

# **Principles of Positioning Industrial Estates**

**Kamran Yeganegi**

**Industrial Engineering Department, Islamic Azad University, Zanjan Branch, Iran**

**Atefeh Mojtabazadeh**

**Department of Urban Design, Islamic Azad University, Zanjan Branch, Iran**

## **Abstract**

Industrial development and growing industry in the world, especially in developing countries in the contemporary, Cause more attention to industrial towns and has been discussed their location and location of the industrial sector in the challenging field of industry And finding a suitable location for industrial are very important for economic managers and leaders of each country. Also the choice of location for settlements and industrial areas, are so important of the complex, multiple dimensions conditions. Now it is very interesting to study about the necessity and importance of development and the industrial sector as a engine driving economic developments, political, social and cultural. This article is the first reviews on basic concepts and significance of positioning sites, then the Factors and parameters influencing on the location of settlements and industrial areas to be addressed. Finally, is presented the conceptual model to locate an industrial estate.

## **Key words**

Industrial Estate, Location, Industrial zone.

## **1. Introduction**

Any phenomenon inevitably occurs in space and location, affecting the same space and location considering its extension. Industry and development are not exceptions. As the need for regions of advanced and modern factories and industries is increased, the thought of erection of industrial estates are reinforced accordingly[12]. Establishment of industrial estates is related to parts of policies in the view of new towns, created following the objectives for establishment of new towns (decentralization, population growth control, population, optimized distribution of population an services, regional development stimulation and environmental protection).

Location of industrial estates in various fields is of great importance. Further to decrease of costs of services, decrease of warehousing fees, exchange of thoughts of industrial plants, decrease of transportation cost and control of air pollutions, industrial estates prevent destruction of agricultural lands and play a prominent role in attraction of manpower seeking for job in the regions where the said manpower are more needed. Consequently, precise location and fundamental design of industrial estates are considered strong steps for environmental improvement and development of industries and fundamental and logical growth of urban and rural districts. Industrial estates establish suitable grounds for employment in the regions where they are needed more than other areas and it can prevent excessive and unharmonious density of large urban areas and play a pivotal role in establishment of regional equilibriums. In this paper, first, definitions of industrial areas and estates are given. Then, respective principals and parameters affecting location of industrial estates and in concluding, a conceptual model for location of industrial estates is presented.

## **2. Theoretical Principles:**

### **2.1 The concepts related to industrial estate:**

#### **2.1.1 Industry:**

Industry means all changes, which are made by humans in natural materials in order to use the said material more efficiently. For example, change of wheat to flour, cotton, wool and silk to fabric and excavation of petroleum and metals [18].

#### **2.1.2 New towns:**

Definition of an industrial estate depends on definition of a new town. A new social town is self-sufficiency. It has certain population and area. It is located at a certain distance from metropolitan. The said town enjoys

predetermined planning, definite objectives and it enjoys all facilities required for an independent environment [4].

### **2.1.3 Industrial city:**

The word "Industrial Park" was commonly used in the 19th century for the first time. The industrial park is a planned complex, which has separately been developed from standard constructed factories. It has been designed to materialize relevant requirements of industries and inhabitants of a town, especially their need of housing. In addition to organizing required space for industry and establishment of industrial plants including environmental facilities and installations and houses in order to fulfill the requirements of employed and unemployed inhabitants[10].

### **2.1.4 Industrial Estate:**

an industrial park is a place that enjoys definite borders and sites where a collection of industries is located providing required services and infrastructure facilities for the owners of industries in the view of type and size of the town and combination of existing industrial activities[16].

It is a developed plot of land, divided into smaller lots for settlement of industries and the said lots are devoted to industrial investors in compliance with specific rules and criteria. The said transferred lands should necessarily have been prepared and enjoy needed infrastructure facilities and services partly or to some great extent.

### **2.1.5 Industrial axle:**

A long path where a few districts, regions, town, industrial pole and industrial park are located [10].

### **2.1.6 Industrial region:**

It refers to a part of an uncultivated and intact plot of land, which are designated for establishment of industrial plants. In urban area is determined for industrial task in the view of specific criteria and conditions. No organization has been considered in the area of space and location [16].

### **2.1.7 Industrial area:**

The industrial estate is a part of regional space consisting of small and mild industries. It enjoys definite service, facility, installation and infrastructure facilities. It is for sale or rent [16].

### **2.1.7 Industrial complex:**

The industrial complex comprises a limited land area, which has been prepared according to urban development plans. It has also been divided into smaller lots accordingly. In an industrial complex, public facilities, transportation and road networks are prepared. It is possible that common facilities are designed for such complex[10].

### **2.1.8 Industrial parks:**

The main objective of establishment of industrial parks in the suburbs is to erect industrial complexes where industries and affiliated functions work adjacent to each other. The first planned industrial parks were established in early 20th century in the United States of America. After the World War II, however, they have been developed. Shortage of urban lands for industries, appropriate location, cost-effectiveness, accessibility of required equipments and facilities are among the reasons because of which industrial parks have been developed [15].

### **2.1.9 Industrial point:**

It refers the first grade centre of an industrial town. It enjoys definite quantity of production and employment and infrastructure facilities, offering certain industrial and commercial services. An industrial area comprises a few points of definite radius within the area of service limits of a 1st- 2nd grade city.

### **2.1.10 Industrial pole:**

It refers to small collections of small manufacturing plants.

## **2.2 Importance of industrial estates:**

Industrial estates play a great role in collection of industries and creation of intra-unit value-added among various industries. Industrial estates are suitable for investment benefiting from possibilities, facilities and advantages for investors, specialists and work forces. Industrial estates are certain spaces which are used in industrial, national and regional planning and strategy planning as a political mean for the following two reasons:

- A. Encouragement of industrial development and equilibrium in its distribution: as partial objectives
  - B. Environmental protection and optimized use of space as strategy planning.
- Conclusively, establishment of industrial estates is a producing infrastructure development task, which plays a determining role in industrial development of regions, attraction of manpower seeking for job, increase of production and necessarily planning space for control of environmental pollutions[14].

**3. The concept of location:**

Desirable location means full observance of a set of principles by which execution, improved locations are specified for industrial activities (based on finding a point conforming to maximum profit)[16].

**Location of industrial estates:**

The problem of location of industrial areas and estates is an important issue for investment. The main objective of land monitoring plan in the view of industry, compared to the entire country, is to locate various fields of industry in space, harmonious, appropriate and equilibrium growth of various regions in various industrial fields and branches simultaneous with complete use of human and natural resources in order to achieve the highest degree of efficiency.

**3.1 Background of location:**

Location has existed as of establishment of intelligent human on earth, seeking for food resources, finding an ambush for hunting or fighting, creation of shelter and workplace.

According to studies carried out throughout the world, industry has been created for the first time in a location with specific conditions such as infrastructure factors (raw materials, manpower, accessibility roads and the ones). Actually, in order to establish an industry in a place, desirable equipments such as accessibility roads and residential areas of major social foundation have been required. For example, in the 18th century, Britain was a country that enjoyed a huge amount of assets, desirable accessibility roads and great raw materials and manpower. All of the said factors have lead to booming industry in the Britain as the first industrial country.

**3.2 Views which are put forth in location of industrial estates:**

Corresponding views that are propounded in location of industrial estates are classified into three groups of classic-modern, behavioral and structural ones. They are elaborated as follows:

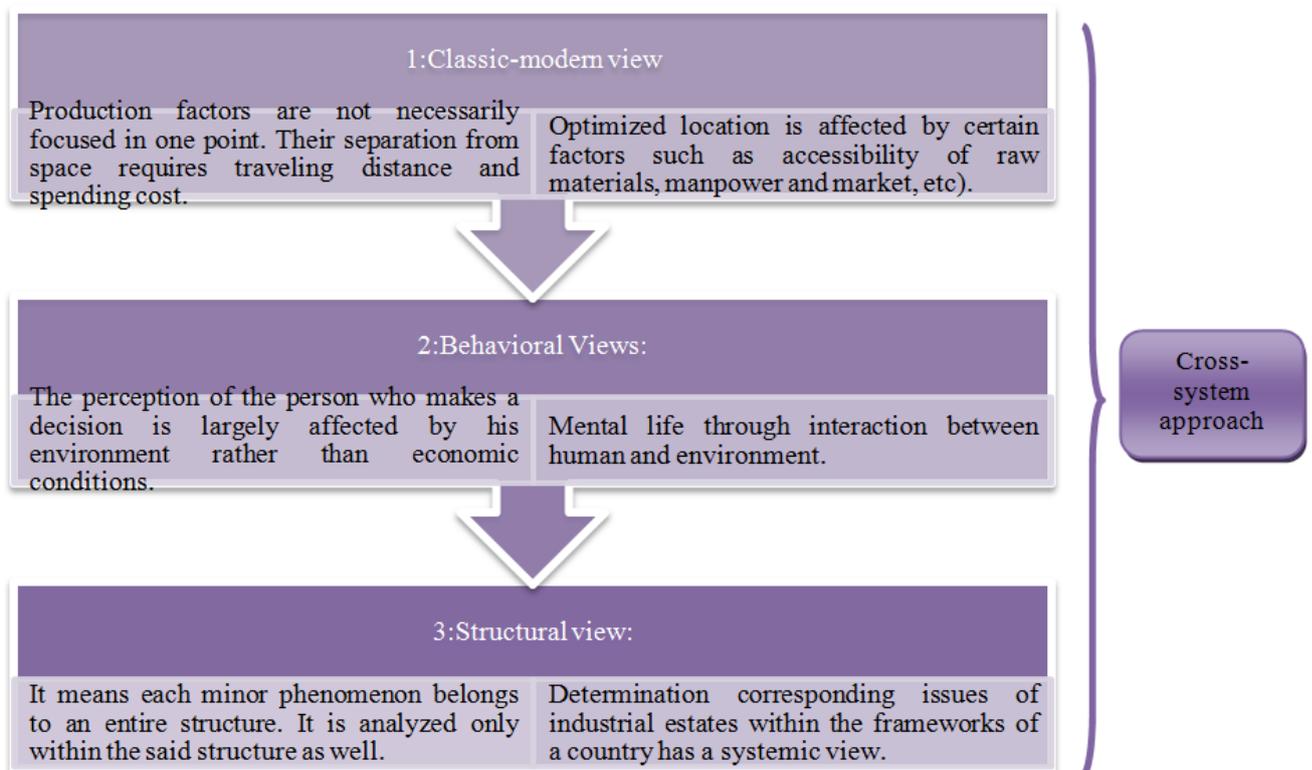


Figure 1: Views, which are put forth in location of regions/industrial estates:

### 3.3 Location of industrial estates:

Location of industrial estates: Determination of the location of an industrial estate, is the most important steps take for establishment of an industrial estate. Because the results of such decisions will appear in a long period of time and they shall have great effect from economic, environmental, and social areas. One of the aspects of intra-organizational effects is its direct effect on factory profiting. From inter organizational view, development of large factories at one district may affect various economic, social, cultural, environmental and other conditions accordingly. From economic aspect, designation of a factory may have a key role in quantity of primary investment upon establishment of the said factory.

Moreover, upon operation of a project, this decision-making shall have a key effect on the cost price of goods and services. Precise and appropriate location studies shall have an economic effect on operation of an industrial plant and will have social, environmental, cultural and social effects on the location where the said plant is established. Meanwhile, regional characteristics are also regarded as effective key factors affecting respective issues related to location [22].

The importance of location of regions/industrial estates:								
economic, social, cultural, environmental and other effects on district	encouragement of industrial development and equilibrium for its distribution	environmental protection	optimized use of space	preventing inappropriate use of urban lands	promotion of production quality and fair economic competition	production with great yield	decrease of expenses (service, production and as such)	attraction of manpower seeking for a job

Figure 2: The importance of location of regions/industrial estates:

### 4. Location parameters of industrial estates:

There are various parameters and indices affecting location of industrial estates. Each parameter has a great share in location of industrial estates each. It depends on locality and land conditions for establishment of an industrial estate. In addition, selection of a desirable location for industrial districts/estates is among much complicated decisions, which should be studied from various views considering different factors simultaneously. Hence, a huge volume of general and detail information should be gathered, combined and analyzed for selection of locations in order to lead an appropriate evaluation of the factors that may affect this selection[20-23].

Table 1: List of indices and parameters affecting location of industrial estates.

Indicator Localization	Parameters Localization
1. knowledge of regions and feasibility study	Do you need industrial estate there? If you can create the industrial estate there?
2. Physical indices:	<p>1. Land particulars:</p> <p>A. Land locality: Locality and location of the land in the region, city, road and its distances from main cities and the nearest cities should be studied.</p> <p>B. Land area: Area of lands, dimensions and size of the lands in respective map should carefully be examined.</p> <p>C. Possibility of land development: The possibility for development of the town in the future and its direction should be taken into consideration accordingly.</p> <p>D. Regional land proprietorship and utilization thereof: It had better corresponding land belong to government so that there will be no problem in the view of land proprietorship.</p> <p>2. Natural resources and conditions (nearness to raw materials resources): The effect of the earliest and raw materials in the view of location is affected by the characteristics of the said materials.</p> <p>A. Resources of raw materials, fuel and energy are dependent on a certain location.</p>

	<p>B. Corresponding industries that can be corrupted like dairy products and as such should be founded in the nearest distance to consumers.</p> <p>C. Corresponding industries for production of construction materials, machine manufacturing and the ones should be founded in the respective places considering both items 1 and 2, especially if transportation faces certain problems.</p> <p>3. Topographic conditions: It refers to the studies addressing topographic conditions, and particulars of land unevenness in particular.</p> <p>4. Slope: As a whole, unstable lands and those lands with a slope over 5% are not appropriate for development of industries.</p> <p>5. Height from sea level: The lands, which are, located in low height from sea level face many problems for drainage and being subject to flood.</p> <p>6. Soil and land potentials: Corresponding lands should be stable in order to tolerate the weight of buildings and various and heavy machinery. The soil should also be appropriate for establishment of structures.</p> <p>7. Study of rifts, seismicity, and earth pressure of the region</p>
3. Indices of vulnerability:	<p>1. Volcano: The ash exhaling the volcano may cause a city become buried.</p> <p>2. Emersion and depression of land from/in water along with coasts may cause a port turn to a leveled land or may cause it to be dressed in water.</p> <p>3. Sandy winds: These winds may cause air pollution, destruction of houses or transfers of sand and soil to other places forming sandy hills.</p> <p>4. Lands subject to flood: Volume of flood plain should be calculated based on frequency of rain, quantity of precipitation, kind of soil and capacity of rivers that receive running water.</p> <p>5. Nuclear explosions: In order to prevent major damages (material, bodily and the ones), nuclear power plants should be taken into consideration regarding location of industrial estates.</p> <p>6. Soil movement and landslides: Soil movement and landslides are parts of geological cycle. Particular kinds of plants may prevent soil erosion.</p>
Indicator Localization	Parameters Localization
4. Geographical, climate and location indices:	<p>1. Prevailing winds: The rout of winds and storms are also among major factors affecting location and establishment of industries. The direction of prevailing wind to any directions whatsoever will determine polluting industries in a way that they are located at the end of the said prevailing wind.</p> <p>2. Precipitation: Precipitation is considered a factor affecting the region. If the industries with relatively high pollution are located in a place, where there is little rain, pollution and environmental problems are doubled accordingly.</p> <p>3. Vegetation (Pastures, forests, deserts and as such): Vegetation differs based on climate, soil, kind of land and other geographical conditions. It should be noted that 1st, 2nd and 3rd grade lands (agricultural ones, forests and pastures) are not appropriate for establishment of industries. The fourth class lands are chosen for establishment of industrial estates and districts.</p> <p>4. Frost: Number of frost days and perpetuation of frost period revealing the effectiveness caused by cold weather fronts during frost period of the year, is of great importance;</p> <p>5. Feasibility of decrease of natural mishaps consequences: Respective danger in various geographical regions may be minimized by compiling precautionary strategies that warn crisis.</p> <p>6. Desirable climate (temperature, precipitation, relative moisture, wind, sunning hours and frost days, ...)</p>
	<p>1 – Water: supply adequate water quantity and quality of the initial condition for the establishment of industrial estate and industrial fields and industries located in the major consumer of water. In the context of a) the status of water resources in the region, b) and distribution of water supply projects and programs at the regional level, c) good access to water resources, d) utilization of water resources facilities e) the disposal of surface water the area should be considered.</p> <p>2 - Power: Power supply is one of the conditions necessary to locate industrial town. In the context of a) the supply and distribution of electricity in the region and b) Transmission networks are important.</p>

<p>5. Indicators of the facilities, infrastructure, equipment</p>	<p>3 - Gas: natural gas than other fossil fuels due to comparative advantage, particularly in sectors requiring industrial plants, gas supply and other factors are important factors in considering a) the supply and distribution of gas in the region and b) gas supply and distribution plans and programs at the regional level is essential.</p> <p>4 - Energy sources: the industries that locate in energy costs, an important part of the cost per unit produced by them can be included as a significant energy resources and the importance of a) the proximity to the energy cost and plants, and b) access to a lot of fuel.</p> <p>5 - Contacts: a) the fixed and mobile telephone lines in the area, (the provision of communications services), b) Internet lines.</p> <p>6 - Urban and welfare services (banking, health care, insurance, post-fire).</p> <p>7 - The establishment of industries in the past: One of the reasons because of the location of the establishment of industries in the past.</p>
<p>Indicator Localization</p>	<p>Parameters Localization</p>
<p>6. Facilities indices, infrastructure installations and equipments</p>	<p>1. Water: supply, quantity and quality of sufficient water is among essential conditions for the establishment of an industrial estate and for most of industrial fields founded in the said industrial estate and major industries consuming water. We can point out the following factors that should be taken into consideration:</p> <p>A. Conditions of water resources in the region</p> <p>B. Designs and plans for supply and distribution of water throughout the region</p> <p>C. Desirable accessibility of water resources</p> <p>D. Operation facilities of water resources</p> <p>E. Removal of surface waters in the region</p> <p>F. Prediction of water consumption in the region</p> <p>2. Electrical power: Supply of electrical power is one of urgent conditions for location of industrial estates. Regarding this item, the following points should be taken into consideration:</p> <p>A. Conditions for supply and distribution of electrical power in the region</p> <p>B. Power transmission networks are of great importance.</p> <p>3. Considering the relative advantage of natural gas compared to other fossil fuels especially at industries sector and requirement of industrial plants of the same, gas supply is among major factors. Regarding this item, the following points should be taken into consideration:</p> <p>A. Conditions for supply and distribution of gas in the region</p> <p>B. Designs and plans for supply and distribution of gas in the region</p> <p>4. Energy resources: Considering location of industries where cost of energy is regarded as major part of expenses spent by the units generating the same, great importance attached to energy resources.</p> <p>Such factors as</p> <p>A. Nearness to cheap energy resources and power plants</p> <p>B. Facilities for accessibility of fuel and energy have a great effect.</p> <p>5. Telecommunications:</p> <p>A. Telephone lines status of stationary and mobile phones across the region (supply of telecommunication)</p> <p>B. Internet lines</p> <p>6. Welfare and urban services (banks, health centers, insurance organizations, post offices and fire services)</p> <p>7. Establishment of industries in the past: One of the reasons for erection of a group of industries in locations refers to establishment of the said industries in the past.</p>

7. Indices related to borders:	<p>Borders should carefully be observed. According to respective rules, the said borders one must be concerned about the said borders as well. The said borders are namely limit of accessibility roads (roads, rails, airports and ports), high voltage power transmission lines, oil and gas transfer lines, borders for bed and limits of rivers, natural rivers, flood plains and borders regarding environmental criteria and limits of wastewater treatment plant.</p>
Indicator Localization	Parameters Localization
8. Economic indices:	<ol style="list-style-type: none"> <li>1. Cost and value of land: Cost and price of land is regarded as an important factor. Estimation of costs should be planned for. It means current value of all costs required for establishment of an estate or area.</li> <li>2. Nearness to market: Closeness to regional, national and even international markets is among major indices for location of industrial estates. It is better for a few industries be near their markets minimizing distribution costs.</li> <li>3. Economic indices: In order to start economic analysis, the following indices should be taken into consideration: <ol style="list-style-type: none"> <li>A. Income earned through operation right</li> <li>B. Net value of project</li> <li>C. Collective frequency of net value of project</li> <li>D. Return period of investment</li> </ol> </li> <li>4. Analysis and evaluation of plan: Considering this factor, it is found that whether the respective plan is cost-effective or not. Otherwise, the said plan will not be cost-effective.</li> <li>5. Nearness to industries (Other factories): At locations where industry is concentrated in one area, there are usually a few sub or support factories. The said factors provide special services or goods for other factories in industry.</li> <li>6. Transportation fee: Nearness to population centers shall result in decrease of transportation fee.</li> <li>7. Investment and competitive motivation (governmental motivation)</li> <li>8. Maximum profit and minimum costs: Technical justification from economic point of view</li> </ol>
9. Technology:	Technology: level of science and technology, existence of scientific and technical structure and desirable life level are among important factors in location.
10. Social indices:	<ol style="list-style-type: none"> <li>1. Population: Establishment of industrial estates and production of various products are done for the purpose of sale and offer to market. If an industrial estate is nearer to population center, corresponding products are offered to consumers more swiftly leading in desirable profiting accordingly.</li> <li>2. Manpower: Manpower can be studied at the following two parts: <ol style="list-style-type: none"> <li>A. Specialized and skillful manpower (experts and consultants)</li> <li>B. Cheap manpower (workers). The combination of manpower can be studied from the following aspects in the view of investment of industrial project. <ol style="list-style-type: none"> <li>1. Manufacturing filed/s</li> <li>2. Type of profession or technique</li> <li>3. Degree of expertise</li> <li>4. Combination of age groups</li> <li>5. Proportion of number of men or women compared to total number of personnel in various fields</li> </ol> </li> </ol> </li> <li>3 Labor Social Security Organization (concentration, expertise, and industrial cooperatives and solidarity)</li> </ol>

	4 Life quality (security, welfare, etc), personal motivations: it is considered an important factor in location.
Indicator Localization	Parameters Localization
11.Security and disciplinary indices:	Safety: Public discipline and security create motivation, promoting interest of investors in investment activities in the estate. Acting in the realm of production and industry under conditions where public security and welfare are available may lead to a great change in economic conditions affecting the said conditions accordingly. Security outside the estate (safer travel of persons)
12. Environmental indices:	<ol style="list-style-type: none"> <li>1. Environment: Acting in the field of location of and organizing industries does require full observance of environmental points toward stable development and maintaining quality of life environment (natural, social and strategic environment).</li> <li>2. Environmental pollutions: It is an important factor for location of industrial areas. <ol style="list-style-type: none"> <li>A. Industry and water pollution</li> <li>B. Industry and noise pollution</li> <li>C. Industry and prospect pollution</li> <li>D. Industry and air pollution</li> <li>E. Industrial sewages</li> <li>F. Plant, animal and human life</li> </ol> </li> </ol> Full observance of rules put forth by environmental protection organization
13. Political indices:	<ol style="list-style-type: none"> <li>1. Political factors (preparatory policies and industrial strategies): In the view of macro economy and industrial development planning, location of and organizing industries is largely dependent on the policies and measures of each country in the field of space planning and land preparation.</li> <li>2. Government policy: Industrial development is accompanied by encouragement in a few regions and by limitation in some others.</li> <li>3. Regional criteria and execution of regulation in location of industries: Corresponding regional criteria and execution of appertaining regulations should be taken into consideration in selection of a desirable location.</li> <li>4. International and worldwide organizations: United Nations Organization, Industrial Development Organization of the United Nations Organization, World Work Organization and etc</li> <li>5. Political supports and investment and competitive motivations: Extensive support by government and active participation of beneficiaries and investment and competitive motivations by mangers are among major factors for attraction of investors in this respect.</li> <li>6. Preparatory policies and industrial strategies</li> </ol>
14. Indices of passive defense and crisis management:	Location of installations, buildings, major safety centers, dispersion of installations and buildings, development of shelters and borders, location of fuel storages, water reservoirs, stations of sale of oil products (gas station), fire services and etc, consideration for principles of crisis management in location of industrial areas aiming at advancement and safety against mishaps
15. Technology indices:	Level of science and technology, existence of desirable scientific and technical structure and existence of desirable life level are major factors, which are of great importance in location.
16. Site Attractiveness indices:	Site attractiveness as residence to live in the industrial estate and location should meet satisfaction of people who will live in.
17. Stable development:	Management and activities, which lead to preservation, integrity and promotion of environmental, social, economic and cultural resources and durability of the same.

## 5. Models for Industrial Location

Theories of industrial location are aiming at explanation of the structure of location for industrial activities based on the factors and variable affecting the location responding the question addressing the best location for establishment of an industrial activity. Many theories of location are rooted in economic thoughts and have been formulated by economists. In order to create these theories, the economists have made effort in connecting the factor of location to main body of economic theories. Although there are a huge number of theories and models for location, only respective theories of more extensive application are offered. On a whole, theories and models of industrial location can be classified into the following three methods:

- A. The method of minimizing costs, which is tried for industrial location in the view of reducing corresponding costs of production factors.
- B. The method of analysis of accessible trading area emphasizing demand and the factor of market. In this method, it is intended to maximize respective income.
- C. Obtaining maximum profit, which the logical result of the two methods mentioned above. There are many models in this respect. For example, models of gravity, Topsis, Larry and the model of process for hierarchal analysis process. One of the said models is selected for location considering conditions and expertise. It should be noted that complexity of models is not considered a reason for their advantage. The simpler the models are, the more efficient they will and eventually, it will be easier to establish relation with data, achieving more effective results. In order to achieve this goal, gravity models, which are simpler and have more application, are among the models of highest application in executive issues. Here, we introduce gravity model:

**5.1: Gravity model:**

Gravity models are created according to the relations, which are discovered in physical sciences and are used in social sciences. They are based on Newton's Theory of Gravity. In this model, it is assumed that there is a direct relation between mutual effects of two population center and mass of the said centers and a reverse relation between the same and distance of the said centers. In order to use the concept of gravity in analysis of urban systems, the gravity between two objects has been interpreted as mutual relation of two regions. There is a direct proportion between the quantity of the mutual relation between two or more than two areas and size (gravity force) of the areas and there is a reverse proportion between the distance of areas and relative gravity of the same.

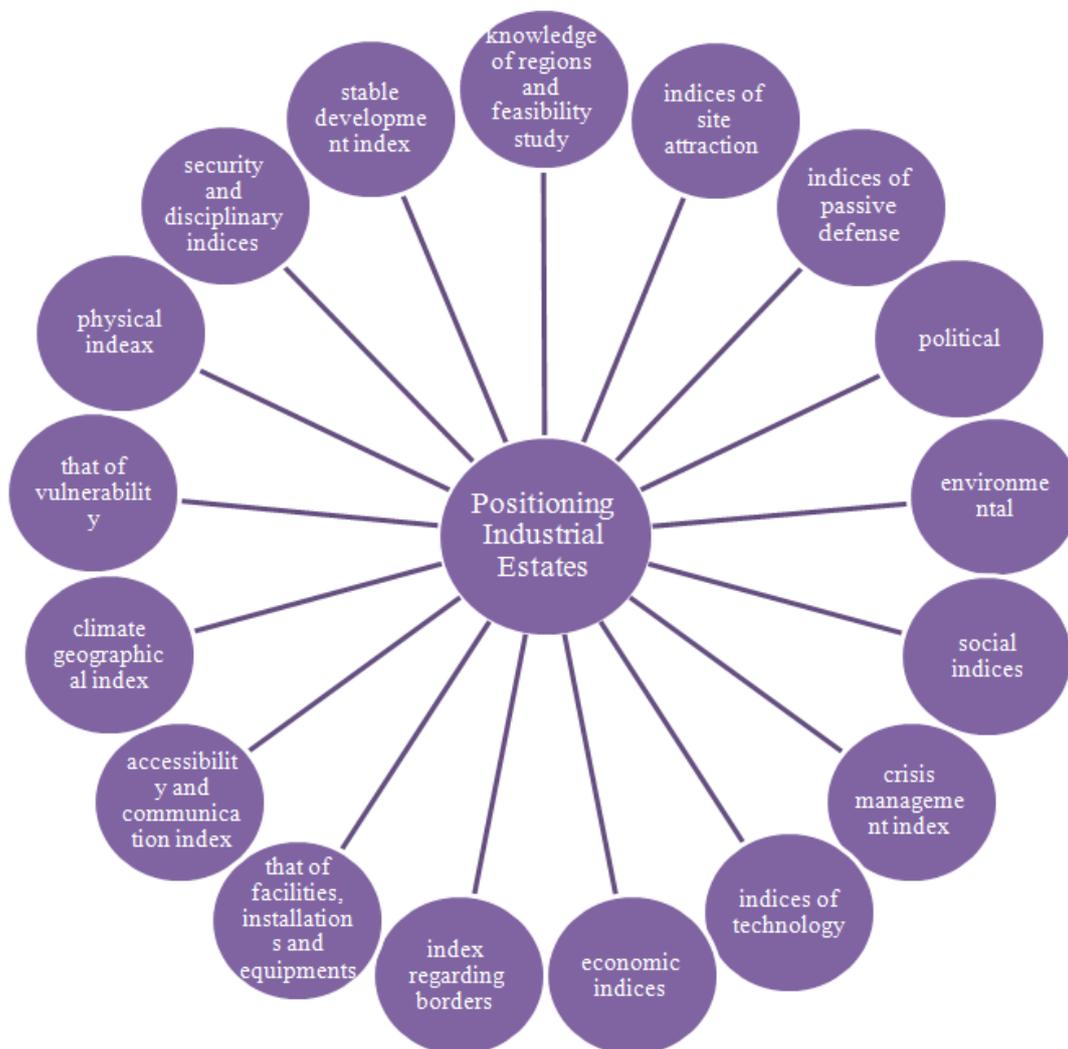


Figure 3: Analytical model for location of industrial estates

## 5.2: Gravity models as models used for location:

From among very useful characteristics of gravity models, we can point out the capability of the said models in estimation of activities as their location may be. In other words, these models can be used as models for activity of location and as models specifying mutual relations. Gravity models are discussed in location in order to compare two or more than two options. This model is of high application in locations. Because environment and potentials available in the environment are affecting location to great extent. In other words, there is a direct relation between desirable location and potentials and reverse relation between the same and distance (from population centers etc).

## 5.3: Analytical model for location of industrial estates:

knowledge of regions and feasibility study, indices of site attraction and passive defense and political, environmental and social indices and crisis management index and indices of technology, economic indices, index regarding borders and that of facilities, installations and equipments, accessibility and communication index, climate geographical index and that of vulnerability, physical index, security and disciplinary indices and stable development index.

## 6. Conclusion

Establishment of an industrial area/estate will start simultaneous with location as first step. Hence, the most important and essential factor that should be taken into consideration in establishment of industrial estates is "location" of the said regions which does require knowledge of environment and existing competences. The matter of location is so important that imprecise studies for location shall bring about irretrievable damages (social, economic and environmental). In other words, for desirable and optimized industrial location, one should consider various factors, dimensions and branches. Consequently, corresponding principles and parameters affecting location of industrial estate are of great importance [1, 10]. All factors, which are mentioned herein this paper, worth attention. Experts, however, should do precise location considering their aims. They should study various aspects of case and probable obstacles. Obviously, a location with more parameters will have priority for attraction of industries. In other words, the previously mentioned indices are used in order to compare two or more than two locations by pointing. If such comparison is absent, the said indices will be used in discussing the potential of industrial development and growth. In order to select optimized industrial location, all factors mentioned earlier should be put together. Because negligence of even one factor may result in great damages. Moreover, none of the theories of location can be executed or generalized separately and generally. Consequently, location of industries will be different in the view of various sciences. Each scientific system emphasizes on a particular aspect of the matter

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