believe that tax control increases the costs of environmental compliance for your institution	3,77	0,808	6	High
Tax control		3,81	0,84	/	High

Source: Prepared by the researcher based on the (SPSS) program.

From Table (08), we note that sample members agree to a moderate degree that there is a positive impact of tax control on raising environmental costs, as the general average reached (3.81). Statement (18) showed the highest average (4.26), which reflects the need to improve technology in control processes, followed by statement (25) with an average of (4.20), which confirms the importance of technology in improving its effectiveness. In contrast, statements (20) and (21) obtained the lowest average (3.51), which indicates the respondents' weak confidence in the transparency of procedures and the fairness of the imposed penalties. The lack of resources is considered a prominent challenge according to statement (23) with an average of (4.09). The data also showed relative satisfaction with the accuracy of reports (3.71) and the speed of response (3.54), with an emphasis on the fact that tax control increases the costs of environmental compliance (3.77).

3.4 Presentation and analysis of the results of the statements related to the environmental costs axis

Here we will discuss the paragraphs of the dependent variable related to environmental costs:

Table(09): Responses of the study sample members to the statements that measure the environmental costs axis

Statement number	Statement	Arithmetic mean	Standard deviation	Rank	Degree of adoption
1	The level of environmental costs in the institution is evaluated periodically	3,83	0,785	4	High

Title :The Impact of Environmental Levies on Environmental Costs in Industrial Enterprises – A Field Study of Selected Enterprises in the Belassel and SidiKhatab Industrial Zones, Relizane Province.

2	Environmental costs affect the profitability of the institution	4,00	0,907	2	High
3	Environmental taxes are considered the most important sources of environmental costs	3,80	0,797	5	High
4	Environmental costs are considered an obstacle to adopting environmentally friendly practices	3,60	1,006	8	High
5	Environmental incentives lead to reducing environmental costs	3,57	1,008	9	High
6	The institution follows certain strategies to adapt to environmental costs	3,66	0,968	7	High
7	Environmental costs affect innovation in the field of pollution reduction in the organization	3,77	0,910	6	High
8	There are major sources of environmental costs in the organization (such as depleted energy, natural resources, and waste)	3,94	0,765	3	High
9	Environmental costs affect the reputation and image of the organization with the consumer	4,00	0,728	1	High
Environmental costs axis		3,80	0,88	/	High

Source: Prepared by the researcher based on the (spss.) program.

The results of the table indicate a positive consensus on the existence of a tangible impact of environmental costs on organizations, as the arithmetic means ranged between 3.57 and 4.00. The phrase "Environmental costs affect the reputation and image of the organization with the consumer" received the highest rank (4.00), indicating awareness of the great importance of environmental commitment. In contrast, the statement "Environmental incentives lead to a reduction in environmental costs" came in last place (3.57), with a higher standard deviation (1.008), reflecting the respondents' lack of conviction in the effectiveness of current environmental incentives. The standard deviation generally shows a slight to moderate variation, highlighting the relative convergence in the respondents' opinions. The results show - in general - a relatively high level of awareness of the importance of environmental costs and their impact on various aspects of the organization, such as profitability, innovation, and public image.

3.5 Results of Hypothesis Testing:

To verify the validity and confirmation of the main hypothesis, which is:

Null hypothesis (H0): There is no statistically significant effect at a significance level ($0.05 \geq \alpha$) of environmental collection on environmental costs on the research sample in industrial institutions.

Table 10. Results of the simple linear regression analysis to test the effect of environmental taxation on environmental costs on the research sample

Relationship	Coefficient of determination R ²	Correlation coefficient R	Probability of correlation coefficient t R	Calculated F value	Significance level SIG	A Coefficient	Constant B
Environmental taxation	0.661	0.813	0.00	64.38	0.00	0.869	0.525

Source: Prepared by The researchers based on the program (spss).

From the previous table, we can extract the model coefficients for environmental taxation and its impact on environmental costs:

It is clear to us from Table () that there is a strong and statistically significant direct relationship between environmental taxation and environmental costs, as the correlation coefficient reached 81.3%, meaning that increasing environmental taxation in general leads to a high increase in environmental costs. The coefficient of determination also reached 66.1%, meaning that 66.1% of the changes in environmental costs can be explained by environmental taxation.

Fisher's test of the significance of the model: We note from Table () that there is a statistically significant effect between environmental taxation and environmental costs, considering that the calculated F value (64.38) and its probability (0.00) are less than the significance level (0.05). These results require accepting the alternative hypothesis and rejecting the null hypothesis, meaning that there is an effect of environmental taxation on environmental costs. Based on the previous results, we accept the alternative hypothesis.

H1: There is a statistically significant effect at a significance level ($\alpha \leq 0.05$) of environmental taxes on environmental costs in industrial establishments.

The following equation can be derived from the previous table:

$$\gamma = 0.52 + 0.87X$$

$$\text{Environmental costs} = 0.52 + 0.87(\text{Environmental taxes})$$

This equation means that every one-unit increase in environmental taxes leads to an increase in environmental costs by 0.87 units while maintaining a constant minimum of 0.52.

The main hypothesis was divided into a set of sub-hypotheses according to the dimensions of environmental taxes. The following are the results of each test:

The first sub-hypothesis:

The null hypothesis (H0): There is no statistically significant effect at a significance level ($0.05 \geq \alpha$) of environmental taxes on environmental costs on the research sample in industrial establishments.

Table 11. Results of simple linear regression analysis to test the effect of environmental taxes on environmental costs on the research sample

Relationship	Coefficient of determination R^2	Correlation coefficient R	Probability of correlation coefficient t R	Calculated F value	Significance level SIG	A Coefficient	Constant B
Environmental taxes	0.571	0.756	0.00	43.95	0.00	0.628	1.374

Source: Prepared by the researchers based on the (spss.) program.

From the previous table, the model coefficients for environmental taxes and their effect on environmental costs can be extracted:

It is clear to us from Table (11) that there is a strong and statistically significant direct relationship between environmental taxes and environmental costs, as the correlation coefficient reached 75.6%, and the determination coefficient reached 57.1%, which is a strong positive degree of influence, which means that environmental taxes explain 57.1% of the changes in environmental costs.

Fisher's test of the significance of the model: We note from Table No. () that there is a statistically significant effect between environmental taxes and environmental costs, considering that the calculated F value (43.95) and its probability (0.00) are less than the significance level (0.05). These results require accepting the alternative hypothesis and rejecting the null hypothesis, i.e. there is an effect of environmental taxes on environmental costs. Based on the previous results, we accept the alternative hypothesis.

H1: There is a statistically significant effect at a significance level ($\alpha \leq 0.05$) of environmental taxes on environmental costs in industrial establishments.

The following equation can be extracted from the previous table, which shows that each one-unit increase in environmental taxes leads to an increase in costs by 0.63 units while maintaining costs at a constant minimum of 1.37.

$$\gamma = 1.37 + 0.63X_1$$

$$\text{Environmental costs} = 0.52 + 0.87(\text{environmental taxes})$$

Second sub-hypothesis:

Null hypothesis (H0): There is no statistically significant effect at the significance level ($0.05 \geq \alpha$) for tax incentives on environmental costs on the research sample in industrial establishments.

Table 12.Results of simple linear regression analysis to test the effect of tax incentives on environmental costs on the research sample

Relationship	Coefficient of determination R^2	Correlation coefficient R	Probability of correlation coefficient R	Calculated F value	Significance level SIG	A Coefficient	Constant B
Tax incentives	0.396	0.629	0.00	21.60	0.00	0.513	1.946

Source: Prepared by the researcher based on the (spss.) program.

From the previous table, we can extract the model coefficients for tax incentives and their impact on environmental costs:

It is clear from Table () that there is a medium to strong and statistically significant relationship between tax incentives and environmental costs, as the correlation coefficient reached 62.9%, and the coefficient of determination reached 39.6%, which indicates that incentives explain about 39.6% of the changes in environmental costs, which is a lower percentage than taxes, but it is still influential.

Fisher's test of the significance of the model: We note from Table () that there is a statistically significant effect of tax incentives on environmental costs, considering that the calculated F value (21.60) and its probability (0.00) are less than the significance level (0.05). These results require accepting the alternative hypothesis and rejecting the null hypothesis, i.e. there is an effect of tax incentives on environmental costs. Based on the previous results, we accept the alternative hypothesis.

H1: There is a statistically significant effect at a significance level ($\alpha \leq 0.05$) for tax incentives on environmental costs in industrial establishments.

The following equation can be derived from the previous table:

$$\gamma = 1.946 + 0.513X_2$$

$$\text{Environmental costs} = 1.946 + 0.513(\text{tax incentives})$$

This means that a one-unit increase in tax incentives leads to a decrease in costs by 0.513 units while maintaining a constant minimum of 1,946.

Third sub-hypothesis:

Null hypothesis (H0): There is no statistically significant effect at a significance level ($0.05 \geq \alpha$) for tax control on environmental costs on the research sample in industrial establishments.

Table 13. Results of simple linear regression analysis to test the effect of tax control on environmental costs on the research sample

Relationship	Coefficient of determination R^2	Correlation coefficient R	Probability of correlation coefficient R	Calculated F value	Significance level SIG	A Coefficient	Constant B
Tax control	0.408	0.639	0.00	22.75	0.00	0.633	1.38

Source: Prepared by the researcher based on the (spss.) program.

From the previous table, the model coefficients for tax control and its impact on environmental costs can be extracted:

It is clear from Table (13) that there is a moderate to strong direct relationship and statistically significant between tax control and environmental costs, as the correlation coefficient reached 63.9%, and the determination coefficient reached 40.8%, that tax control explains about 40.8% of the changes in environmental costs.

Fisher's test of the significance of the model: We note from Table No. () that there is a statistically significant effect of tax control on environmental costs, considering that the calculated F value (22.75) and its probability (0.00) are less than the significance level (0.05). These results require accepting the alternative hypothesis and rejecting the null hypothesis, i.e. there is an effect of tax control on environmental costs. Based on the previous results, we accept the alternative hypothesis.

H1: There is a statistically significant effect at a significance level ($\alpha \leq 0.05$) of tax control on environmental costs in industrial establishments.

The following equation can be extracted from the previous table:

$$\gamma = 1.38 + 0.63X_3$$

$$\text{Environmental costs} = 1.38 + 0.63(\text{tax control})$$

Indicates that each increase in tax control by one unit increases costs by 0.63 units while maintaining a constant minimum of environmental costs at 1,946.

4. CONCLUSION

The results show the importance of environmental taxation in its three dimensions in influencing environmental costs in the studied industrial institutions, as these two variables are linked by a strong and statistically significant relationship, which confirms the impact of environmental policies in general on shaping the cost of environmental compliance for institutions. The most important results can be summarized as follows:

Environmental taxes are considered one of the most important tools of environmental policy, and the results showed that they have a strong positive impact on costs in institutions, as this may affect their competitiveness, prompting them to search for innovative or creative solutions to improve efficiency and reduce negative financial impacts, meaning that they are forced to restructure their financial plans and production strategies to reduce compliance costs. This may include investing in environmentally friendly technologies to reduce the tax burden. However, work must be done to enhance the transparency and fairness of the tax system on the one hand and to spread awareness of the importance of environmental taxes to ensure that those responsible for it accept it.

Tax incentives, as a complement to taxes, aim to enhance voluntary environmental compliance by encouraging institutions to adopt environmentally friendly practices by providing tax benefits in the form of exemptions, discounts, or even financial support. The results showed that tax incentives have a moderate impact on environmental costs, indicating that they contribute significantly to reducing financial burdens, which may be reflected in an increase in investments in clean technology and improving overall environmental performance. Therefore, improving and expanding the scope of tax incentives can enhance their positive impact and encourage more institutions to adopt sustainable practices. However, they must be reconsidered and studied in depth so that they achieve their purpose by providing financial savings to institutions that enable them to invest in green technology and considering granting financial subsidies for this type of investment, similar to the incentive programs provided by the United States of America, such as clean energy tax credits. The latter helped companies such as Tesla increase investment in solar energy and electric cars. These incentives contributed to reducing costs and providing additional sources of income by selling these credits to other companies.

Tax control is an important tool to ensure compliance with environmental laws. The results of the study showed that it has a moderate to strong impact on costs. However, it must be developed in all aspects: legislation, technical aspects, technology, human resources training, and work to increase its effectiveness by making it more flexible and, in particular, more objective and transparent to increase the trust of those responsible for it. If tax control is weak in any way, it will have a direct negative impact on the effectiveness of environmental taxation, as instead of institutions turning to innovative environmentally friendly solutions, they will resort to tax crime (fraud or evasion) to reduce tax costs, which is a tangible reality confirmed by the high levels of tax crime in Algeria. The results show that environmental taxes represent the most influential dimensions, followed by control and tax incentives, which confirms the results of previous studies that confirmed that tax incentives alone are not sufficient to enhance environmental

compliance of institutions, and this is due either to the lack of awareness among these institutions or because the incentives offered are not studied, which is what this study reflects in the conflicting opinions of respondents about the effectiveness of environmental incentives in reducing environmental costs. The need to achieve a balance between using environmental taxes and control as a deterrent tool and tax incentives as an incentive for change is highlighted, as this balance can push institutions to adopt sustainable environmental strategies without negatively affecting their competitive capabilities. On the other hand, organizations should improve their strategies in dealing with environmental costs by working to promote green innovation, which can have a high financial return in the long run, although it may be costly in the short run, as shown by Porter's narrow theory, which states that environmental taxation can motivate organizations to green innovation, which benefits them in the long run. Investing in clean technology not only reduces environmental tax costs but also improves the organization's image and reputation, which attracts investors and expands its customer base. In the end, To ask about the optimal composition of environmental taxation that would achieve the highest compliance with environmental standards, the highest levels of green innovation, and the best protection of the environment from various pollutants, therefore this field can be expanded to study the effectiveness of environmental taxation in enhancing compliance with environmental policies in Algeria, as well as encouraging academic and practical scientific research and unifying efforts where practitioners can diagnose the problems posed by the practical application of laws and identify gaps and weaknesses in the current system and put them up for academic discussion to find practical solutions capable of increasing environmental awareness and thus environmental compliance, whether by benefiting from the experiences of leading countries in this field or by developing innovative solutions derived from the Algerian environment.

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