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ASSESSING THE INTERACTION BETWEEN URBAN AIR POLLUTION AND LAND USE ON THE SUSTAINABILITY OF TABRIZ CITY

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ABSTRACT

The urban environment spatially air quality represents one of the most important sources to global climate change, while at the same time holding the key to a more sustainable way of living. Given the rapid growth of the function and forms of cities, meeting the requirements of population changes aspects within the context of variable risks overshadowed by environmental challenges (e.g., climate change and air pollution) highly comes to the fore. In this regard, this study aims to investigate the interactions between urban sustainability coupled with urban pollution in order to deals with an integrated approach adopted to improve the air quality of the city of Tabriz at northwest Iran. In this way, six pollution assessment stations within the study area have been examined by using the geographic information system (GIS) to measure the level of pollution in the city. Overall, results of the study revealed the point that pollution level experienced an increasing trend and the weather is being polluted not merely based on emissions from cars in downtowns at the main streets but also based on the nearby industrial places results in a high concentration of nitrogen oxides (NOx) gas very high at areas with high road traffic while that of sulfur oxides (SOx) varied differently. The results show that there are higher CO emissions around downtown areas of the city of Tabriz. It should be mentioned that industrial land use is overshadowed by the circle of carbon and changing our climate. With low-carbon technologies, Land use distribution balance, implementation of polycentric urban form, mixed land use in city centers, Transformation of heavy industrial units out of city exclusion, and energy-efficiency improvement, Tabriz can achieve environmental sustainability and wellbeing for citizens.

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Keywords: Air Pollution, Land use, Sustainability, Tabriz City

AVALIANDO A INTERAÇÃO ENTRE POLUIÇÃO ATMOSFÉRICA URBANA E USO SUSTENTÁVEL DA TERRA NA CIDADE DE TABRIZ

RESUMO

O ambiente urbano espacialmente a qualidade do ar representa uma das fontes mais importantes para as mudanças climáticas globais, ao mesmo tempo em que é a chave para um modo de vida mais sustentável. Dado o rápido crescimento da função e das formas das cidades, o atendimento aos requisitos das mudanças populacionais no contexto de riscos variáveis ofuscados por desafios ambientais (por exemplo, mudanças climáticas e poluição do ar) vem à tona. Nesse sentido, este estudo visa investigar as interações entre a sustentabilidade urbana aliada à poluição urbana, a fim de lidar com uma abordagem integrada adotada para melhorar a qualidade do ar da cidade de Tabriz, no noroeste do Irã. Desta forma, seis estações de avaliação de poluição dentro da área de estudo foram examinadas usando o sistema de informação geográfica (GIS) para medir o nível de poluição na cidade. No geral, os resultados do estudo revelaram que o nível de poluição experimentou uma tendência crescente e o clima está sendo poluído não apenas com base nas emissões dos carros nos centros das ruas principais, mas também com base nas áreas industriais próximas, resultando em uma alta concentração de nitrogênio óxidos (NOx) gasosos muito elevados em áreas com alto tráfego rodoviário enquanto que o de óxidos de enxofre (SOx) variou de forma diferente. Os resultados mostram que há maiores emissões de CO nas áreas centrais da cidade de Tabriz. Deve-se mencionar que o uso industrial do solo é ofuscado pelo círculo de carbono e pela mudança do nosso clima. Com tecnologias de baixo carbono, equilíbrio de distribuição do uso do solo, implementação de forma urbana policêntrica, uso misto do solo nos centros das cidades, transformação de unidades industriais pesadas fora da exclusão da cidade e melhoria da eficiência energética, Tabriz pode alcançar sustentabilidade ambiental e bem-estar para os cidadãos.

Palavras-chave: Poluição do Ar, Uso do Solo, Sustentabilidade, Cidade de Tabriz

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1 Introduction

Urban sustainability has become a major concern throughout the world with which all the communities are grappling especially in the developing countries (Li and et al. 2019, 1052). Sustainability is an influential factor for human society to survive (Izakovičová et al,2018). Also, land-use plays a vital role in urban sustainability. Li's study indicated that current land-use policies are against sustainability (Li and et al. 2019, 1052). Izakovičová manifested that some environment issues were completely related to sustainable land-use like environmental pollution, increased demand for natural resources, climate change, energy security, political-economic, and environmental goals (Izakovičová et al,2018).

For instance, in economic rapid development, cities are faced with some challenges (e.g. air pollution, human health concerns, traffic congestion, climate change and etc) (Zhang et al, 2019). Moreover, climate change effects on human health, so it should be considered in urban land-use planning. It is depended to social activities, which release greenhouse gases to the atmosphere (Miller 2013, 177). Yigitcanlar, revealed that there are a lot of environmental issues including population increment, rapid urbanization, high private motor vehicle dependency, deregulated industrialization, and mass livestock production menace our wellbeing (Yigitcanlar & Kamruzzaman 2015, 14678). It can be estimated that, air quality with measuring pollution factors encompasses, Carbon Monoxide (CO), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2), Ozone (O3), and the particles with a diameter of 10 micrometers (PM10). Furthermore, Air Quality Index (AQI) is an influential factor in assessing air quality (Safavy et al. 2016, 158-77).

There are lows on protecting the environment and reducing air pollution in Iran. According to Iran's legislation about how to reduce air pollution, define air pollution like "Air pollution refers to the presence and dissemination in the open air of one or more pollutants, including solid, liquid, gas, radioactive and non-radioactive radiation, ..." (season1, article2). This legislation also divided air pollution sources into three groups, that include: 1) Automobiles (motor vehicles) 2) Factories, industrial unite, and power planets, 3) Commercial, domestic and miscellaneous sources (season1, article3). There are some rules for motor vehicles and factories too in season 2 and 3. According to these rules, each motor vehicle should have a special certificate that follows the allowable emission limit of air pollutants (season2, article5). About factories "Building new factories, improving, modifying, and the location or production line of existing factories should have complied with the environmental protection organization's regulations and

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guidelines" (season3, article12). Industrial poles, complex, power plants, etc. are obliged to allocate at least 10% of their space for creating green space and cultivate trees that suitable for the region (season3, article19).

Some research within this field is discussed in the continuation. In the article about Mexico City air pollution, Son developed finer spatiotemporal (LUR) models for some pollutant gases, by using mixed effect models with the LASSO[1]. Their approach to use the LASSO with hourly metrological and crowd-sourcing traffic data, which can increase to air pollution (Son et al. 2015, 40-48). Izakovičová, used an approach for sustainable land-use management. Integrated approach considered landscape as a geo-ecosystem with diverse potential. It also, introduced an aspect of land-use management, which can provide social development (Izakovičová et al, 2018).

Borrego (2006), focused on analyzing land-use types, and three different city structures on air quality. Results showed that between compact cities and network cities, compact cities can supply better air quality (Borrego et al. 2006, 461-467). Martínez-Bravo, using the structural equation model, examined the relationships between urban sustainability, pollution, and livability. Urban pollution data and the EU citizen obtained from 79 European cities (Martínez-Bravo et al. 2018). Mohamed, compared the sprawling pattern demographics, degree of built-up growth goodness, and land-use land cover (LULC), in his research. The article, focused on integrated management and urban- regional planning approach, sprawling, quantifying the built-up intensity, for controlling LULC dynamics to plan and manage sustainable urban growth (Mohamed and Worku 2018, 145-158).

2 Literature review

Sustainable development

Indeed, sustainable development is described as the development that provides present-day demands, without sacrificing future generations to meet their own needs (Marzukhi et al. 2012, 767, Cao 2018, 244). This is the base of the sustainability concept. Sustainability has different aspects comprises economic, Environmental, and social. In the economic context, it is important to continuously produce goods and services, maintain healthcare, to manage finance, etc. Eviting overexploitation of natural resources, protection of biodiversity, and other critical ecosystem functions such as climate, water and land resources,

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etc. are subsets of sustainability. Social sustainability includes activities which bring welfare to society (Cao 2018, 244).

As these aspects can't be considered separately. For instance, when it comes to the matter of providing wellbeing, environmental considerations should be on the first priority. Sustainable development typically focuses on enhancing the quality of life for all Earth's inhabitants without increasing the use of environmental assets beyond the ecosystem's capacity to provide them forever (Marzukhi et al. 2012, 767-774). The main objective of this research contributed to the cities discussion. Urban sustainability can be describing as, the ongoing process of dynamic integrated and co-evolution between the subsystems that make up a city without sacrificing the growth possibilities of nearby area and thus leading to the reduction of the negative impacts of growth on the biosphere (Alaloucha et al. 2019). As the sustainable city includes all of the city components like structure, land-use, population flow, traffic congestion.

Urban design or urban structure refers to the patterns of land-use, transport networks, water and energy facilities, as well as the physical process of growth that promotes human activity and its interactions (Marquez & Smith 1999, 541-548). Buildings and roads define the city's structure. Also roads and land-use determine population fallows and this fallow will directly effect on air quality. Within air quality, land-use influences urban development by specifying travel distances, which influence the fuel consumption and air pollution (Alalouch et al. 2019). According to Wong, relationship among buildings and their surroundings is seen as part of the urban design process (Wong et al. 2011, 387). There are three types of urban forms which relate to land-use, include Compact city, Corridor city, and the Disperse city (Borrego et al. 2006, 462). Alalouch (2019), stated that allocation of urban land-use is an integral part of urban sustainability. The effect of urban sustainability is widely expressed on land-intensive use, energy efficiency, environmental, and social, economic growth (Alalouch et al. 2019). Afterward, as Izakovičová stated, sustainability requires socio-economic development that maintains sustainable land-use values and protects the natural and cultural-historical sources and territorial potential (Izakovičová et al. 2017).

Land use:

Land utilization is one of the most relevant factors in determining place activity. That describe the connection to the economic, social, and commute operations within neighborhoods and cities (Alalouch et

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al. 2019). According to Hubert and Cao study (2018), land-use defined as, systematic examination of environmental resources, land-use opportunities and socioeconomic factors with a view to choosing and adapting the best land-use options (Van Lier 1998, 83-91, Cao 2018, 246). Land-use planning is the process of assigning various activities or functions such as, manufacturing, agriculture, recreation, or conservation to different area unit within a community, which is a priority for cities around the world (Zhou 2015, 479-491). Benton (2018), believe that land would provide some key ecosystem services that are important for human health and well-being: water, carbon storage, food, energy, amenities, leisure activities, living space, and cultural services (Benton et al. 2018, 88-95).

Indeed, sustainability is one of the land-use planning's goal. Thus sustainable land-use planning is a tool for setting land-use policies, enforcing those policies for the appropriate location of different land-uses and improving physical and spatial conditions for optimal long-term use and protection of natural resources, although dealing with present generations demands and expectations. Also Cao (2018), uses this diagram to show sustainable land-use planning (fig1):

Fig1. Contents of sustainable land use planning (Cao, 2018, 246)

Spatial compactness, environmental protection, control air pollution, minimizing traffic congestion are some targets in sustainable land-use planning (Cao 2018, 246). Many land-use, such as industrial sectors, also have a direct effect on air pollution. Thus it is essential to air quality is to be included in land-use planning.

Air pollution

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Climate change is one of the most important issues in sustainability aspect (Baghanam et al,2020b). As Colvile (2004) stated, air pollution is the most important factor in climate change. In addition, not only air pollution effect on sustainable environment, but also it has impacts on human health (Colvile et al,2004). Air pollution is the presence in the air of any substance which is harmful for plants, animals and human health (Hosseini and Shahbazi, 2016). Industrialization, urban population growth, vehicle traffic, are some principles of air pollution sources, which add chemical components, particulate matter and biological material to the atmosphere. (Haque and Singh, 2017, Zhang et al, 2019, Safavy et al, 2016).

Most of the damage caused by the spread of pollution is fossil fuel products, which in most cars are mainly by-products of combustion engines. While their amounts are limited in most large cities they are still pose a hazard to humans. Impacts of these compounds in the environment may also be compounded by water vapor, natural dust and sunlight, which in turn, causes chemical reactions and creates a secondary series of harmful pollutants, including ozone (O3), secondary organic aerosols (SOA), sulfates and nitrates.

Greenhouse gases like NOX and SOX cause serious problems for the global climate and play a key role in fastening climate change (Rauland and Newman, 2015). Nitrogen oxides or NOX is released by industrial activities (Liu et al, 2016). Also, NOX forms O3 in atmosphere (Clean Air Technology Center, 1999). According to world bank handbook burning high-sulfur coal or heating oil are the main sources of Sox which released by industrial boilers and nonferrous metal smelters. Moreover, domestic coal burning and vehicles can contribute to concentrations of sulfur dioxide (world bank group,1998). According to the over mentioned studies, these two gases are so dangerous for the environment and health. For decades, most large Iranian cities; Tehran, Mashhad, Arak, Isfahan, Ahvaz and Tabriz have confronted with major air pollution problems. However, the main goal of this study contributed to analyzing dominant factors related to industrial land-use, wind and etc. in Tabriz city's sustainability.

AQI

AQI is an index for monitoring air quality. It informs users that clean or polluted their air is, and also what corresponding health impacts could be a concern for them. The AQI focused on the health impact that might feel after breathing polluted air in a few hours or days. Colors are key for communication. AQI's range is 0-500(no units), and it is also providing indicator of the quality of the air and its health effects

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(U.S. Environmental Protection Agency, 2003).

Table 1, shows AQI's range with their related health effects and Table 2, whenever pollutant gases get an AQI above 100, informs sensitive classes (U.S Environmental Protection Agency 2003).

Table1. Note: values above 500 are considered "beyond the AQI".

For this AQI	Use this descriptor	And this color
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for sensitive group	Orange
151 to 200	unhealthy	Red
201 to 300	Very unhealthy	Purple
301 to 500	hazardous	Maroon

Table2. Notes: statements may be combined so that each group is mentioned only once.

When this pollutant has an AQI above 100	Report these sensitive group
Ozone	People with lung disease, children, older adults, people who are active outdoors (including outdoor workers), people with certain genetic variants, and people with diets in certain nutrients are the groups most at risk
PM2.5	People with heart or lung disease, older adults, children, and people of lower socioeconomic status are the groups most at risk
PM10	People with heart or lung disease, older adults, children, and people of lower socioeconomic status are the groups most at risk
CO	People with heart disease is the group most at risk
NO2	People with asthma, children, and older adults are the group most at risk
SO2	People with asthma, children, and older adults are the group most at risk

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Case study

The study area (Fig2) encompasses the Tabriz metropolis at the heart of the East Azerbaijan province at northwest Iran. Tabriz city lies on the plain with a mild slope and at 60 km west ends on the east bank of the Urmia Lake (Baghanam et al. 2020a).

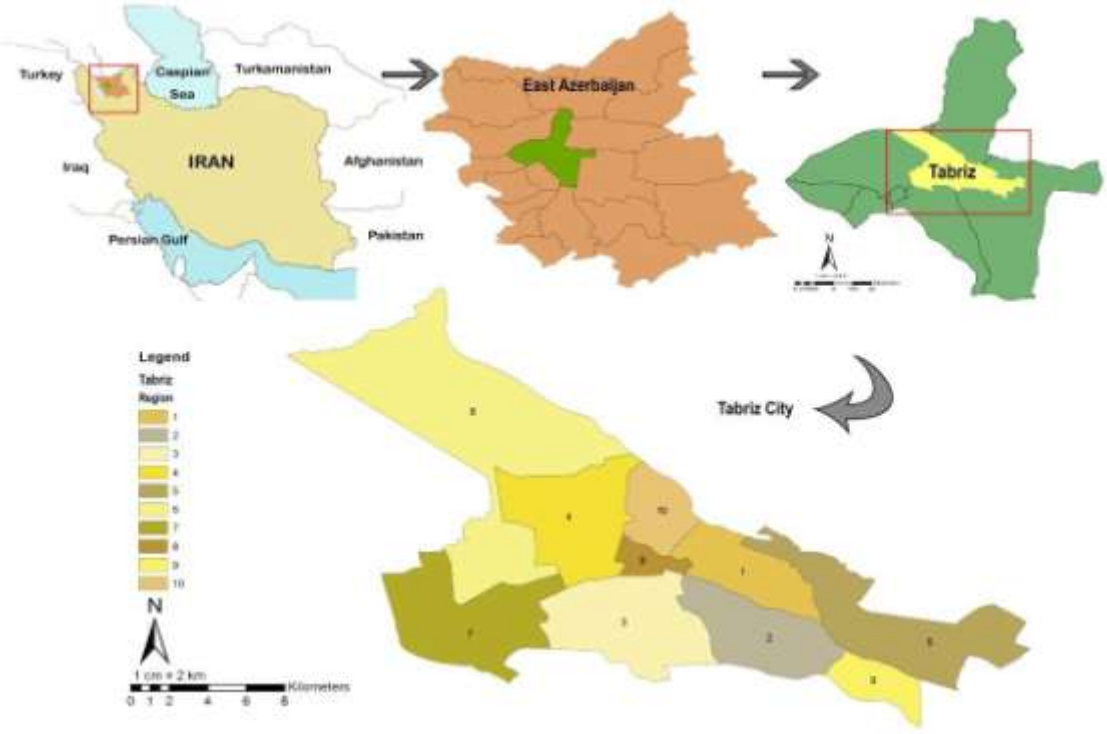

Fig. 2: Map of the study area

This mountain city, located between Sahand and Eynali mountains in a fertile area at banks of Aji- chay and Ghuri-chay rivers. The natural land of Tabriz (Fig3) is surrounded by mountains on three sides, the northern part of the city is limited to Eynali mountain and its southern part is limited to Sahand mountain. It is only in the west that the city opens up into plain lands resulting from the functions of a river's conical section.

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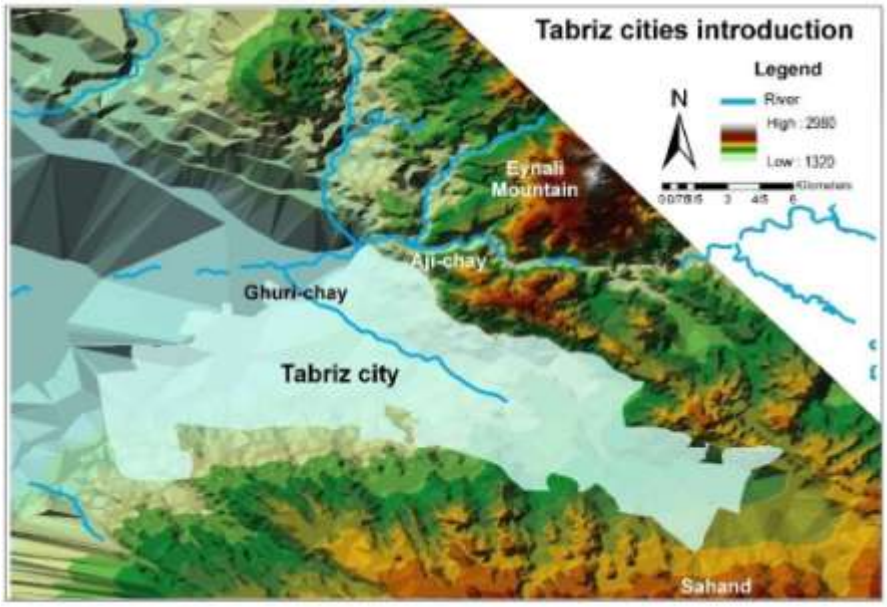

Fig. 3: Tabriz cities introduction.

Tabriz has a continental climate with regular seasons bordering cold arid climate. It is a city with annual precipitation around 320 millimeters, and the average annual temperature of 12.6 °C. In summer cool winds mostly blow from east to west. The wind rose for Tabriz (Fig4) indicates how many hours a year the wind blows from the shown direction. In Tabriz South-West (SW) to North- East (NE) wind is blowing strongly.

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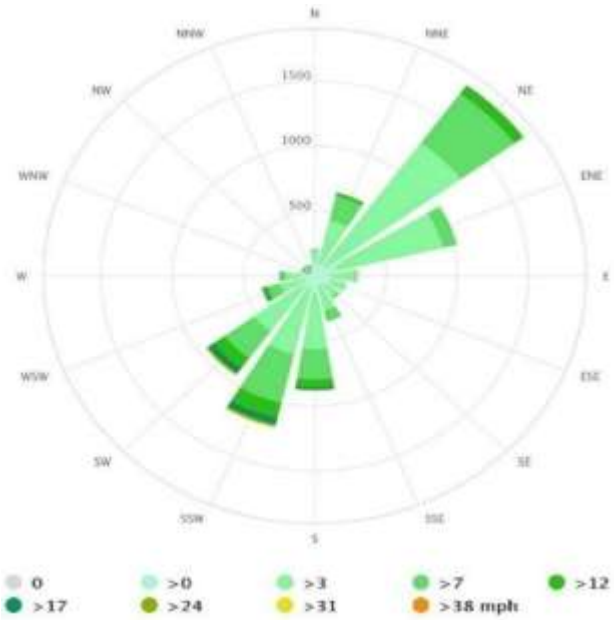

Fig4. Wind rose for Tabriz city (meteoblue,2020)

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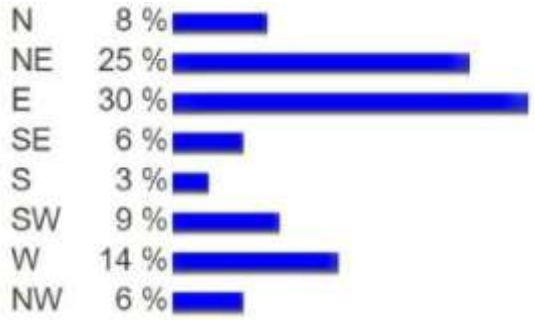
As shown in the Figure 5 and wind rose of Tabriz city, winds from the west and then the northeast have the highest values in the last ten years, therefore Tabriz is a relatively windy city.



Fig, 5: Wind direction of Tabriz city (January 2010 – January 2020)

In this industrial city air pollution is one of the major environmental issues. In the second half of the 20th century, air pollution levels continuously increased due to the increase in the number of cars in the city's commuting and polluting industries such as thermal power plants, petrochemical complexes and oil refineries in the west. The air quality in this city is far away from world norms for clean air. Air quality has become a Very influential issue in Tabriz city (Fig6).

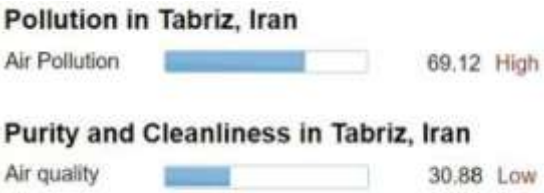


Fig. 6: Pollution in Tabriz city (numbeo, 2020)

3 Proposed methodology

The air quality station maps of the Tabriz city were drawn with ArcGIS and seven pollution assessment

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stations (Fig9) in title of Abresan, Azerbayjan square, Baghshomal, Behdasht, Hakim nezami, Namaz square and Rah Ahan stations have been examined by using the geographic information system (GIS) to measure the level of pollution in the city. In addition, the Azerbaijan Square station does not have enough information because of its recent construction, it totally has pm10 information among the polluters. The information of PM10, CO, NOX, SO2, O3, NO, NO2 pollutants are stored in Excel then internalized and analyzed with ARC GIS software.

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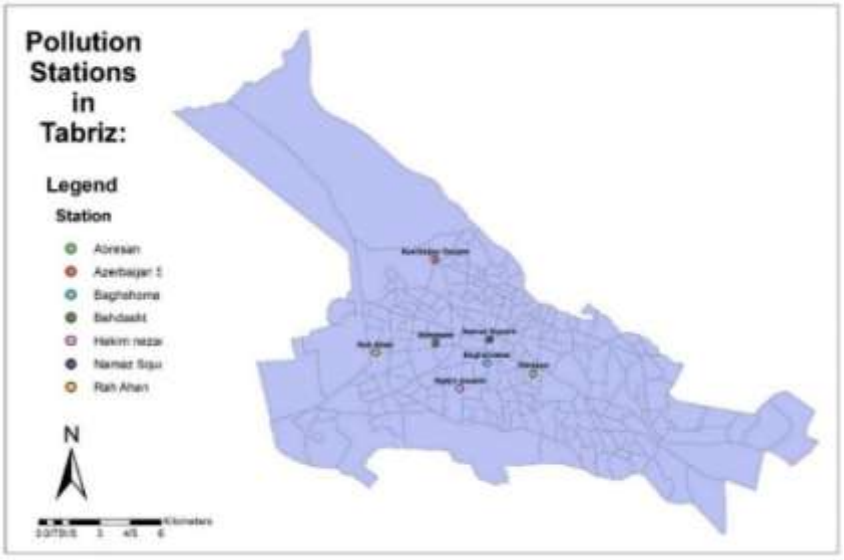

Fig. 9: Pollution stations of Tabriz city

Spatial interpolation

Spatial interpolation is the method of using points with known values to estimate values at other unknown points. Spatial interpolation could estimate the air pollution at locations without reported data by using known pollutions readings at nearby pollution assessment stations. There are several interpolation methods but two commonly used interpolation methods are Inverse Distance Weighting (IDW) and Triangulated Irregular Networks (TIN). For this research data are going to interpolate by Inverse Distance Weighting for estimating air pollution of Tabriz city.

Inverse Distance Weighting (IDW)

The IDW is one of the most widely used forms of interpolation. It obtains the value by computing a weighted average of known values in a particular area (Fig10).

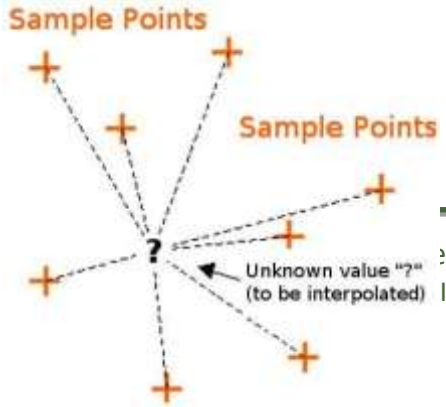

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Fig.10: Inverse Distance Weighted interpolation based on weighted sample point distance

The weights are proportional to the proximity of the sampled points to the unsampled location and can be specified by the IDW power coefficient. The larger the power coefficient, the stronger the weight of nearby points as can be gleaned from the following equation that estimates the value **z**
at an unsampled location **j**:

$$\hat{Z}_j = \frac{\sum_i Z_i / d_{ij}^n}{\sum_i 1 / d_{ij}^n}$$

The carat ^ above the vector **z** reminds estimating the value at **j**. Parameter **n** is the weight parameter used as an exponent of the distance thus amplifying the irrelevance of a point at location **i** as the distance to **j** increases. So a large **n** results in nearby points wielding a much greater influence on the unsampled location (Gimond 2019, 77).

4 Results

Industrial Land Use

Industrial centers are located in Tabriz 's southwest, northwest and southeast, and the most concentrated industrial uses are to be found in the west, especially southwest of Tabriz (Fig7).

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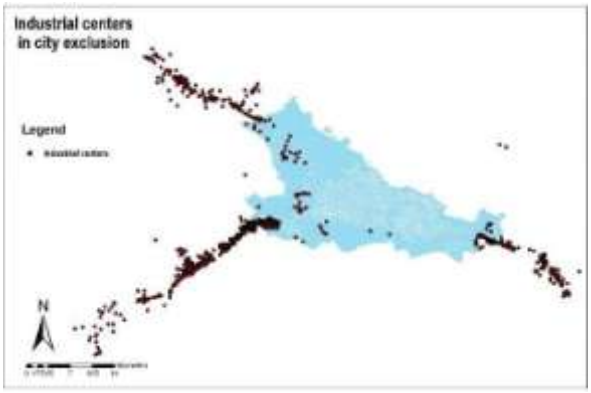

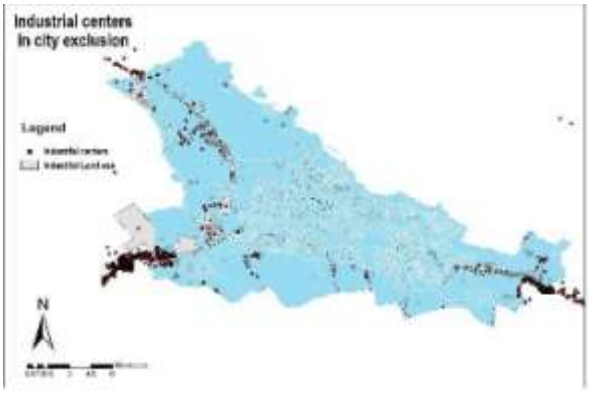

Fig. 7: Industrial centers in Tabriz city exclusion **Fig 8.** Industrial Land Use in Tabriz city

As shown in Figure 8, many of the major factories and pollutants are currently located in the south- west of Tabriz. Southwesterly wind blows high in spring, and it is relatively high in fall and winter.

Air pollution

The concentration of pollutants in the town and their origin will be discussed in continue.

PM10

PM10 is particulate matter 10 micrometers or less in diameter. The map, revealed that in Abresan and behdasht stations, PM10 concentrations are higher than other stations. This pollution can be directly released from a source, such as construction sites, unpaved roads, farms, chimneys or fires or chemicals such as sulfur dioxide and nitrogen oxides are produced in the atmosphere as a result of complex reactions and are pollutants emitted by power plants, factories, industries and vehicles. Figure 11 demonstrated that in Rah Ahan and behdasht stations, CO concentrations are higher than other stations, which is probably due to high traffic loads.

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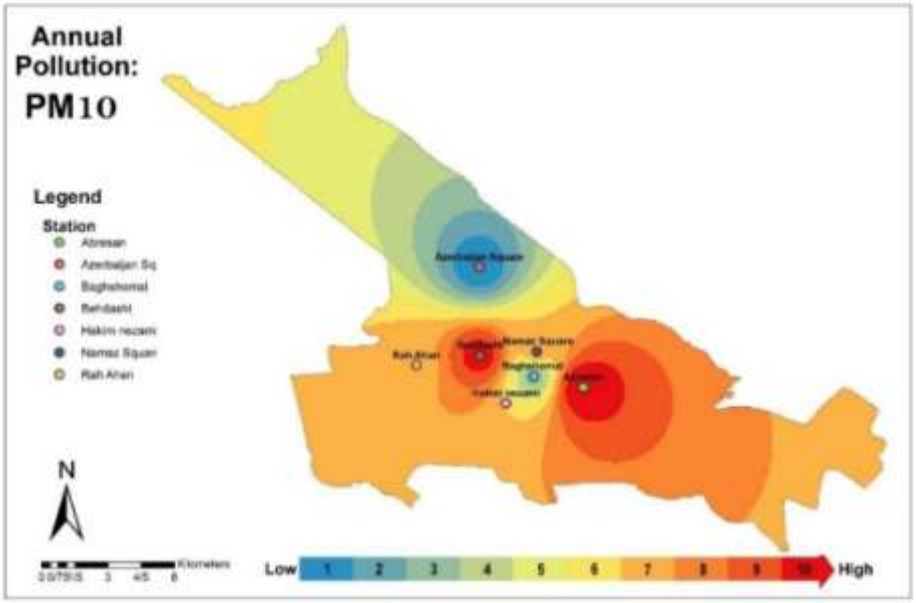

Fig. 11: Tabriz cities annual PM10 pollution index

CO

Carbon monoxide (CO) is generated through incomplete combustion which usually happens in any fuel-using device. The important effect of Carbon monoxide is on decreasing the blood flow to circulate oxygen through the body, deprives the heart, brain, and other vital oxygen organs. A high concentration of CO can be dangerous, but about low concentration, it only causes headaches and dizziness (Hosseini, Shahbazi 2016, 1030, ASHA,2012). The outputs (Fig12) indicated that CO concentrations at Rah Ahan station and behdasht station, are higher than other stations, which can be overshadowed by high traffic loads.

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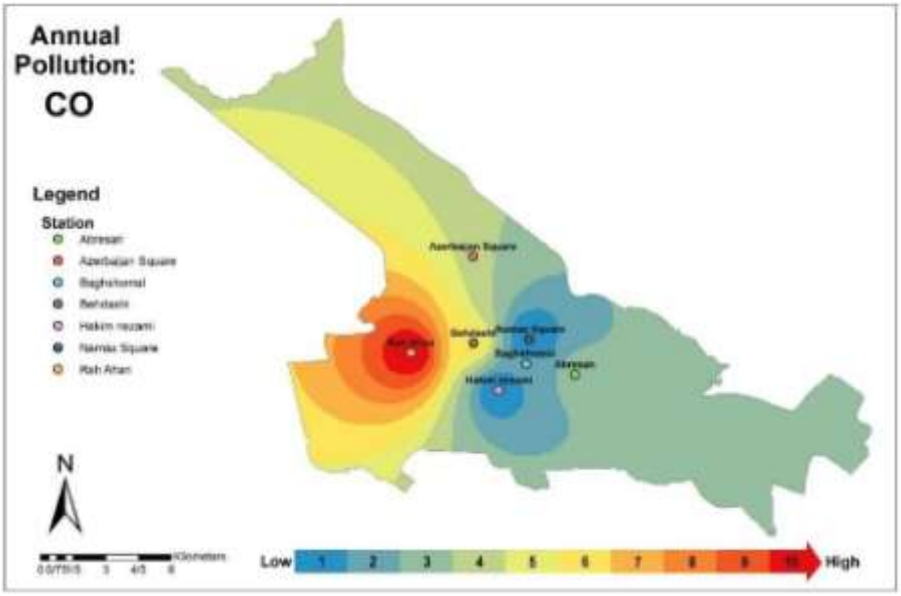

Fig. 12: Tabriz cities annual CO pollution

NOX

Internal Combustion engines produce Nitrogen oxides (NOX), including NO and NO2. The most noticeable and common NOX sources are diesel- and gasoline-powered vehicles. Both are irritating to the lung and respiratory systems, and are especially harmful to small children, NOX also produces secondary air pollutants and is one of the main sources of photochemical smog (smoke plus fog), the prominent brownish colored air pollution that occurs in many main Iranian cities, spatially Tabriz (Hosseini and Shahbazi 2016, 1030).

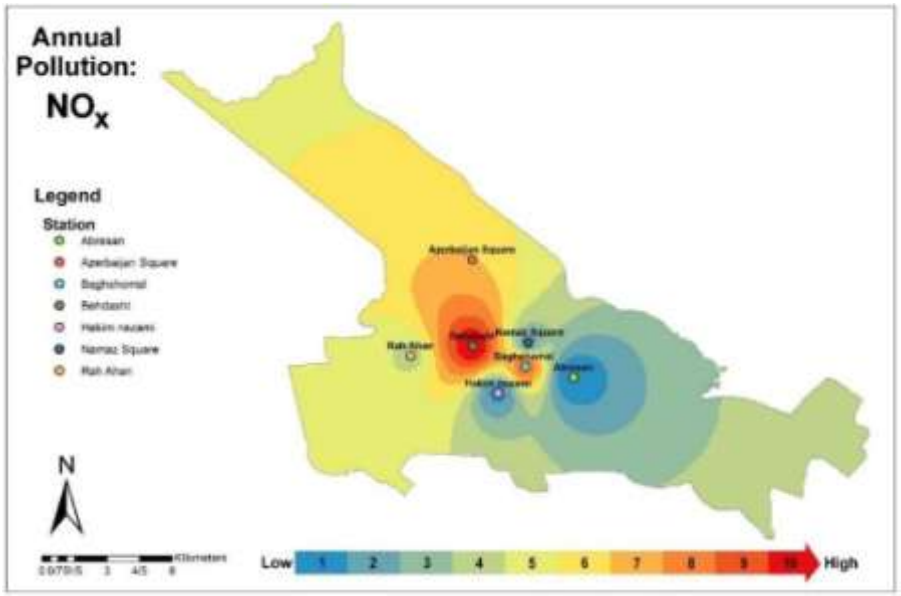

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Fig. 13: Tabriz cities annual NOX pollution

Figure 13 showed that in Behdasht and bagshomal stations, NOX concentrations are higher than other stations.

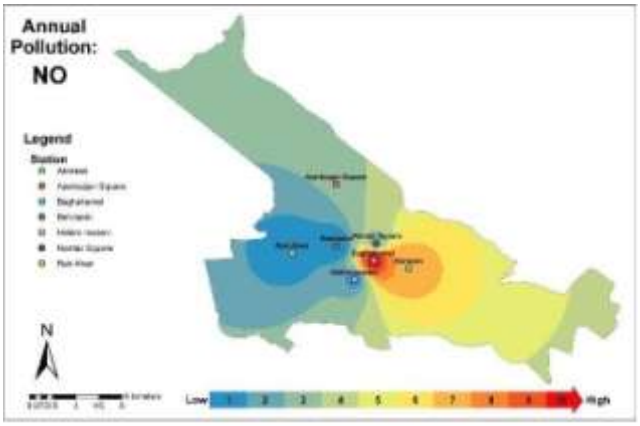

Fig. 14: Tabriz cities annual NO pollution

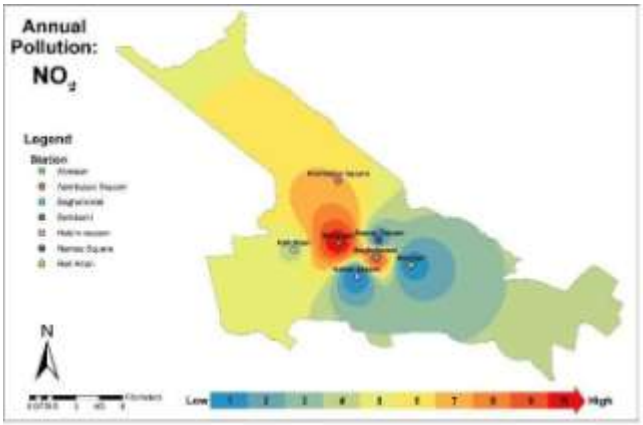

Fig. 15: Tabriz cities annual NO2 pollution

Annual NO pollutions map (Fig 14) represented that, NO concentrations are higher in Bagshomal and Abresan stations. Also, NO2 map (Fig 15) demonstrated that in Behdasht and Bagshomal stations, NO2 concentrations are higher than other stations.

SO2

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Sulfur dioxide (SO2) produced by combustion is the outcome of sulfuric substances in the fuel; SO2 is mostly produced by diesel engines since standard gasoline normally contains lower levels of sulfur and Another source of SO2 emission is petrochemical plants.

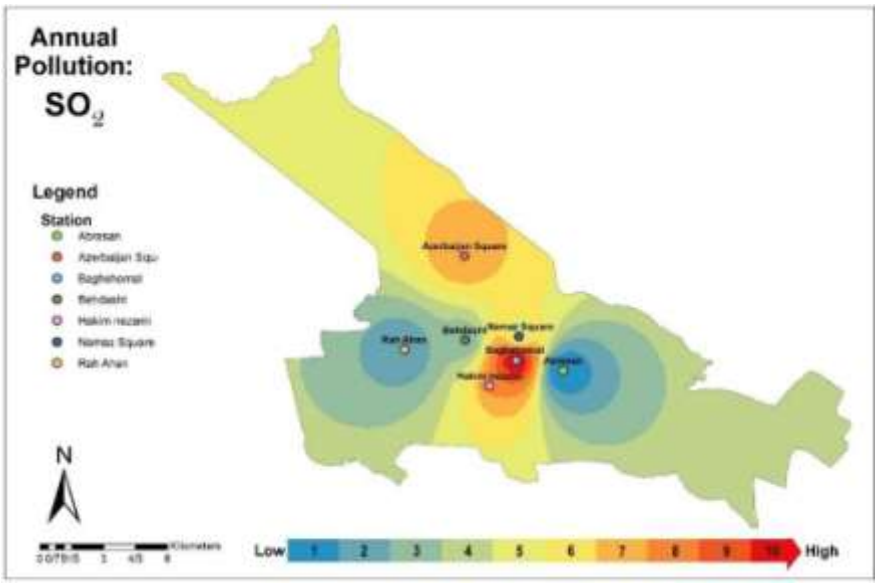

Fig. 16: Tabriz cities annual SO2 pollution

As the annual SO2 pollutions map (Fig16) showed, in Bagshomal and Azerbaijan square stations, SO2 concentrations are higher than other stations.

O3

Ozone (O3) is a reactive oxidant, colorless gas that constitutes an important smog in the atmosphere. O3 resources are natural and anthropogenic. Some of these sources are automobiles, power planets, and chemical planets. Ozone pollution is more common in warmer months (Worldbank1998, 227, U.S Environmental Protection Agency 2009). The forming of Ozone is slow and also its density is greater aside from the pollution source (Hosseini & Shahbazi 2016, 1031). Figure 17 showed that O3 concentrations at Behdasht station, are higher than other stations. The map showed that in central part of Tabriz spatially Behdasht station, O3 concentrations are higher.

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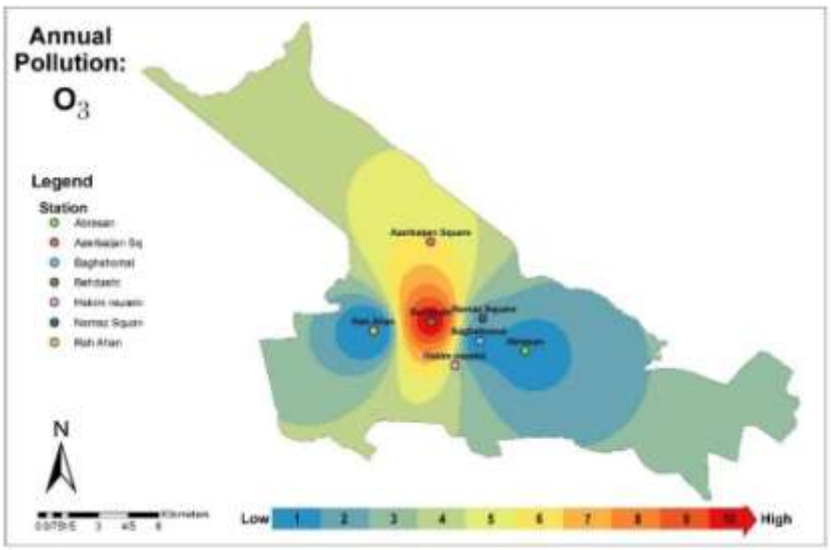

Fig. 17: Tabriz cities annual O3 pollution

As figure18 show, in the winter season spatially in September and November from 12 am to 12 pm wind speeds have lowest speed, and in July, May and March from 12 pm to midnight are at their highest speed, with a general wind speed of 15 percent during The year in the spring season.

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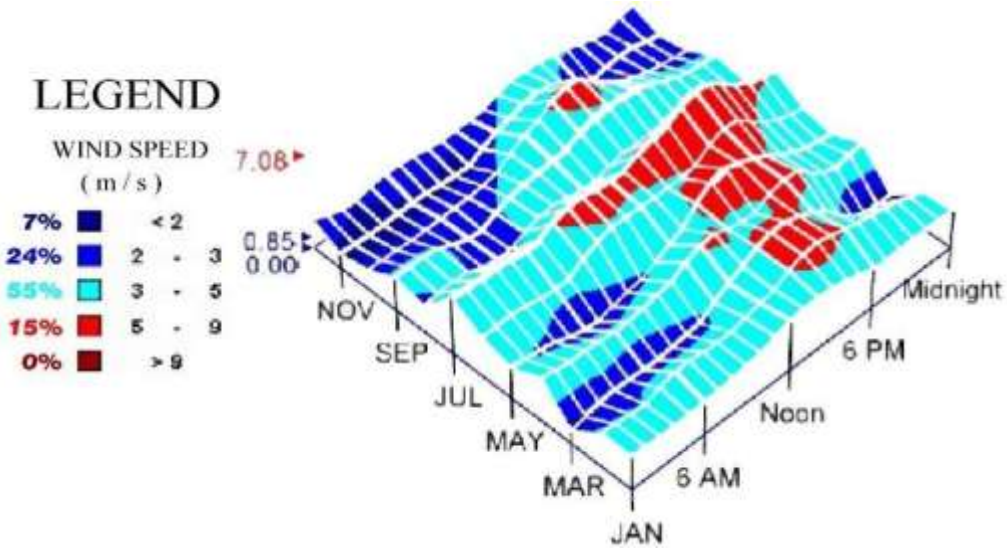

Fig. 18: Monthly wind speed of Tabriz city

5 Discussion and conclusions

Air pollution is an important issue in most of metropolitans and also directly affects environmental sustainability. Tabriz metropolitan is struggling with air pollution. This article uses GIS tools to analyze Tabriz air pollution with data on seven major pollutant gases. Results show that PM10 density, particularly in the city center is high at all stations except Azerbayjan square station, which can occur due to traffic congestion and industrial units. In western part of city CO, NOx, NO2, gas density is high. NO has higher level in eastern part of city and O3, SO2 are high density gases on center of Tabriz city. Many of the major factories and pollutants are currently located in the south- west of Tabriz. The Southwesterly wind blows high in spring, and it is relatively high in fall and winter. The situation at Tabriz gets even worse in winter because of the inversion phenomenon. One can see the moving polluting products entering into the center of the city. Tabriz has special topology features like Eynali mountains in north-eastern region, is one of the key causes for increase air pollution and reverse in winter temperature causing physical disease, destruction building and greenspace. Also, Tabriz has a valley and basin structure that may accumulate smoke and poison gases in the region.

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The density of air pollution is on the highest level, over recent. As research pointed Tabriz air pollution sources were factories, industrial units, vehicles and the city center's land-use accessibility. This study suggests some solutions to mitigating air pollution at Tabriz. The population of Tabriz is increasing, and this may lead to increased demand for industrial growth. Factories and heavy manufacturing will move beyond city boundaries. According to Tehran metropolitan law, factories have been transferred to 200 kilometers away from Tehran, but it caused a lot of issues for Tehran neighboring cities. Therefore, future factories should built-in non-residential areas with sufficient accessibility, and new location features should be considered for the factory transfer site. Another air pollution source of is the output of factories. So these factories should pay tax for generating pollutant gases. But they could also use modern technologies to reduce emissions, build green space and plant trees that are suitable for the area. Important land-uses are concentrated in Central part of Tabriz city, so air pollution causes traffic congestion in this area. In order to solve this, issue a poly-centric structure is recommended.

This structure can distribute land-use with a suitable access. A successful solution to reducing traffic congestion is also to use a mixed-land-use system. There is some traffic guideline to follow, including improving public transit, restricting the single-occupant movement of vehicles by paying fine for it, assessing the congestion zone. To obtain more accurate information on these pollution assessment stations, it is recommended that the number of pollution assessment stations in Tabriz city be increased and seasonal study of urban emissions is recommended for future studies.

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