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THE COMPOSITION OF THE PETROLEUMSCAPE OF PORT CITIES IN NORTH AFRICA, THE CASE OF SKIKDA (ALGERIA)

LA COMPOSITION DU PAYSAGE PÉTROLIER DES VILLES PORTUAIRES D'AFRIQUE DU NORD, LE CAS DE SKIKDA (ALGÉRIE)

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Abstract
This article discusses the composition of the petroleumscape, using Carola Hein's hybrid, multiple, transformative and uneven ways of multi-layering, and its impact on societies such as industry, administration, architecture, oil culture and citizens' response to the petroleumscape, This approach is presented in a panel, which is projected on Skikda, the northeast stronghold of the Algerian oil industry in North Africa, as a case study. Citizen feedback as a component layer of the petroleumscape is presented through the text mining method, which is a word cloud text visualization. This study deals with aspects of the petroleumscape, their economic and cultural importance and their impact on the city and society of Skikda.

Keywords
petroleumscape, oil industry, society, Skikda, Algeria, Hein approach, cloud text, architecture

Résumé
Cet article discute la composition du paysage pétrolier, en utilisant les modes hybrides, multiples, transformatifs et inégaux de Carola Hein, ainsi que son impact sur les sociétés telles que l'industrie, l'administration, l'architecture, la culture pétrolière et la réponse des citoyens au paysage pétrolier. Cette approche est présentée dans un panel, qui est projeté sur Skikda, le bastion nord-est de l'industrie pétrolière algérienne en Afrique du Nord, comme étude de cas. Le feedback des citoyens en tant que couche constitutive du paysage pétrolier est présentée par la méthode de l'exploration de texte, qui est une visualisation de texte en nuage de mots. Cette étude traite des aspects du paysage pétrolier, de leur importance économique et culturelle et de leur impact sur la ville et la société de Skikda.

Mots-clés
paysage pétrolier, industrie pétrolière, société, Skikda, Algérie, approche Hein, nuage de texte, architecture

INTRODUCTION

Bird approached the relationship between city and port by considering ports as gateways, and from British ports he developed the Anyport model in 1963, which deals with the dynamics of port evolution of maritime technologies, port infrastructures and their activities, in the temporal and spatial dimensions. The Anyport model also addresses the relationship between the port and the urban core, and the impact of the development of naval architecture on the efficiency of the port, thus imposing a discontinuous spatial development with the oldest port sites, or the relationship between port and city spans centuries of development (Bird, 1980; Notteboom *et al.*, 2022).

In addition, containerization is, perhaps, the most visible factor in the separation of port and city, but other industrial activities have long required some separation between port and city (Urbanyi-Popiołek & Klopott, 2016). Oil storage, refining and transportation have become a key element in the development of the world's ports and the petroleumscape (Hein, 2018). Over the past one hundred and fifty years, the global increase in oil consumption, since the 1950s, it has encouraged the creation of large industrial areas (Couling & Hein, 2018). As a result, new oil and gas facilities have emerged in port areas and created a new energy and geographic interface that has affected the urban landscape, where ports around the world have facilitated global oil flows and built extensive infrastructure for oil transportation, storage and processing, including refineries, storage tanks and pipelines. (Hauser *et al.*, 2021)

Between the 1960s and 1970s, ports faced the challenge of attractiveness and port competition,

of which the concentration of the economy and the encouragement of agglomeration processes, were solutions to attract customers and suppliers (Ducruet, 2010). These solutions, led to the emergence of industrial-port development, and its maritime industrial development areas (MIDAs) (Ducruet *et al*., 2010). MIDAs, are indeed a combination of large-scale industry, equipped with extensive maritime infrastructure and pipeline transportation facilities (Dunford & Yeung, 2009).

Furthermore, the Maritime Industrial Development areas (MIDAs) are a model to promote regional industrialization and improve economic growth such as the port of Açu in Brazil, considered the largest oil industrial agglomeration with maritime access in South America. This seaport is located in a moderately populated rural area, which has been affected by the transition of activities from agriculture to heavy industry, deeply impacting the local ecosystem. However, the condensation of industry in the agglomeration has been beneficial for the regional economy thanks to the industrial-port activities mainly in the oil field. (Beynet, 2020; Neves *et al.*, 2022)

The economic activities of the oil industry, such as oil refining and transport, are at the heart of port clusters, as in the case of the seaport of Rotterdam, whose port spaces have influenced the spatial structure and planning of the city/port interface (Ducruet, 2008). The limited availability of land and the increase in its prices, particularly for chemical and oil activities, has led to the clustering of companies on the same site and to the intensification of storage space for chemical and oil products, in order to reduce the need for storage areas (Langen, 2015). These solutions have thus allowed the port space and the soils contaminated by industrial-port activities to be valorized, creating more efficient port clusters, as regional and industrial concentrations of economic activities (Krugman, 1991; Zreik *et al.*, 2017).

The history of oil as an element of spatial transformation and expansion of industrial activities on land and sea has contributed to the production of the petroleumscape, and the reclamation of the sea. The concept petroleumscape depends on a tangible material that affects the physical space, in terms of architecture and landscape, and that has contributed to the emergence of various spatial development of oil manifestation. The petroleumscape is the result of collaboration between various actors, of which oil itself has become a dynamic actor in shaping the landscape, the built environment, and the political and military environment. The petroleumscape is composed of several layers, each with its own function and typology; however, these layers attract additional functions, generating the formation of a secondary petroleumscape, whose complexity will contribute to the strengthening of the petroleum infrastructure (Couling & Hein, 2020; Hein, 2022).

Supposed to make life easier, oil has caused inequalities and jeopardized the future of humanity (Hein, 2022). Faced with this critical situation, oil industry actors around the world, in collaboration with the public, have launched initiatives aimed at creating an energy culture as part of the petroleumscape (Hein, 2022). This initiative focuses on making the use of oil a positive factor in daily life, preserving the reign of oil as an energy source, by optimizing the economic interests of oil companies (Hein, 2022). Over the last decade, former oil and industrial ports have appeared in the petroleumscape as abandoned industrial wastelands (Rey & Lufkin, 2015), these sites require special attention as underutilized land resources, and a clean-up of historic environmental pollution. (De Valck *et al.*, 2019; Hein, 2010). Unlike previous waterfront redevelopment projects that incorporated historic ports (Porfyriou & Sepe, 2017), these areas are much larger and necessitate different revitalization approaches for the next generation of waterfront regeneration (Berry *et al.*, 1991).

In this context, Skikda is a prehistoric city, located in the northeast of Algeria with a new Mediterranean oil port. The city has a long history linked to the sea, towards its foundation by the Phoenicians, it was called Rusicade in ancient times. Then the Romans, the Vandals and the French occupied it (Guyon, 1852). Today, Skikda plays an important role at the national and regional level through its industrial and port activities.

I. METHODOLOGY

According to Carola Hein, the concept of petroleum spatial landscape aims to go beyond the segmented, mono-disciplinary and localized approach to oil spaces. The oil spaces appear as a physical, social and economic resultant between the practices of

companies, governmental actors, and oil activities, under the public/private sectors. This particular spatial network impacts and is impacted by urban planning, policy and regulation, and then, it manifests it in the daily lives of citizens (Hein, 2018).

Understanding the multiplicity of oil spaces and their interconnectedness with physical, spatial, temporal, economic, and social entities, allows us to understand the complex interrelation and mutual constitution of spatial networks that support petroleum exploration. The petroleum spatial landscape is derived from the layering of several layers, provided by the collaboration of different actors in hybrid, multiple, shifting, and uneven methods, from which they derive three main layers, composed of several sub-layers. The sub-layers present and discuss the different elements of the petroleum spatial landscape through its industrial, commercial, administrative, infrastructural, auxiliary, architectural, and philanthropic components (Hein, 2022).

Using this approach, the paper consists of the projection of these layers on the case of Skikda in order to build a specific panel model of the case study, in light of the type of panel that extends the different layers edited by Carola Hein (Figure 1). Therefore, the results can reflect an overview of the composition of the Skikda petroleumscape. The first panel describes each layer and sub-layer by points. The second panel is presented under photos taken by the authors. The last layer that evolved the response of the citizens will be translated by a small questionnaire survey, using feedback like a tool, for the target population to express its impressions about the petroleumscape of Skikda. The results of the collected words will be considered as a lexicon of citizen feedback, from which it will first be processed on a graph by Microsoft Excel software, then, it will be generated using a word cloud generator online, in the form of a lexical cloud. After that, the cloud will be inserted into the panel of the hybrid, multiple, changing and uneven ways in which many actors collaborate to create the global petroleumscape.

According to Maurice Harteveld, and from discussions of the PCF team[1], the mind mapping method is adopted in the field of urban design, in order to create a link between the history of the port city and its future, (Moughtin *et al*., 2003; Carmona *et al*., 2003; Larice & Macdonald, 2013; Sheppard, 2015). Mental map consists of translating the subconscious representation of the life experience of the port city on paper, the use of this method aims to reveal the hidden dimensions of port cities and understand their complex nature. Dependent on the experimental research of psychophysical correlations, the mental map thus makes it possible to demonstrate the unobserved (Boring, 1934), linked to an identity of the port cities.

II. THE CASE STUDY

A. Algeria, a young oil industry stronghold

Algeria, the oil giant of North Africa (Bardot *et al*., 2010), is rich in fossil fuel reserves, ranked 10th in the world for natural gas reserves and 16th for oil reserves. These capacities have allowed it to be one of the main exporters of hydrocarbons and the sixth largest exporter of gas worldwide (Riccardi *et al.*, 2021). Oil was first discovered in the Algerian desert in January 1956, at the Ain Amenas region. The discovery of the largest Algerian oil field, Hassi Messaoud, took place in June of the same year (Malti, 2010). Thus, Algeria has a hydrocarbon domain subdivided into three provinces: The Eastern province which dominates the basins of Berkine, Wadi Mya and the Amguid-Messaoud mole, the deposits of Hassi Messaoud (oil) and Hassi R'mel (gas). The western province includes the dry gas basins of Ahnet, Timimoun, Bechar-Wadi Namous, Reggane, Tindouf, Taoudeni and Sbâa. The Northern Province contains the basins of South-East Constantinois-Melrhir, Hodna, Chelif, Offshore and Saharan Atlas[2].

Algeria exports these hydrocarbons mainly by sea (Benmecheta & Belkhir, 2018). In 1979, the Algerian state planned the erection of three key sites for the export of hydrocarbons by sea: in the east, the centre and the west of the country. Gas was pumped from the south to the Mediterranean terminals of Arzew and Skikda (Shammas, 1999). Where Skikda, is chosen to play the role of the eastern gateway of the oil trade. This city has become a major element of the petroleumscape and of the Algerian economy, as the major refinery of Algeria[3], and the second Algerian maritime terminal for the export of gas and oil products from the extraction sites of the great Algerian Sahara (Ghennaï *et al*., 2022).

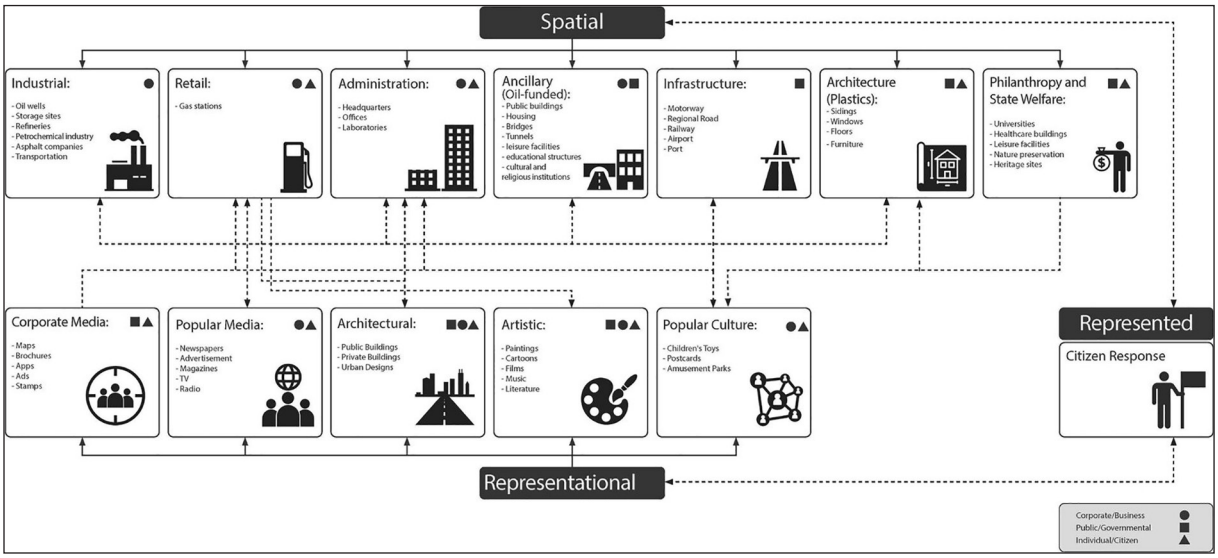

Figure 1. The hybrid, multiple, shifting, and uneven ways in which many actors are collaborating to create the global petroleumscape. Source: Carola Hein, 2022

Today, Algeria ensures the export of these hydrocarbon products by its 22 systems of transport by the pipeline (STP), which extends over a total length of 20 705 km on the Algerian territory. This system is equipped by infrastructures of transport, with regard to the stations of compression and pumping, the stations of sectioning, the dispatching, and the stations of loading to quay and in sea, at the level of the three oil harbours of Algeria: Arzew, Bejaïa and Skikda[4]. The oil infrastructures of Algeria confer it to impose its political balance in the region which reflects the social, economic and political complexity of the oil port cities of Algeria.

B. The History of the oil Industry in Skikda

Throughout history, the ports of Skikda have always played an important role in the economy and maritime trade, until the launch of the oil industry as the backbone of the Algerian economy. Whereas, Skikda's refining complex was built in the seventies by the Italian company SNAM-PROGETTI, assisted by three Algerian companies SONATRO, SONATIBA, and SNMETAL. The construction was launched in 1976, and the work was completed in 1980. The refinery was commissioned in 1981, but the official inauguration of the complex was on November 27, 1983, with a gradual start-up of the units, such as the pre-treatment and catalytic reforming unit, and the LPG treatment and separation unit, which started in 1993 (Kaoud, 2020).

In addition, the mixed port of Skikda was built between 1860 and 1890 by the French colonization (Salva & Ribaucour, 1892). After the independence of Algeria, the authorities began to develop this port by the creation of the mole of Green Castle in 1965, and the crew of the port by three oil jetties, in 1969. These operations aimed to adapt the old port with its future functions of maritime transport of hydrocarbons, especially after the installation of the refinery of Skikda in 1979 (International Business Publications, 2016). This development of the petroleumscape in Skikda, required a modern oil port compatible with the new industrial orientation of the city, as a hydrocarbon hub of the northeast Algeria. Consequently, the Algerian government will place the city of Skikda in the heart of the oil economy (Malti, 2010.), by continuing the development of the hydrocarbon port of Skikda until today (Ghennaï & Madani, 2020).

However, port and oil activities have a strong impact on the environment in Skikda, especially due to the discharge point of wastewater from the oil refinery, which is insufficiently treated (Belahmadi *et al.*, 2021). As a result, chemical substances contaminate the seawater of Skikda, such as polychlorinated aromatic hydrocarbons, polycyclic hydrocarbons and heavy metals (Mudu *et al.*, 2014). Due to the hydrophobic nature of the water, the concentration of pollutants is in the organic matter and sediments, which poses a serious threat to the marine ecosystem and the rare biodiversity of Skikda's deep waters (Belahmadi *et al.*, 2021).

The petroleumscape in Skikda is also characterised by vulnerability, due to the various hazardous acci-

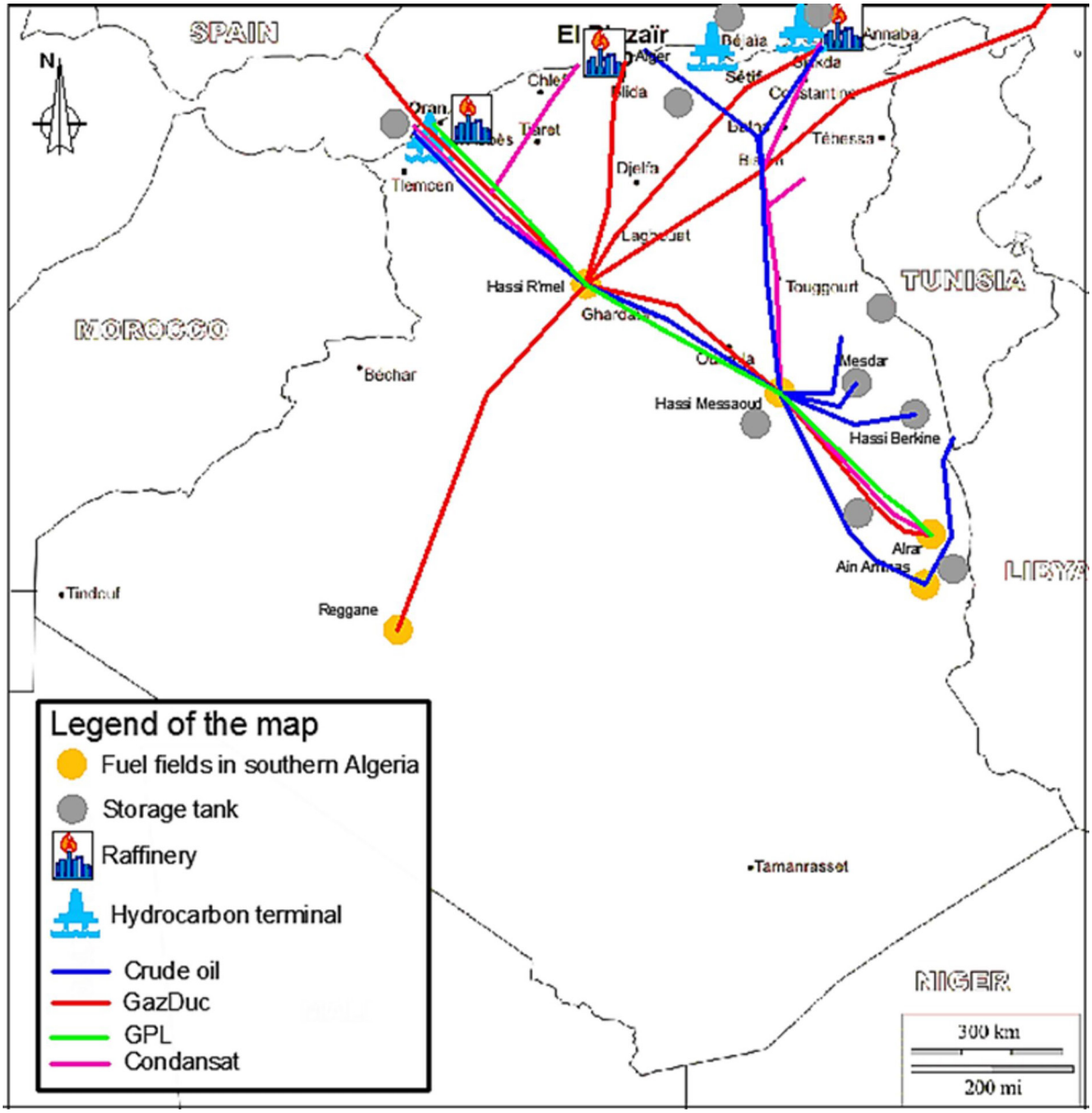

Figure 2. Approximate map of extraction veins and pipeline transport of fuel energy in southern Algeria to refineries and oil ports in northern Algeria. Source: The authors, 2022, are based on data from the hydrocarbon pipeline network description document provided by sonatrach in 2021 - https://sonatrach.com/wp-content/uploads/2021/02/DESCRIPTION-DU-RESEAU-DE-TRANSPORT-PAR-CANALISATION-DES-HYDROCARBURES-TARIF-DE-TRANSPORT-ANNEE-2021.pdf

dents that Skikda had witnessed between 2004 and 2022 (Samia *et al.*, 2018). In recent years, industrial facilities have experienced a rapid increase in the number of major industrial accidents and disasters in Skikda, where Domino effect fires and explosions in the Skikda oil refinery (Smaiah *et al.*, 2019), have caused severe impacts and effects on people, property and the environment (Ait Ouffroukh *et al.*, 2018). Because of these severe damages, Skikda has become an industrial threat zone, making the city unsafe (Taibi *et al.*, 2022), and an important case of the urban vulnerability (Benouar, 2006).

C. The oil Spaces and petroleumscape in Skikda

The petroleumscape in Skikda is composed of several elements spread over its vast territory; this landscape combines oil spaces such as the plant, the refinery, the oil port, the smoke emissions, the black tides, the dynamics of oil tankers and hydrocarbon transport ships, and all manifestation of the oil rent on the building environment. In this context, the oil and gas terminal of Skikda, connects the largest refinery in Africa (Amungo, 2020) with the second largest port in Algeria, making an overlapping pe-

troleumscape between the liquid aspect of the sea, and the solid aspect of the land.

The petrochemical complex of Skikda and the oil port present the main and basic components of the oil spaces and petroleumscape in Skikda, the petrochemical complex consists of two refineries, called RA1.K, and the refinery of Topping Condensate, RA2.K. equipped by two units of hydrocracking of fuel oil and treatment of naphtha surpluses, two complexes of liquefaction and separation of natural gas GL1K and GL2Z, the petrochemical complex CP2K, two petrochemical complexes in partnership, the Helison Complex, and the Helios Complex[5] (Ghennaï *et al*., 2022).

The petrochemical complex is considered as the entry point of oil and gas in Skikda, which will be piped to the oil port, considered as the last exit point of Algerian hydrocarbons, the port of Skikda, is one of the ports dedicated to the export of surplus crude oil and condensate to the international market. Despite the adoption by Sonatrach of international norms and standards in order to ensure optimal conditions of safety and respect for the environment, the risk remains present in the petroleumscape of Skikda. The vulnerable aspect of a circuit of hydrocarbon pipelines in the heart of an urban fabric creates a critical situation of a petroleumscape composed of polluting elements. Therefore, the soil contamination, oil slicks, and the uncomfortable visual aspect characterize the petroleumscape of Skikda, as the strong smell of gas and hydrocarbon products, a very strong sound effect, and gray clouds formed by fume and gas emissions.

This petroleumscape occupies a major position in the general context of Skikda, due to its economic and geostrategic importance. Since its installation, the industrial zone does not cease to develop and progress on the land or the sea, consuming more peri-urban spaces, which adds to the challenge of the industrialization of the territory. It consumes the beaches and the natural landscape, for the benefit of the development of the port infrastructures (Ghennaï *et al*., 2022); consequently, the sprawl of the petroleumscape invades the historical material heritage, and natural landscape thus threatening the maritime identity to Skikda.

Moreover, the deep modification of the landscape of Skikda in these last fifty years caused a clash between two opposite directions, on one side the blooming of the oil and port industry, and on the other side the expansion of the city due to the phenomenon of urbanization. In this critical situation, Skikda currently presents an urban blockage in a four-sided "sandwich", the ports in the north, the petrochemical complex in the east, the mountains in the south, the heritage areas in the west and everywhere else.

The mental map of Skikda shows the layout of the main elements that prevent the development of Skikda, mainly the refinery that constitutes a barrier in the form of a spot, the sea that presents a linear natural barrier, the mountains, the landscape, and

Figure 3. A panoramic view of the hydrocarbon terminal and the oil port. Source: Authors, 2018

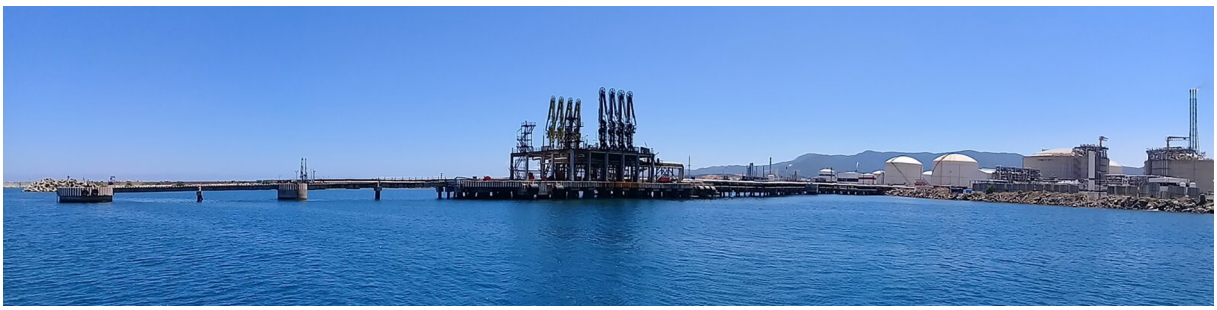

Figure 4. A petroleumscape, the oil port of Skikda. Source: Authors, 2018

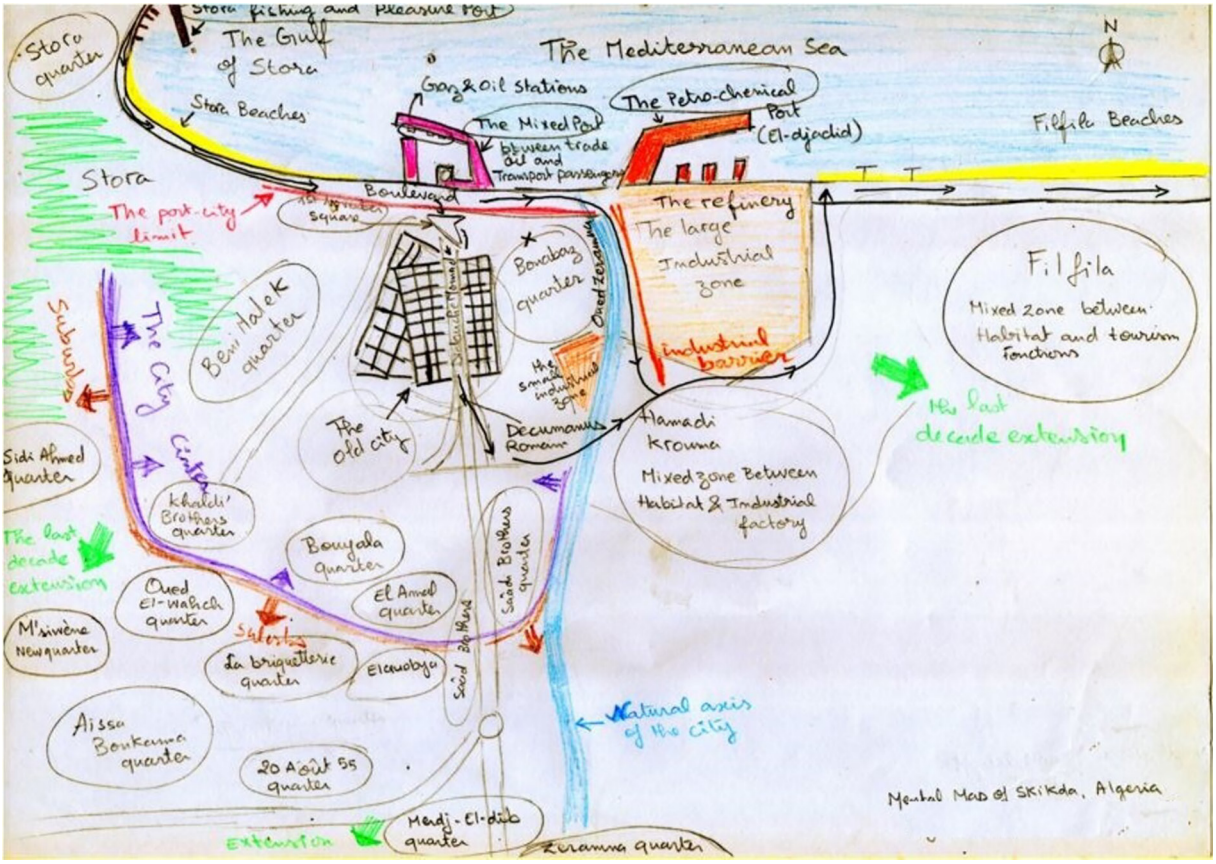

Figure 5. A Mental Map of Skikda, which was made in the context of the course (Re) Imagining Port Cities. Source: Authors, 2022 - https://www.leiden-delft-erasmus.nl/en/education/minors/reimagining-port-cities, last access: 24.07.2022 at 04:49

the heritage areas that form a belt of urban blockage. Therefore, the city shows an anarchic urban shift to the periphery, exploiting other municipalities around the municipality of Skikda and agricultural land, such as El-Harrouche and Azzaba. In addition, the industrial area occupies a central location in relation to urbanized areas, in view of the restriction of public access to this vast industrial space, people are forced to bypass the industrial area in order to reach the other side of the city, which negatively affects the porosity in Skikda.

The mental map is an approach that allows showing the key elements of the city, that the visitor or the habitant of the city have it in their memory. The mental map gives a significant amount of data from the public, which gives it this approach to play the role of a mindset participatory planning tool that can contribute to the understanding of the complexity of the port city. Otherwise, living the experience of a place without theoretical foundations, will not give the same reflection as someone who experiences a space with data and theories. However, dealing with a port city based on literature will not give the same amount of information as someone who experiences this space, so experiencing and glimpsing a space with literatures, influences the amount of information provided in a mental map, which will lead to the creation of a significant amount of information about the place.

In this context, the collection of data was not enough to see and live the impact of the petroleumscape on Skikda, and even being an inhabitant or visitor to the city; it does not allow to correctly interpreting the signs and phenomena seen. Living the city showed us the negative impact of the petroleumscape on the space, and the quality of life, but having a theoretical background on the possibility of integrating oil in social and cultural life, has changed our thinking on the future of the petroleumscape in Skikda and our way of thinking about the port city. Accordingly, this approach gives another angle of vision, an expert angle; due to the ability of this approach to generate a complexity between theory and experimentation, like a puzzle, where one completes the other for a better understanding of the petroleumscape of Skikda.

With these social circumstances and the spatial situation imposed on the inhabitants of Skikda, different reactions have emerged between supporters and opponents. In order to understand and analyze these reactions of the population towards the petroleumscape of Skikda, we opted for the identification of a sample of the society of Skikda, which will participate in a survey in order to extract their reactions translated by a single word. The results will be regenerated into word clouds. This method can give an insight into the nature of the interaction between the population and the industrial-port activities of Skikda, as a participatory demonstration, in order to build together the future of the petroleumscape of Skikda.

III. RESULTS AND DISCUSSION

The study sample is composed of people from different areas of Skikda, who visit or live near the different manifestations of the petroleumscape. The sample of selected people of Skikda, who are affected by the petroleumscape, is identified based on the population size of Skikda, from which they are randomly selected. As the population of Skikda is large, we accept a confidence level of 90% with a margin of error of 5%, for a population of 898680 people in 2008 (according to the latest official statistics). Where (n)=272,16≈273.

In order to process people's reactions, the collected words will be classified into six clusters, each with a common denominator: Environmental Degradation Cluster, Health Decline Cluster, Negative Social Impact Cluster, Economic Growth Cluster, Negative Vibes Cluster, and Positive Vibes Cluster, each cluster, will be presented under a special graph, and regenerated into a specific word cloud.

A. The Composition of the oil Spaces and petroleumscape in Skikda

With the superposition of the different layers according to Hein's approach, we obtained a panel that gives a representative image of the petroleumscape in Skikda.

The spatial layer is composed of six layers: industrial, retail, administrative, ancillary (oil founded), infrastructure, architecture (plastics), philanthropy and state welfare. Therefore, the industrial layer occupies a large part of the petroleumscape of Skikda, due to its key infrastructures, such as the refinery, the maritime transport of hydrocarbons of the mixed port of Skikda, the oil port, and the company Sonatrach, leader in Africa in the field of oil and hydrocarbons.

The two main actors in the petroleumscape in Skikda are Sonatrach and the EPS. Sonatrach is the acronym for «Société nationale pour la recherche, la production, le transport, la transformation, et la commercialisation des hydrocarbures» (national company for the research, production, transport, transformation and marketing of hydrocarbons). It is an Algerian and public oil and gas company. Sonatrach is regarded as the first hydrocarbon group in Africa. It operates the refinery, the gas terminal and the oil port, as well as other spaces and oil companies in Algeria and abroad. The company of the Port of Skikda, by abbreviation EPS (Entreprise Portuaire de Skikda): is a public company which was created in 1982, it manages and operates all the ports of Skikda: the mixed port of Skikda, the hydrocarbon port of Skikda, the fishing ports of Stora, El-Marsa, Oued Zohor and Collo (Ghennaï *et al*., 2022).

The retail layers are manifested by means of the gas stations and LPG pumping stations, of which there are at least 15 stations of Nafta only at the level of the commune of Hamdi Krouma, and Skikda Chef Lieu, which are managed by either state companies or private companies. Moreover, Skikda, as a young centre of oil industry and business, hosts several headquarters and administrative, companies and enterprises either private, state, or foreign. Many companies in Skikda are active in the field of hydrocarbons, with regard to the various headquarters of the port company EPS, the headquarters of Sonatrach, private companies such as ICM, a private company specializing in industrial maintenance, installation and construction of pipelines, and the private company Evolutec international, which is specialized in industrial maintenance.

The auxiliary layer appears directly and indirectly through the treasury financed by petroleum rent, which contributes to the development of housing and infrastructure of the country, financing cultural events and national days. However, the managing company of the hydrocarbon complex of Skikda, contributes directly to the financing of some oper-

Clusters	Citizens' feedback	Frequency	Relevance
Cluster of environmental degradation	pollution	33	0.995
	disaster	17	0.413
	dansger	8	0.179
	bomb	6	0.154
	crime	4	0.087
	catastrophe	3	0.109
	beach deterioration	2	0.210
	devastation	2	0.074
	serious ecological disaster	1	0.157
	city distortion	1	0.105
	boring fume	1	0.105
	imminent threat	1	0.105
	dangerous road	1	0.105
cluster of declining health	illness	17	0.434
	cancer	6	0.139
	asthma	3	0.114
	slow death	2	0.210
	silent killer	2	0.210
	allergy	2	0.082
	stress	2	0.055
	cardiac arrest	1	0.105
	mass suicide	1	0.105
Negative social impact	unemployment	7	0.215
	indignation	3	0.129
	unknown future	1	0.105
	random housing	1	0.105
Cluster of economic growth	economy	9	0.187
	employment position	1	0.105
	economic resources	1	0.105
	oil rent	1	0.105
Cluster of negative vibes	negative	5	0.068
	scary	2	0.074
	shocking	2	0.070
	unfortunate	2	0.068
	inappropriate	2	0.066
	upset	2	0.056
	maleficent treasure	1	0.105
	bad location	1	0.105
Cluster of positive vibes	mixed blessing	4	0.419
	dairy cow	1	0.105

Table 1. The frequency of people's feedback words to the oil port and petroleumscape classified into six clusters. Source: Authors, 2022

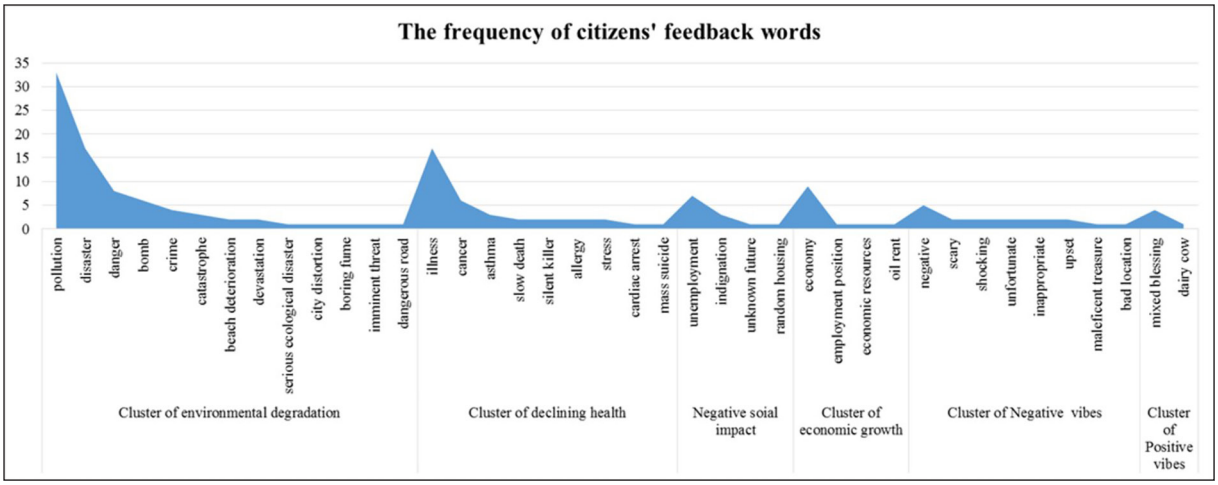

Figure 6. The Graph of the frequency of people's feedback words to the oil port and petroleumscape, categorized into six clusters. Source: Authors, 2022

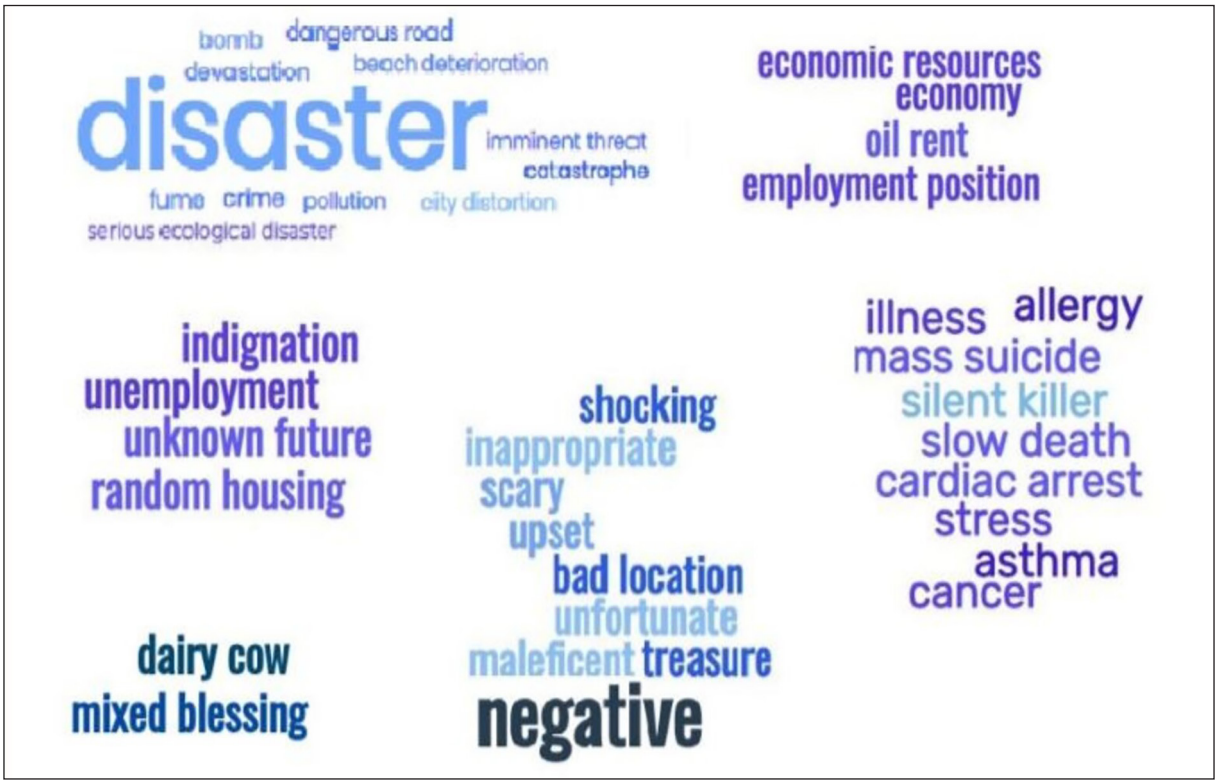

Figure 7. The Clouds of citizens' feedback words to the oil port and petroleumscape, categorized into six clusters. Source: Authors, 2022

ations of development of the port infrastructures in Skikda, and the sponsorship of national sports teams.

Oil revenues; finance the infrastructure layer indirectly, such as the East-West highway. However, Sonatrach has totally financed the development operations of the oil port of Skikda (Ghennaï & Madani, 2020). It has also contributed to the creation of a new penetrating road, in order to promote the porosity and fluidity of mechanical transport between the mixed port, and the oil port with the dry port, and the small industrial zone, or the hinterland in general. Meanwhile, the layer of architecture and plastic in Skikda benefit directly and indirectly to oil revenues, by means of Sonatrach, which it has contributed to the financing of urban equipment of the place of November 1, 1954 (ex-place of the navy), the financing of the development of the marina in Stora, and the provision of its street furniture.

The oil revenues finance educational structures such as the University of Skikda, which houses one of the Algerian Petroleum Institutes (IAP) school of

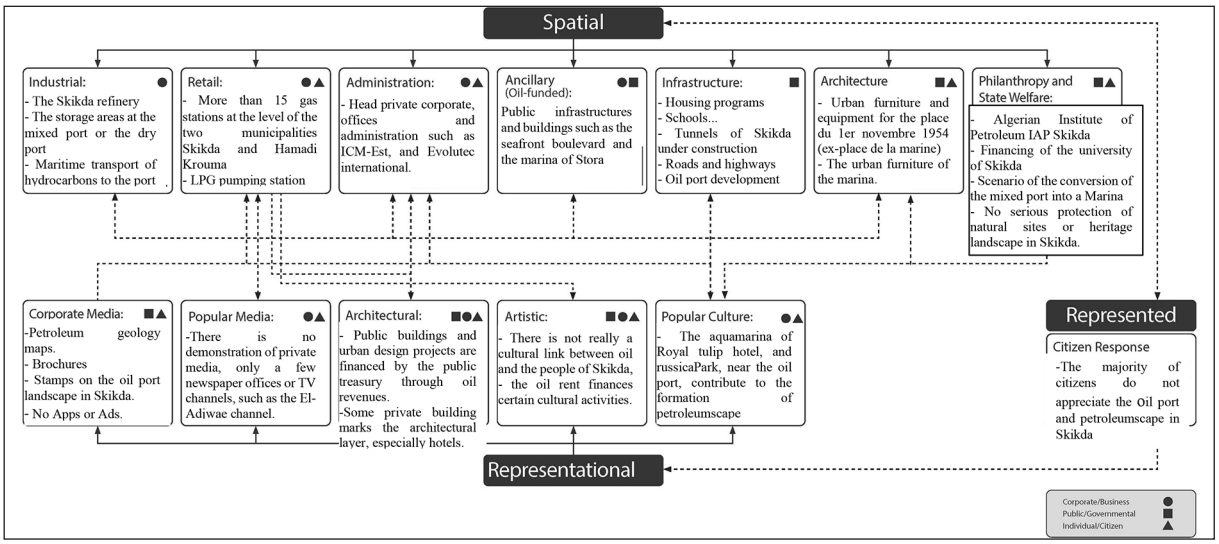

Figure 8. The hybrid, multiple, shifting, and uneven ways in which many actors collaborate to create the global oil port and petroleumscape projected on the Skikda case. Source: Authors, based on the scheme of Carola Hein, 2022

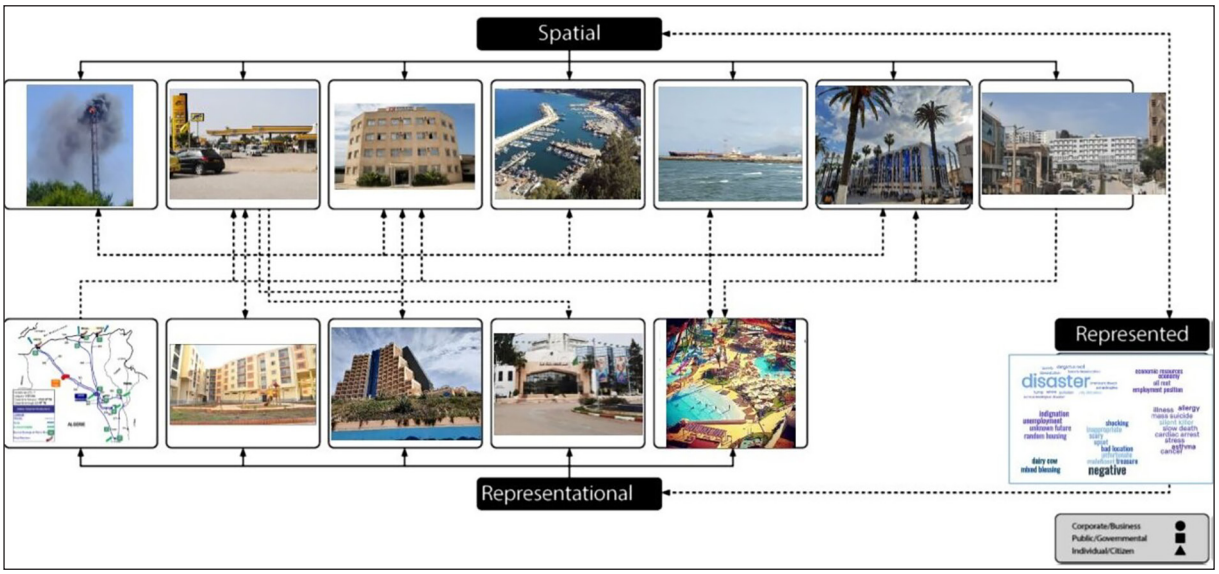

Figure 9. The hybrid, multiple, shifting, and uneven ways in which many actors collaborate to create the global oil port and petroleumscape projected on the Skikda case. Source: Authors, based on the scheme of Carola Hein, 2022

Skikda. The state funding also concerns the Algerian Ministry of Solidarity, whose layer of philanthropy and public aid benefit from state funding. Thanks to the oil, revenues Sonatrach pays taxes to the municipalities of Skikda, and it contributes to the financing of a hospital specialized in burns because of the frequent accidents at the petrochemical complex. On the other hand, the port company (EPS) has proposed to contribute with 30% of the cost of the development project of the mixed port of Skikda, based on a scenario of extension of the port, the creation of a new jetty, and the reconversion of the old part of the port into a Marina. However, the heritage landscape or the preservation of nature scape in Skikda, do not seem a serious priority for the government or oil companies (Ghennaï *et al*., 2022).

The layers of the industrial, the retail, and administration constitute an important manifestation of the petroleumscape in Skikda. Despite the direct contribution of Sonatrach in the financing of the infrastructure of Skikda, the layers of the ancillary and infrastructure show an insufficiency in the rendering of the built environment, and especially in terms of architecture. The built environment in Skikda remains far from the true creation of a modern atmosphere, in relation to the important revenues of the oil economy, and the wealth of the treasury of Skikda.

Panel layers	Photo source	Designations of the photo
Industrial layer	Authors, 2021	It shows the smoke of the Skikda refinery; the choice refers to the refinery managed by Sonatrah as a corporate government busniss and a major oil event in Skikda.
Retail layer	Authors, 2022	it illustrates a gasoline pump in Hamadi Krouma, as a private bisness managed by a citizen.
Administration layer	Evolutec Official site[i], 2022	It presents the siege of Evolutec international in skikda, as a private corporate administration
Ancillary layer	Authors, 2021	It presents the fishing and pleasure port, as a public infrastructure of leisure.
Infrastructure layer	Authors, 2021	It presents the hydrocarbon port of Skikda, as a government infrastructure, and a significant image of oil in Skikda.
Architecture (plastics) layer	Authors, 2022	It shows through this municipal library, the supplies the architectural elements in the glazed facade, decorated by openwork panels according to an Arab-Muslim architecture. It also presents, a public facility built by the government, for the benefit of the citizens.
Philanthropy and state Welfare layer	Authors, 2022	it presents the public hospital of Skikda, as a public facility built by the government, for the benefit of the citizens.
Corporate Media layer	Official website of Sonatrach[ii]	it presents the energy map in Algeria, and the link between the hydrocarbon export sites in the north, with the extraction sites in the Sahara. The choice of map aims to reflect the role of providing information to the public by Sonatrach as a government corporate.
Popular Media	Official site of El-Adjwae TV	It presents the Office of the private TV channel, El-Adjwae in the residential city zefzef Skikda.
Architectural layer	Authors, 2022	it presents the Royal Tulipe Hotel in Skikda (four stars), which is a private establishment.
Artistic layer	Authors, 2022	it presents the Palace of Culture of Skikda, as a public establishment, built by the government.
Popular culture layer	Official site of Marina d'or	It presents The Marina d'or, an aquatic garden.
Represented layer	Authors, 2022	It illustrates the citizens response through a visual representation of the data generated as a text cloud.

Table 2. Presentation of the photos used in the petroleumscape layer panel. Source: Authors, 2022. [i]evolutec-international.com/fr/, [ii]https://sonatrach.com/

As for the heading of the representational layer, it is manifested in the superposition of the layers of corporate and popular media, an architectural layer, an artistic layer, and the layer of popular cultures. The corporate media layer is present by the government's means of communication towards the Ministry of Energy or the public company Sonatrach, from which they provide maps such as petroleum geology maps published on websites or special magazines, brochures, and stamps about Skikda, its port, its history, and even its oil industry. However, this layer lacks technological and digital innovation, as it does not yet support digital applications and Ads aimed at the public or its customers.

Figure 10. The oil port and petroleumscape from the Goat Islet (Trik l' îlot), Skikda. Source: Authors, 2022

The popular media layer is not present as a manifestation of the petroleumscape in Skikda. The majority of the seats of the media like the privates' chains of television or newspapers, are in the capital Algiers, an office of the channel El-Ajwae is in a residential district of in skikda, whose apartment are part of the program of social housing of the State, funded by oil revenues. Otherwise, it seems that there is no link with the oil revenues and the popular media activities in Skikda in terms of private sectors.

The architectural layer concerns the buildings, the public infrastructures and the urban design, of which they are financed by the state treasury. The former ensures its funds via the oil economy; therefore, one can consider all port infrastructures as manifestation of the petroleumscape in Skikda. Concerning the culture, this layer ensures the financing for the construction of the cultural infrastructures with regard to the palaces of cultures, or the municipal libraries of Skikda. Oil revenue also sponsors the cultural or artistic demonstrations thanks to the state financing, but beyond this indirect relation between oil and culture.
Despite the strong presence of hydrocarbons and fuel energy in the daily life of citizens of Skikda, in a direct or indirect way, there is not really a concrete cultural link between oil and people in Skikda. There is a lack in the artistic appreciation of black gold except for the works of literature that deal with the oil field in Algeria from a political or scientific point of view. Indeed, the layer of popular cultures is present on various occasions especially, the fishing and pleasure port of Stora, which has hosted local festivals such as the strawberry festival, concerts and musical evenings, as a public cultural space.

On the other hand, many private economic and commercial facilities are manifested in Skikda, such as the aquapark of Marina d'or, a real place of relaxation and pleasure, which reflects the culture of the population attached to the sea and all its aquatic events. In addition, the new tourist village of Filfila RussicaPark, located in the front of the beaches, is an attractive place of recreation especially in the summer period. These facilities are located near the oil port; where they are part of the composition of the petroleumscape, in a framework of challenge, between the oil industry and the economy based on tourism revenues.

The last layer of represented, contains a single layer of the citizens' response. In this perspective, we opted for a questionnaire survey that aims to extract the feedback of citizens towards the petroleumscape of Skikda. Then, the results are processed and generated on a word cloud, which transforms a textual data into a visual representation. This method allowed the authors to render a general view on

the most repeated words that reflect the rejection of the petroleumscape in Skikda by the majority of the participants in this survey.

CONCLUSION

The petroleumscape of Skikda has contributed to mark the economic and cultural identity of the society in Skikda, between those who refuse the reality of the oil industry in Skikda, and those who encourage it. The petroleumscape of Skikda, provokes several feedbacks, such as concern because of the vulnerability of the oil, port activities and its impact on health and the environment. On the other hand, a faction of people shows their feeling of comfort towards the economic, social security, and stability that has offered the black gold to Skikda and Algeria in general.

Carola Hein deduced a hybrid, multiple, shifting, and uneven way created by private and public actors in the stratification of the petroleumscape based on local, geographic, historical, and technological characteristics in oil spaces. Hein's approach is practical for providing insight into the impact of oil on societies, and the ability to understand the negative and positive effects of the composition of the petroleumscape and society's response to oil spaces. Understanding the hybrid, multiple, changing, and uneven ways in the composition of the petroleumscape facilitates finding solutions to the observed problems, or strengthening of oil spaces, in order to create a positive integration between the petroleum industry in the city and society.

This research, does not examine the administrative or auxiliary petroleumscape, but focuses on the role of the industrial petroleumscape and its impact on the space and quality of life of the population. The application of Carola Hein's approach on the case of Skikda, as an important oil industrial pole at the national and Mediterranean level, aims at understanding the unnoticed composition of the petroleumscape in Skikda, which can contribute to the enrichment of the concept of petroleumscape, both conceptually and through the case study.
Projecting Hein's approach on the case of Skikda, the authors find that oil participates in the financing of economic life in Algeria; oil economy is considered the primary financier of all sectors. Thus, the petroleumscape panel in Skikda reflects the efforts of the state to strengthen the basic infrastructure of the city, in terms of development of the industry, the education sector and health. Although the oil rent is the main funder of the culture sector in its various activities, culture in Algeria in general and in Skikda in particular. However, the petroleumscape of Skikda, is not affected by the manifestations of oil as a cultural object, or as a factor interfering in the structure of culture shared by the society.

Carola Hein's approach devotes an entire layer to the feedback of citizens to the petroleumscape, the faction of people who accept the petroleumscape of Skikda, argues their feedback thanks to the socio-economic stability of the oil rent. Futhermore, some citizens find this landscape beautiful, of which they present 13.28% of the study sample with 38 words that support the petroleumscape on 286 words collected. On the other hand, 5.59% of the citizens provided words either neutral or against and for the petroleumscape at the same time.

The section of people who reject the petroleumscape in Skikda have a feeling of insecurity towards the manifestations of this industrial landscape, of which the word pollution was frequent 33 times. The majority of the words that reject the oil industry revolve around diseases, cancer, fear, danger, and deterioration of the beaches, this reflects a degree of awareness of citizens of the risks caused by this industrial reality, due to their suffering from the negative impacts of the industrial crisis, the situation of degradation of their urban and maritime intoxication. Hence, this feedback constitutes 81.11% of the total feedback, so it presents the largest faction of citizens, of which out of 286 words collected, and there are 232 words, which are against the petroleumscape in Skikda.

The text mining methods can highlight the most commonly used keywords. It is possible to create a word cloud, also called a text cloud or lexicon cloud which is a visual representation of text data. Word clouds provide simplicity and clarity. The most commonly used keywords appear best in a word cloud. Word clouds are a powerful communication tool; They are easy to understand, easy to share, and have great impact. However, the application of this method on a large slice, limits the analysis of words collected in a smaller sample, which focuses on the most important words. This may limit the relevance of the visualization of the text data.

In fine, the urban environment and the architectural product of Skikda do not reflect the positive effects expected from the generous revenues of the oil industry. The city is experiencing continuous degradation and urban problems are greatly exacerbated while pollution aggravates the situation, amidst the indignation of a large faction of citizens who, according to them, only benefit from the evils of these industries. Oil is the main financer of all projects and daily life in Algeria, and the layers that intertwine the petroleumscape in Skikda; however, oil is both indispensable and rejected by society, a reason why oil would not be able to access the cultural and social structure of Skikda.

NOTES

[1]https://www.portcityfutures.nl/home, consulted on September 28, 2022.
[2]https://www.energy.gov.dz/, consulted on February 02, 2021.
[3]https://www.energy.gov.dz/?rubrique=produits-petroliers, consulted on April 20, 2022.
[4]Idem
[5]https://sonatrach.com/wp-content/uploads/2021/02/DESCRIPTION-DU-RESEAU-DE-TRANSPORT-PAR-CANALISATION-DES-HYDROCARBURES-TARIF-DE-TRANSPORT-ANNEE-2021.pdf
[6]evolutec-international.com/fr/
[7]https://sonatrach.com/

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