

INDUSTRIAL INVESTING AS AN INSTRUMENT OF SUSTAINABLE DEVELOPMENT IN ALGERIA (CASE IN BOUIRA PROVINCE - EASTERN ALGERIA)

Djamal BELARBI * 

University of Science and Technology Houari Boumediene (USTHB), Faculty of Earth Sciences,
Department of Geography and Land Use Planning, Algiers, Algeria, e-mail: belarbidjamal02@gmail.com

Abdelmadjid BOUDER 

University of Science and Technology Houari Boumediene (USTHB), Faculty of Earth Sciences,
Department of Geography and Land Use Planning, Algiers, Algeria, e-mail: abouder@yahoo.fr

Citation: Belarbi, D., & Boudier, A. (2023). INDUSTRIAL INVESTING AS AN INSTRUMENT OF SUSTAINABLE DEVELOPMENT IN ALGERIA (CASE IN BOUIRA PROVINCE - EASTERN ALGERIA). *GeoJournal of Tourism and Geosites*, 47(2), 459–467. <https://doi.org/10.30892/gtg.47212-1044>

Abstract: Algeria has developed an interesting manufacturing sector since its independence with the aim to develop the national economy. In this paper, we'll highlight the industrial investments that Bouira's municipal government (Eastern Algeria) made between 2003 and 2020. To achieve this goal, we used a series of LANDSAT 7ETM+/LANDSAT 8OLI satellite images acquired respectively in 2006, 2014, and 2020. The processing applied to images evaluates the normalized vegetation (NDVI), which provides an estimation of the used area for industrial investment. All processed images were combined in a GIS (Geographic Information System), to digitize subsequently industrial areas. This research shows that over 242.69 ha of Oued El-Berdi's zone was used for industrial projects.

Key words: Industrial investment, Landsat 7ETM+, Landsat 8OLI, GIS, Urban industrial mapping, NDVI

* * * * *

INTRODUCTION

Since its independence, Algeria is one of the countries that have paid great attention to the industrial sector, as it is an essential factor in driving economic growth and improving production, as well as keeping pace with developing countries (Doyle and Al-Bazzaz, 2022; Khaidher et al., 2019). After its reforms, the State's desire to promote investment in the industrial sphere was clearly demonstrated by the enactment of various laws, in order to facilitate real estate, grant concessions and alleviate fiscal expenses (Alsamara et al., 2022; Bouznit et al., 2022). However, European and African reports highlight Algeria's vulnerability in investment field. According to the Ekovan Swiss agency report; Morocco is the top destination for capital invested in North Africa, with more than half of all capital invested in the region over the past five years.

Investment funds injected more than \$ 7.1 billion into North Africa between 2010 and 2015, followed by the Kingdom, Egypt (\$ 653 million), Tunisia (\$ 26.180 million), Algeria (\$ 80 million), Sudan (\$ 1.70 million) and Libya, which attracted only \$ 1.11 million (Shah, 2016). Many countries also take advantage of industrial areas to develop other sectors, such as tourism (Insani et al., 2023; Van der Merwe and Rogerson, 2018). It is regarded as an industrial heritage that can bring tourists from different areas into the fatherland, or from abroad.

Economists attribute the reasons for the reluctance of foreigners to invest in Algeria (Werenfels, 2002) to bureaucratic obstacles; the instability of economic legislation and the lack of clarity of the Algerian market.

Concerns arising from the imposition of 51/49 investment regulation in the 2009 Supplementary Finance Act and the limited role of the private sector in Algeria (Kwasi and Cilliers, 2020).

Therefore, the Algerian authorities have decided to include new measures in the draft finance code for 2016 (Mouloud and Lalali, 2022), by which they seek to facilitate the real estate acquisition by economic clients, especially those intended for the investment projects realization. Private clients may create, develop and operate business or industrial zones throughout the national territory, unless agricultural land;

✓ Land in urban or reconstruction areas that has not been started three years after the date of the building permit is subject to a fourfold increase in the land fee;

✓ Extensive reorganization of ANIREF¹ to facilitate continued access to assets;

✓ Development of a national program of 50 industrial parks.

The volume of investments varies by region, the following figure shows in detail the distribution of investments by the National Agency of Investment Development (NAID).

The Figure 1, we note that the investments reported at the NAID vary from one province to another during the year 2020. The province of Algiers ranks first in attracting investment with 15.8% of total national investment and 45.73% of

* Corresponding author

¹ The National Agency of Intermediation and Land Regulation was created by the executive decree N° 07-119 of April 23, 2007, modified and completed by the executive decree N° 12-126 of March 19, 2012.

total investments in the central northern territory. The investment volume is concentrated in the first crowned of the north-central region, accounting for 24% of the total national investment and 69.16% of the total investments in the north central region. Algeria now knows a renaissance in the field of industrial investment. For example, in Skikda State, transformative methods are being devised for oil. This is what the researchers Doyle and Al-Bazzaz (2022) studied in order to determine the importance of this manufacturing industry to the province of Skikda and its community.

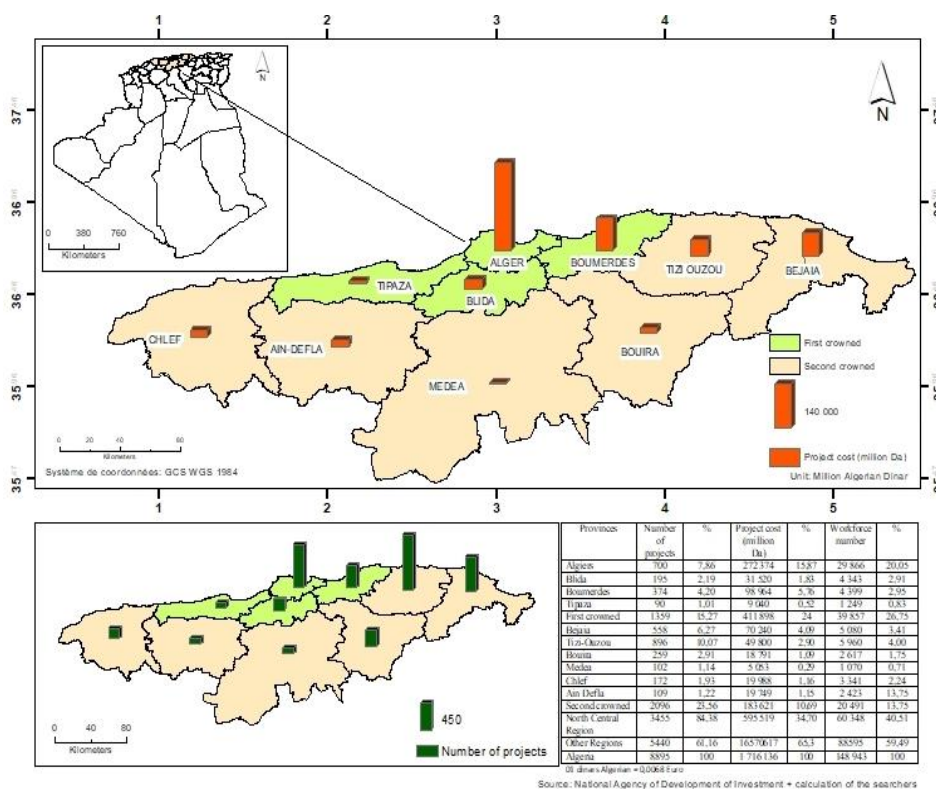


Figure 1. Breakdown of investments by region in Algeria in 2020 (Source: National Agency of Development Investment, 2020)

Bouira province got 1.09 % of total domestic investment and 3.15% of total North Central investment. Among the 10 provinces in the north-central area, it has the seventh-highest volume of investment. The increasing demand for industrial real estate in Bouira State, which is situated in a strategic location, a village from Algiers, which is only 100 km away, is what led to this venture. In addition to its moderate climate, the province has outstanding industrial qualifications, including water supply, the raw material for some industries like the building materials industry, and three dams: the "Lekhal" dam in Ain Bassam, the "Codiante Aserdoun" dam, and the "Tilsdit" dam with hams.

Bouira province has benefited from significant financial investments in the creation of the industrial zone and the locations of its activities, with a view to providing the optimum atmosphere for the promotion of the industrial sector.

Industry contributes to the creation of jobs, the provision of manufactured and semi-manufactured materials, and the generation of financial incomes for the municipality in particular and the State's treasury in general based on the taxes it pays. It also plays a significant role in achieving sustainable development. The SNAT (National Urban Development Scheme) is one of the programs that strive to achieve sustainable development, through (UNESCO, 2020):

- Assist in the development of a Contribute to the emergence of a diversified and competitive, diversified economy that uses the potential of every region and substitutes innovation and productivity growth for public expenditure.
- Strengthen the SNAT's guiding principles to ensure the region security Economical Food Energy Water.
- The leadership position played by Algeria at the regional level in preserving and valuing our nation's natural and cultural capital is very important.
- Create competitive development areas in territories by developing their resources and potential - Convert all budget-consuming industries, excluding hydrocarbons, into sources of riches and surplus value.
- SNAT's support to the growth nation's key industries, including. agriculture, tourism, industry, business, higher education, and the knowledge economy.
- A balanced distribution of the population and activities, as well as attractiveness of the national territory.

The industrial sector is one of the tasks of the plan's activities, It emphasized the need of expanding the industrial sector in order to reach the desired objectives we have previously mentioned. Therefore, promoting these settlement factors invites a regional strategy that is multi-sectoral and linked and aimed to gradually create a positive brand image of the province (Wallner, 1999). It can be declined under multiple forms: The expense and accessibility of productive land.

- Exploitation of the advantageous geographical locations in relation to the markets, for supplies and outlets of productions of the companies: these grant an importance to the proximity of their customers and their suppliers, in order to improve their productivity by the lowering the costs of transport, storage, and other related costs.

- Favorable positions in relation to transport and communication infrastructures (roads, rail, etc.) as well as an increase in the efficiency of those systems (fluidity, speed, quality and cost of services, etc.).

- Local business climate (Pedapalli et al., 2022) (responsiveness, speed and performance of the administration, climate of relations with the private sector, image perceived by investors, dynamism of the local business community, security, etc.)

- Human resources: Availability and quality of local resources (qualified personnel, available manpower); the presence of higher education structures and training institutions that are attentive to the requirements and satisfy the expectations of companies (Deac et al., 2023).

- The availability and expense of industrial solid waste management systems (collection, transport, landfills, waste disposal sites, etc.) or waste and effluent treatment infrastructures (wastewater, gaseous emissions, etc.) are additional factors of companies sites (treatment costs, solid waste, wastewater and gaseous emissions, etc.). In our study, we will outline the initiatives taken by the Algerian government and Bouira province's local authorities to promote the industrial sector. We will also carefully examine and demonstrate the detrimental effects of industrial stability on this rural area.

This study aims to evaluate industrial investment in the province of Bouira, as an example of the Algerian government's incentive to industrial investment. We are also clarifying the impact of industrial stability in the Bouira region on the ground.

MATERIALS AND METHODS

This Paper aims to assess industrial investment in Algeria, particularly in the Bouira province, and present the most important investments in the various State regions in order to understand the position that industry occupies in the area as well as the extent of industrial investment. To achieve this goal, field surveys data as well as statistics from numerous local directories have been used in this study. We have also followed the following methodology:

At the beginning of the study, we introduced Bouira's mandate and took a look at the history of industry in the province since independence (1962). Later, we tried to give a look at the current industrial sector in the state by introducing the areas of activity and industrial areas located in the province. We also presented the most important projects related to the restoration of the sectors of activity and the efforts undertaken by the provincial authorities to promote the industrial sector. We also heard about the number and activity of small and medium-sized businesses operating in the province of Bouira until 2022. In the technical aspect of the study, we used the standardized vegetation analysis index (NDVI) to study the impact of choosing the location of the industrial zone Sidi Khalid (municipality of Oued El Berdi). As well as expansion of the area and reduction of agricultural area. A series of LANDSAT 07 ETM+/Landsat 08 OLI images taken in 2006, 2014 and 2020, these images were preprocessed and processed. A standardized vegetation analysis (NDVI) resulting from images processing was integrated in a GIS in ArcGIS 10.3 software. The purpose of using a GIS is intended to show how economic stability can exist in a predominantly rural area.

The use of a GIS is intended to show how. The extent of the area's vegetation loss is thus explained, particularly in light of the industrial zone's expansion. By using the infrared band of the electromagnetic spectrum, where vegetation reflects the most energy that can be observed and recorded by a satellite sensor (Berger et al., 2020; Joiner et al., 2013; Martins et al., 2023), the NDVI is used to display the chlorophyll activity of the vegetation. According to the NDVI an area with defensible and living vegetation has a high value, while one without vegetation has a low value. However, the methodological approach is based on the calculation of the index under the following formula (Huang et al., 2021):

$$N_{DVI} = \frac{N_{IR} NIR - R_{ed} Red}{N_{IR} NIR + R_{ed} Red}$$

Where N_{DVI} is normalized difference vegetation index. R_{ed} and N_{IR} are spectral radiance (or reflectance) measurements recorded with sensors in red (visible) and NIR regions, respectively.

The situation of the study area

The province of Bouira is located in the north-central Algeria, 120 km from the city of Algiers. As a result of the administrative division instituted by Order N°74/69 of 02 July 1974, relating to the redesign of the territorial organization of the provinces (Direction, 2020), the region has an estimated area of 4454 km² (Lamri et al., 2020), bounded by: the province of Boumerdes and Tizi-Ouzou in the North; the province of Bejaia and Bordj Bou Arreridj in the East; Blida and Medea in West; the province of M'sila in South (Figure 2). Among the factors assisting Bouira's province in industrial resettlement are:

✓ Its geographical location, which makes it a crossroads for many provinces (seven provinces), as well as its proximity to the capital.

✓ Completion of the East-West Motorway.

✓ The natural resources available, as well as the economic substantial estate existing in all municipalities of the province, industrial zone, activity zones, extension of tourism zones, agricultural land, land pockets at the level of land use plans.

The province approved all of these indicators, as well as the development initiatives and programs outlined in the various plans. In addition to the policy and strategy adopted by the local authorities through their investment support and support of project promoters, have helped to attract a considerable number of investors from neighboring provinces.

RESULTS AND DISCUSSION

1. Distribution of industrial units in the Bouira province for the year 2021

The industrial sector in Bouira went through several stages, until the end of the 1974 administrative division. The state had only 04 industrial units in Lakhdaria and Bouira circles (Bouder and Tacherift, 2007):

✓ SNIC green coating unit employs 314 workers;

✓ Ben Haroun's mineral water unit employs 114 workers;

- ✓ The mill SN.SEMPAC mill employs 646 workers;
- ✓ The SONITEX unit for the furniture industry employs 150 workers.

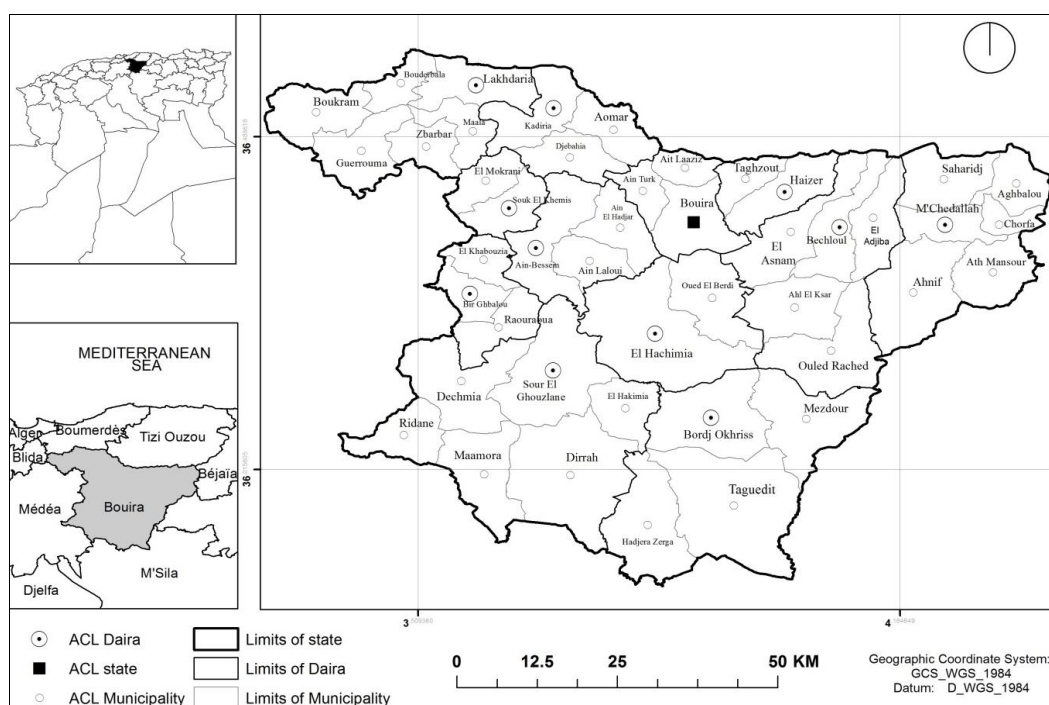


Figure 2. Location of the province of Bouira and administrative distribution

In 2021, the number of industrial units increased in Bouira province and industrial activities diversified due to the multiplicity of units belonging to various branches of industrial activity. The province has 10 national industrial units all belonging to the government. The following table illustrates this:

Table 1. Distribution of national industrial units in Bouira province 2020 (Data Source:(Direction, 2021)

Type of activity	Municipality	Number of workers	Production capacity (tons)	Production 2020 (tons)
Detergent industry (ENAD)	Sour El Ghouzlane	748	86 000	14 929
cement industry (ERCC)	Sour El Ghouzlane	353	1 000 000	780 000
Paint industry	Lakhdaria	358	51760	30654
Detergent industry	Lakhdaria	101	22 000	2900
Brick industry	Aomar	70	77 280	40255
Textile	Bouira	130	100 000 units	95 000 units
Gravel production	El Hachimia	113	75 000	49 900
Cereal processing	Ain Bessem	97	500 000	29 659
Industrial gas production	Oued El Berdi (Sidi Khaled)	57	816 000 M3	84 939 units

Table 1 shows that the volume of national public investment in agricultural and agro-industrial activity in the province does not exceed two units (grain processing) when compared to other activities, indicating that the province has a first-degree agricultural character. Central and local managers should give a great importance to the investor's orientation towards agricultural activity through industrial investments that contribute to the development of this activity.

According to experts at the National Center for Studies and Analyses on Population and Development (CENEAP), the development of the agricultural sector has become one of Algeria's most important bets economically, politically, and socially because it raises the issue of food security in the country in the medium and long term, especially after the large and rapid decline in oil revenues since 2014, which ensured Algeria's food needs and decrease the problem of drought.

The province of Bouira has 13 activity zones (Table 2; Figure 3). It is a small area equipped and adapted to the establishment of small and medium industries. It is a land area smaller than that of the activity zones and contains several production or service activities (Horváth and Szabó, 2019). In order to be useful and provide occupation positions, the activity zones provided 2112 workplaces. Since 2011, the province of Bouira has received large sums to establish and restructure the state municipalities business zones.

In 2014, the total amount was 1022739000 Da in order to finance the industrial sector and develop the areas that surrounding the territory so that it becomes attractive location for investors. According to Bouira's, Director of Industry in the development and promotion of investment, 06 mini-activity zones totaling 16.69 hectares were created across 05 municipalities (02 Bir Ghablou, 01 Djebahia, 01 Tagdit, 01 Bordj Akhris). Construction work has also started on a 2.35-hectare of land in Djebahia and Bir Ghablou, where 26 items were developed. The retail licenses for the two areas were also approved as mini-activities in Bir Ghablou and the municipality of Tagdit on an area of 7.36 hectares.

Table 2. Status of Activity Areas by Municipality as of 12/31/2020

Activity areas	Total area (M2)	Total number of lots	Number of lots awarded
Bouira D1	39 081,00	46	40
Bouira D2	118 190,00	34	34
Taghzout	53 850,00	26	23
SEG	233 352,00	153	129
Dirah	95 430,00	86	50
Lakhdaria	74 500,00	46	45
Aomar	15 580,00	18	18
El Esnam	19 097,00	13	13
Bechloul	102 456,83	30	25
M'chdallah	20 605,00	13	13
Ain Bessem	88 846,00	92	92
El Hachimia	175 141,40	69	58
Bir Ghablou	500 600,00	322	100
Zone des Clinique	7 418,00	6	6
Chorfa	284 000,00	/	/
Total	1 828 147,23	954	646

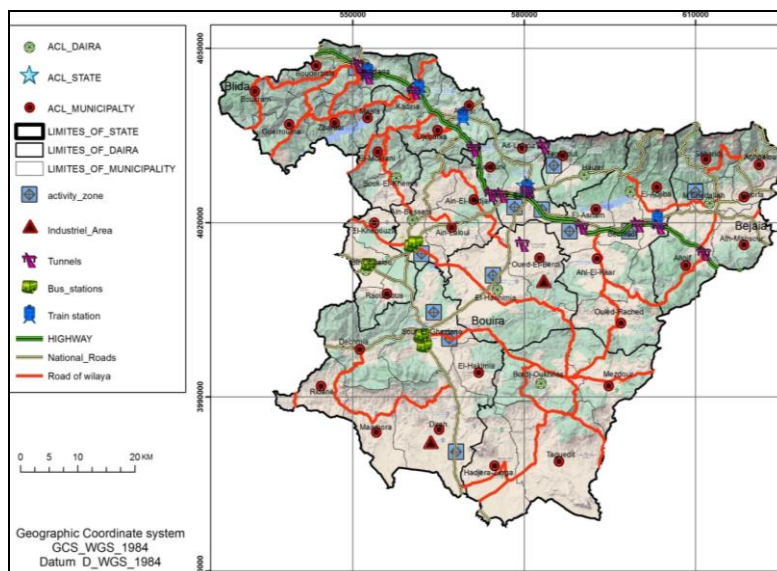


Figure 3. Distribution of activity areas in Bouira province 2021

Table 3. Financing projects for the rehabilitation of activity areas (Source: Direction of Industry and Mines of Bouira, 2022)

Year	Title of operation	Amount (da)	Percentage of progress of works
2011-10-03	Preparing and developing the activities area of Oued Haus Bouira	632208.75	%60
	Preparing and developing the Taghzout activity area	632208.75	%90
	Creation and development of Omar's activities area	632208.75	%60
2012-04-18	Creation and development of Lakhdaria activities area	842945	%85
2012-12-31	Follow-up and preparation of the activity area, Sour Al-Ghozlane	547914.25	%100
	Follow-up and preparation of the activity area in Bechloul	1095828.5	%100
2014-04-15	Studying and following up the activities area of Deira, Al Hashimiya, Ain Bassam, Al Asnam and Mechdallah	4214725	frozen process
28-12-2022	The rehailing of the activities area Ain Bessam- M'chdallah-Dirah- El Asnam- El Hachimia	500000000	frozen process

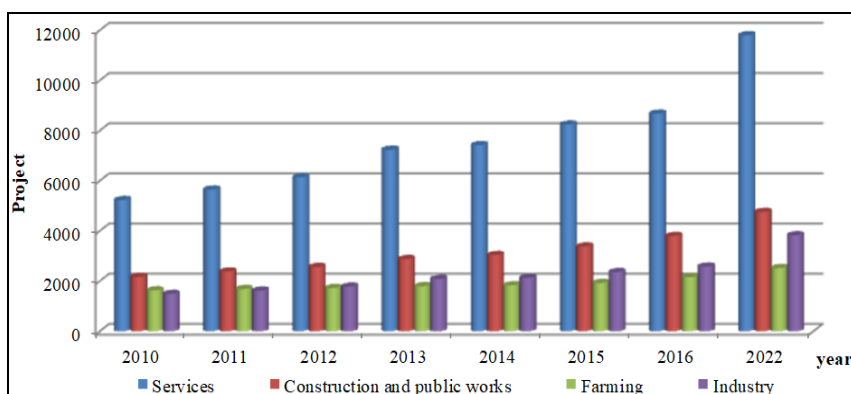


Figure 4. Rice small and medium enterprises in the province of Bouira from 2010 to 2022 (Source: Direction of Industry and Mines of Bouira, 2022)

Table 4. Distribution of investments by sectors of economic activity declared at the Bouira in 2020 (Source: National Agency of Development Investment 2021)

Sector	Number of projects		Cost of projects	
	Number	%	Amount (million DA)	%
Industry	110	60.61	2085	74.73
Agriculture	4	12.12	107	3.84
Construction and public works	3	9.09	87	3.12
Services	6	18.18	511	18.32
Total	33	100	2790	100

As for the number of small and medium enterprises located in the activity areas in the Bouira province, we will highlight them through the following Figure 4. The Figure 4 shows that Bouira province has registered an increase in SMEs across the areas. It has increased from 10534 in 2010 to 22917 in 2022. The number of SMEs in 2022 engaged in services is 11803 (approximately 50%), while the construction and public works sector is 20%. The number of projects in the field of agro-industry is 2524. In terms of the number of companies operating in the industrial sector, we have increased from 1492 in 2010 to 3831 in 2022. It also describes the rapid increase in the number of small and medium-sized businesses caused by the enactment of legislation encouraging their creation. The most important of which are:

✦ The establishment of the National Agency for Support of Youth Employment by Executive Decree 296-96 of 8 September 1996 (Bounouala and Rihane, 2019);

✦ The National Investment Development Agency ANDI by Presidential Order 01-03 of 20 August 2001 (Kebir, 2001);

✦ The Establishment of the National Investment Council for the Promotion of Small and Medium Enterprises in 25 February 2003 (Bouazza et al., 2015);

✦ Financial support from Export Support Fund (FPE), National Agricultural Development Fund (FNRDA), Stabilization Fund for SMEs (CGCIPME) (Hamza and Nassima, 2022).

Furthermore, the field investigation revealed a shortage of equipment in the industrial zone with a water utilization rate of 70%. We discover a 70% connectivity rate for sewage and 70% of roads are in good condition. Electricity connectivity is only 30%, while gas is not linked (Communal Popular Assembly, 2014). These statistics are inspired by the of the municipality’s technical interest, so local and national interests have attempted to remedy the situation by connecting the area to the Tilesdit Dam so that the area is supplied with water (Lamri et al., 2022b).

3. Declared Single Window Investment Volume in Bouira

The investments declared in the investment window of the National Agency for Investment Development (NAID) by sector for 2021 amount to more than 2700 million Da. The volume of these investments by industry is detailed in Table 4.

According to Table 4, the business in Bouira ranked first in terms of investment volume when compared to investments in other sectors. Thus, the total volume of investments reached 2085 million Algerian dinars, representing a 74.73% growth rate.

This follows the installations adopted by the National Investment Agency and its ability to dispose of industrial land. The second is the service sector at a cost of 511 million Algerian dinars, at a rate of 18.32% which is required among the majority of young people to invest. While the construction and other public works sector received 87 million dinars, representing 3.12%, agriculture received a low level of investment not exceeding 4%.

4. Breakdown of Industrial Investments Reported to the Single Investment Window (GUD) by Industrial Industries For 2020

Industrial investment in the Bouira province varies according to the branches of industrial activity, with 20 industrial investment initiatives spread across 06 branches of industrial activity (Table 5). The agricultural food industry is the first with 09 projects. The table below provides a detailed breakdown of the number of initiatives projects and the size of their investments. The table below provides a detailed breakdown of the number of initiatives and the size of their investments.

Table 5. Breakdown of industrial investment reported to the Single Investment Window (GUD) by industrial activity for 2020 (Source: National Agency for Development of Investment 2021)

Branches of industrial activity	Number of projects		Project costs	
	Nombre	%	Amount (million Da)	%
Steel, Metal, Mechanical and Electrical Industry (ISMME)	03	15.00	300	14.39
Building materials, ceramics and glass	01	5.00	640	30.70
Chemical and Plastics Industry	06	30.00	446	21.39
Food agriculture industry	09	45.00	679	32.57
Leather and textile industry	00	0.00	00	0.00
Wood, paper and cork industry	01	5.00	20	0.96
Total	20	100	2 085	100

Table 5 shows that the food industry branch comes in first place among the branches of industrial activity, in terms of volume of investment that reaches 679 million Algerian dinars or a rate of 32.57% of total industrial investments for the year 2020 declared to the Single Window Investment (GUD). The agricultural nature of the province is the primary motivator for investors in this branch, which is followed by the branch of building materials, ceramic and glass have 640 million Algerian dinars or a rate of 30.70%. The cause of the spread of this type of investment to the large number of housing projects registered in the first five-year plan (2005/2009) with 15,600 dwellings, and the second five-

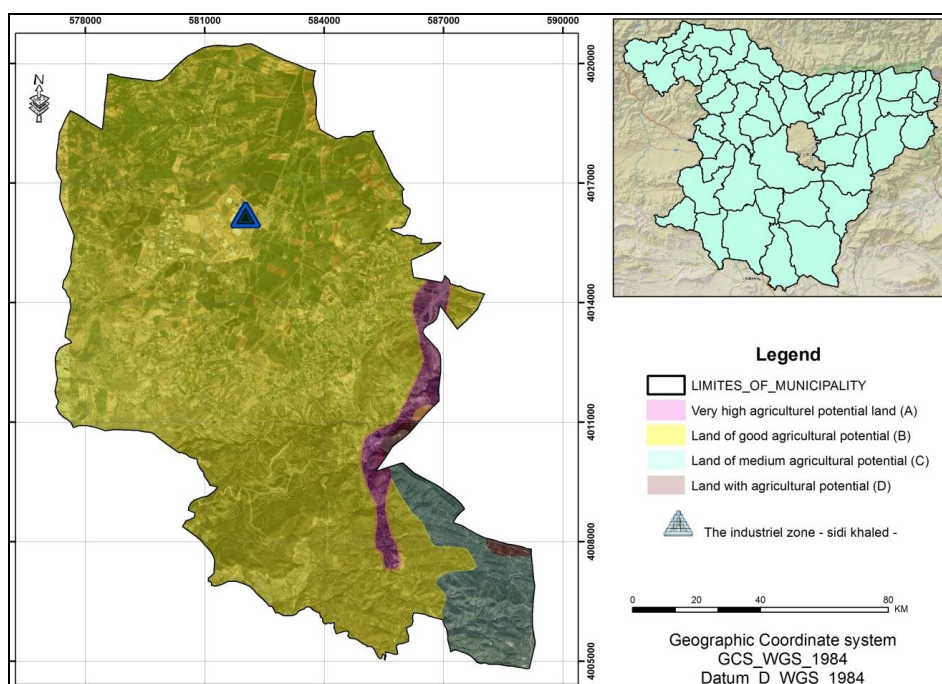


Figure 5. The Extension of The Industrial zone of Oued El Berdi (Source: PDAU Oued El Berdi, 2014)

- year plan (2010/2014) with 34,150 dwellings, which require the supply of all the materials necessary for the realization of this type of housing (ceramic, glass), followed by the branch of the plastic chemical industry with 446 million Algerian dinars or a rate of 21,39%, followed by the metal, mechanical and electrical steel industry with 300 million

Algerian dinars, a rate of 14.39%. The volume of investment in the other branches: wood, paper, cork, leather and textile manufacturing, the volume of investment is small and does not exceed 1%.

5. Appearances for Industrial Investment in the Province (industrial zone Oued El Berdi)

Owing to the increasing demand for investment in Bouira province by investors from outside, 102 investment files were submitted in 2012. This is due to site's privacy, as well as its proximity to the city (about 120 km) (Khedidji et al., 2017).

The saturation reached by the adjacent industrial zones and state, such as Algeria's capital, Burj Bouarrij, Bejaya and Setif. By decision N013 of the 51st Session of the National Investment Council, dated 19/04/2011, the local authorities of Bouira province decided to create the Sidi Khalid industrial zone (Figure 5), Oued El Berdi in an estimated area of 193 hectares (Lamri et al., 2022b). Figure 5 shows us that the industrial zone is located on good quality agricultural land, endangering the farming area and reducing the area used for agriculture, thereby reducing the area's productivity, in addition to being close to the industrial zone with the municipal urban caucus (Lamri et al., 2022a). The Industrial Zone received 990750000 Dza in funding support under the Guarantee and Solidarity Fund for Local Communities in 2019. With respect of laying the floors and connecting them to various networks (gas, electricity, water) to help investors' completion their investment projects.

The employment rate in December 2022 was 75%. Although the Oued El Berdi municipality possesses an industrial area (Samir and Nardjesse, 2019), which is planned to be expanded. According to the Bouira Industrial Directorate, it has received from an estimated financial amount of 250000000 Da for the rehabilitation of the expanded industrial zone, and the percentage of its work has reached 92% (Figure 6).

These parcels have the same natural, geological and climate characteristics as the Sidi Khaled industrial zone, they are also distinguished by their location on fertile agricultural land. The province in general and the Oued El Berdi municipality in particular (which is one of the municipalities with significant agricultural production), have important agricultural qualifications (previously mentioned), (Figure 6). However, the decision makers desired to transform the municipality into a distinguished industrial municipality, converting an extra 190 ha into industrial property. In the space images used for this study, a clear transformation can be seen in the study area since 2006.

Figure 7 shows the extent of the transformation that occurred in the Oued El Berdi region. The industrial area increased from 26.7 ha in 2006 to 55.4 ha in 2014 and reached 106.7 ha in 2020. That implies there will be less farmland. There is also the expansion of the Oued El Berdi zone, which brings it closer to the industrial park, increasing the population's exposure to pollution caused by these industrial activities. Figure 8 shows the decline of agricultural land from 300.8 ha in 2006 to 10.04 ha

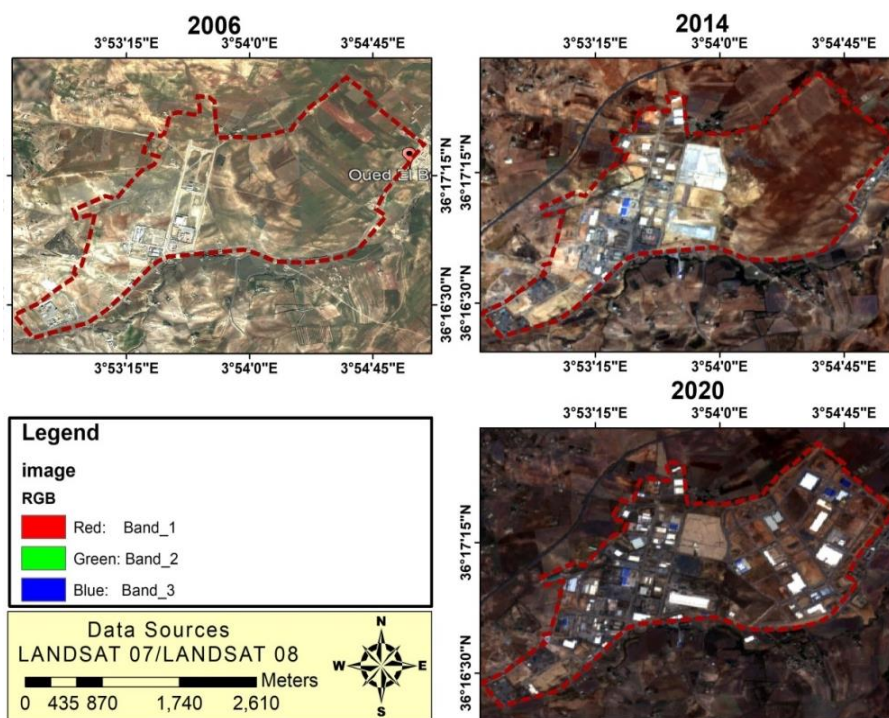


Figure 6. Project of the extension of the Oued El Berdi industrial zone (Source: Landsat 07/ Landsat 08)

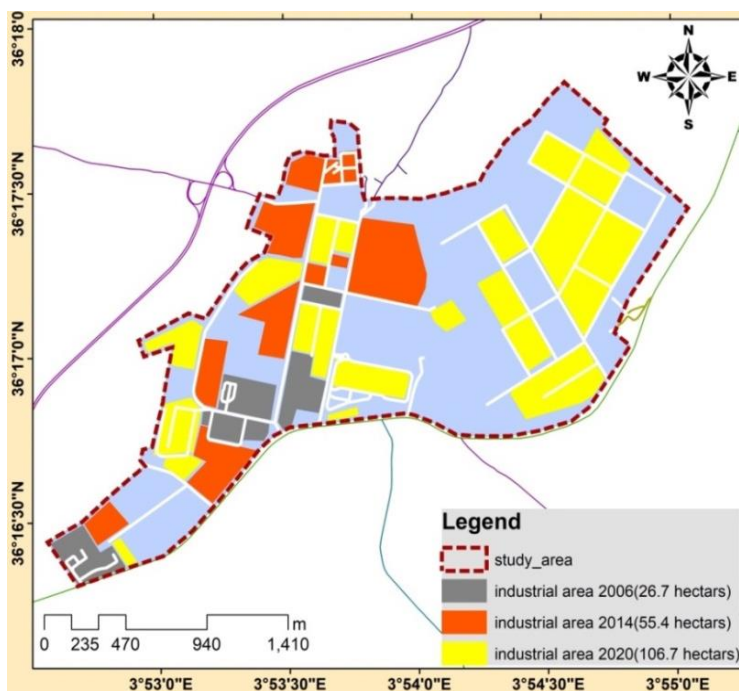


Figure 7. The transformation of Oued El Berdi from an agricultural land into an industrial barn

in 2014 and thento 65.31 ha 2020 in (decrease of 235.49 ha). This area can be interpreted as a parcel used in agriculture prior to 2006, and it is a higher-quality area, as is the case for the entire municipality of Oued El Berdi which has seen reduction in agricultural land from 7308 ha in 2006 to 7014ha in 2020 (DSA Bouira, 2021) (a decrease of 294 ha).

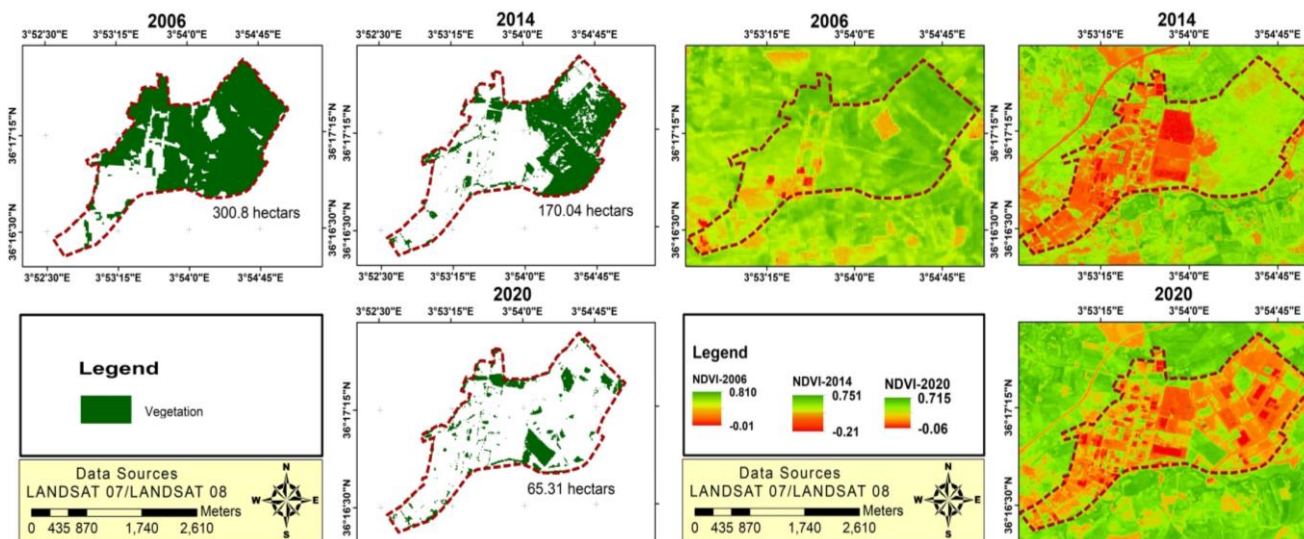


Figure 8. The changes of the industrial zone of Oued El Berdi (2006-2020) Figure 9. Resulting NDVI maps (Source: Landsat 07/ Landsat 08)

When the NDVI of the area is calculated, it is observed that the area contains dense and active vegetation in 2006 due to agricultural exploitation, then it decreases more and more in 2014 since the wheel color is dispersed in half of this image and in 2020 it is the entire area that takes the red color and the NDVI reaches 0.06 (Figure 9).

CONCLUSION

The province of Bouira contains 13 Activity areas and an industrial zone, it is considered one of the provinces of the second ring of the central northern region of the city of Algiers, the majority of which suffer from problems and obstacles to the upgrading and development of its investments, resulting in management and organizational difficulties, however, these areas have contributed on the polarization of many industrial investments, in accordance with the single counter of investment that will inevitably contribute to the strengthening of the agricultural sector to the mandate through the rehabilitation of available agricultural land, and the exploitation of various agricultural products in manufacturing and food industries. Industrial investments in the province control the private sector to the public sector, and most of the subjects of business and private sector are not related to other industrial activities located in the province.

What can be deduced that the province of Bouira has promising prospects in the field of industrial investments thanks to the availability of the property of the extension of the industrial zone of Sidi Khaled and offers three new industrial zones on the one hand and provides all the factors that contribute to industrial investment in this province on the other.

According to our research, the Bouira province is losing more and more agricultural land due to industrial development, which has an impact on the agricultural production and air pollution. However, the local authorities expect a reasonably high return on this industrial investment.

Author Contributions: Conceptualization, B.D. and B.A.; methodology, B.D. and B.A.; software, B.A. and B.D.; validation, B.D. and B.A.; formal analysis, B.D. and B.A.; investigation, B.D. and B.A; data curation, B.A. and B.D; writing - original draft preparation, B.D. and B.A.; writing - review and editing, B.D. and B.A.; visualization, B.D. and B.A; supervision, B.D.; project administration, B.D. All authors have read and agreed to the published version of the manuscript.

Funding: Not applicable.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study may be obtained on request from the corresponding author.

Acknowledgments: The research undertaken was made possible by the equal scientific involvement of all the authors concerned.

Conflicts of Interest: The authors declare no conflict of interest.

REFERENCES

Alsamara, T., Farouk, G., & Adel, A. (2022). Public health and the legal regulation of the pharmaceutical industry in Algeria. *The Pan African Medical Journal*, 41. <https://doi.org/10.11604/pamj.2022.41.86.31524>

- Berger, K., Verrelst, J., Féret, J.B., Wang, Z., Woche, M., Strathmann, M., & Hank, T. (2020). Crop nitrogen monitoring: Recent progress and principal developments in the context of imaging spectroscopy missions. *Remote Sensing of Environment*, 242, 111758. <https://doi.org/10.1016/j.rse.2020.111758>
- Bouazza, A.B., Ardjouman, D., & Abada, O. (2015). Establishing the factors affecting the growth of small and medium-sized enterprises in Algeria. *American International Journal of Social Science*, 4(2), 101-115. <https://www.scinapse.io/papers/2183751796>
- Bouder, A., & Tacherift, A. (2007). L'industrialisation de la kabylie: L'émergence d'une vocation. *Sciences & Technologie. D, Sciences de la terre*, 91-96. <http://revue.umc.edu.dz/index.php/d/article/view/460>
- Bounouala, R., & Rihane, C. (2019). Commercial banks in microfinance: entry strategies and keys of success. *Innovations*, 11, 1-1. https://www.businessperspectives.org/images/pdf/applications/publishing/templates/article/assets/5733/imfi_en_2014_01cont_Bounouala.pdf
- Bouznit, M., Elaguab, M., Selt, M.M., Himrane, M., & Aïssaoui, R. (2022). Climate change and agricultural production in Algeria. *Climate Change in the Mediterranean and Middle Eastern Region*, 249-268. https://doi.org/10.1007/978-3-030-78566-6_12
- Communal Popular Assembly, B. (2014). Master Plan of Land Use and Urbanism (PDAU).
- Deac, L., Gozner, M., & Herman, G. (2023). The dynamics of human resource by ethnicity in the lands and areas of crișana region in the perspective of sustainable development. *GeoJournal of Tourism and Geosites*, 46(1), 194-199. 7. <https://doi.org/10.30892/gtg.454spl10-981>
- Direction of Planning and Budget Monitoring. (2020). Monograph of Bouira.
- Direction of Planning and Budget Monitoring. (2021). Monograph of Bouira.
- Doyle, M.H., & Al-Bazzaz, S.T.A. (2022). The Development of the Industrial Sector in Algeria (from 1999 to 2008). *Adab AL Rafidayn*, 52(89.1). <https://www.iasj.net/iasj/article/243002>
- Hamza, F., & Nassima, B. (2022). *The Impact of Financial Development on Economic Growth: Empirical evidence from Algeria*. <https://www.asjp.cerist.dz/en/downArticle/530/6/2/201081>
- Horváth, D., & Szabó, R.Z. (2019). Driving forces and barriers of Industry 4.0: Do multinational and small and medium-sized companies have equal opportunities? *Technological forecasting and social change*, 146, 119-132. <https://doi.org/10.1016/j.techfore.2019.05.021>
- Huang, S., Tang, L., Hupy, J.P., Wang, Y., & Shao, G. (2021). A commentary review on the use of normalized difference vegetation index (NDVI) in the era of popular remote sensing. *Journal of Forestry Research*, 32(1), 1-6. <https://link.springer.com/article/10.1007/s11676-020-01155-1>
- Insani, N., Narmaditya, B., Habibi, M., A'Rachman, F., & Majid, Z. (2023). Prospect and challenges with penta helix model for unesco global geopark and local economic development: A lesson from indonesia. *GeoJournal of Tourism and Geosites*, 46(1), 156-162. <https://doi.org/10.30892/gtg.46117-1011>
- Joiner, J., Guanter, L., Lindstrot, R., Voigt, M., Vasilkov, A., Middleton, E., & Frankenberg, C. (2013). Global monitoring of terrestrial chlorophyll fluorescence from moderate spectral resolution near-infrared satellite measurements: Methodology, simulations, and application to GOME-2. *Atmospheric Measurement Techniques Discussions*, 6(2), 3883-3930. <https://doi.org/10.5194/amt-6-2803-2013>
- Kebir, Y. (2001). Algeria. *Yearbook of Islamic and Middle Eastern Law Online*, 8(1), 284-290. https://brill.com/view/journals/yimo/8/1/article-p284_.xml
- Khaidher, K., Safi, W., & Eneizan, B. (2019). Small and Medium Enterprises as a Strategic Choice for Development Case Study of Algeria. *International Journal of academic research in business and social sciences*, 9(3). <http://dx.doi.org/10.6007/IJARBSS/v9-i3/5632>
- Khedidji, S., Balducci, C., Ladji, R., Cecinato, A., Perilli, M., & Yassaa, N. (2017). Chemical composition of particulate organic matter at industrial, university and forest areas located in Bouira province, Algeria. *Atmospheric Pollution Research*, 8(3), 474-482. <https://doi.org/10.1016/j.apr.2016.12.005>
- Kwasi, S., & Cilliers, J. (2020). Stagnation or growth? Algeria's development pathway to 2040. *ISS North Africa Report*, 2020(5), 7-48. <https://hdl.handle.net/10520/ejc-isnar-v2020-n5-a1>
- Lamri, N., Bachouche, N., & Bentaleb, L. (2022a). Evaluation of the treatment of purified wastewater in the city of Bouira (Algeria). *Technium Soc. Sci. J.*, 37, 573. <https://doi.org/10.47577/tssj.v37i1.7695>
- Lamri, N., Belayadi, A., & Abbas, F. (2022b). *Evaluating the combination of agriculture and industry sectors in the Province of Bouira (North Algeria)*. <https://www.asjp.cerist.dz/en/downArticle/598/5/2/200225>
- Lamri, N., Bouder, A., & Bendib, A. (2020). The Impact of Precarious Habitat's Eradication on Socio-Economic and Spatial Changes in State of Bouira, Algeria. *Journal of Settlements and Spatial Planning*, 11 (1), 17-30. <https://doi.org/10.24193/JSSP.2020.1.03>
- Martins, G.D., Santos, L.C.S., dos Santos Carmo, G.J., da Silva Neto, O.F., Castoldi, R., & de Oliveira Charlo, H.C. (2023). Multispectral images for estimating morphophysiological and nutritional parameters in cabbage seedlings. *Smart Agricultural Technology*, 100211. <https://doi.org/10.1016/j.atech.2023.100211>
- Mouloud, A., & Lalali, R. (2022). Private Investment in Algeria: Timeline of 60 Years of Unfinished Legal Reforms (1962–2022). *les cahiers du cread*, 38(3), 197-228. <https://doi.org/10.4314/cread.v38i3.8>
- Pedapalli, S.C.K., Gupta, B., & Mahajan, P. (2022). Climate change and tourism: a paradigm for enhancing tourism resilience in SIDS. *Worldwide Hospitality and Tourism Themes*(ahead-of-print). <https://doi.org/10.1108/WHATT-07-2022-0081>
- Samir, A.A., & Nardjesse, M. (2019). The role of the University of Bouira in the creation of the entrepreneurial spirit. <https://www.asjp.cerist.dz/en/downArticlepdf/314/8/1/100626>
- Shah, M.H. (2016). *Financial development and foreign direct investment: The case of Middle East and North African (MENA) developing nations*. <https://mpira.ub.uni-muenchen.de/id/eprint/82013>
- UNESCO. (2020). National Plan of Territorial Development. <https://fr.unesco.org/creativity/policy-monitoring-platform/plan-national-damenagement>
- Van der Merwe, C.D., & Rogerson, C.M. (2018). The local development challenges of industrial heritage in the developing world: Evidence from Cullinan, South Africa. *GeoJournal of Tourism and Geosites*, 21(1), 186-199. http://gtg.webhost.uoradea.ro/PDF/GTG-1-2018/280_Merwe.pdf
- Wallner, H.P. (1999). Towards sustainable development of industry: networking, complexity and eco-clusters. *Journal of cleaner production*, 7(1), 49-58. [https://doi.org/10.1016/S0959-6526\(98\)00036-5](https://doi.org/10.1016/S0959-6526(98)00036-5)
- Werenfels, I. (2002). Obstacles to privatisation of state-owned industries in Algeria: the political economy of a distributive conflict. *The Journal of North African Studies*, 7(1), 1-28. doi: <https://doi.org/10.1080/13629380208718455>