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# An Approach for Activating Industrial Settlement Strategies in the Egyptian Regions: A Case Study of North Upper Egypt

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**ABSTRACT:** Industry has conspicuously gone through four industrial revolutions. Each revolution was accompanied by patterns of development and discoveries of new technology called **Waves of Innovation**, which affected the form of industrial settlement and the economic and social life of countries. Consequently, this was reflected in urban expansion. Moreover, the scientist **Walt Whitman Rostow** mentioned in his theory of the phased growth of the region that the regions go through five economic stages, starting from the traditional society through the pre-take off stage, followed by the take off stage, then the maturity stage, and finally the stage of High Mass-consumption(welfare). Besides, he relied in his theory on industry as a basis for the economic progress of regions and countries.<sup>1</sup> Through theoretical study, it was found that the economic stage that the region is going through is linked to the innovative trend it has reached. Therefore, the region needs to implement an appropriate strategy for industrial settlement so as to transfer it from the stage it is going through to the next economic stage. Hence, the research conspicuously aims to develop a method to activate the industrial settlement strategies so that it determines the economic stage that the region has reached by identifying the innovative trend that it is going through. This is in addition to deriving the appropriate industrial settlement strategy for it in order to transfer it to the next stage. The research also presents an applied study of this approach on the northern Upper Egypt region and determines the most appropriate spatial sites for implementing the appropriate industrial settlement strategy.

**KEYWORDS:** Industrial Settlement Strategies - Innovative Waves - Theory of Phased Growth for Regions - North Upper Egypt

## I. INTRODUCTION

**The Ministry of Trade and Industry** has conspicuously developed a strategy for industrial development in Egypt for a period of five years with a clear vision represented in that “industrial development is the locomotive of sustainable inclusive economic growth in Egypt and meets local demand. It also supports the growth of exports so that Egypt becomes an active player in the global economy and is able to adapt to global changes”.<sup>2</sup>

This vision emerges from Egypt’s Vision 2030, which states that the Egyptian economy should be a disciplined market economy characterized by stable macroeconomic conditions, capable of achieving sustainable inclusive growth, characterized by competitiveness and diversity, and based on knowledge. Thus, Egypt becomes an active player in the global economy. It is done through creating a supportive climate for sustainable inclusive growth based on knowledge, competitiveness and diversity that allows maximizing added value and providing decent and productive job opportunities.

In light of this vision, previous studies indicated that Egypt has reached the starting stage. Additionally, Egypt is going through the fourth wave of innovation and is also heading towards the fifth wave. The research proposes an approach to activate industrial settlement strategies by defining the economic stage that the Egyptian regions are going through, as it aims to bring Egypt to the stage of sustainability for industry and increase competitiveness, which achieves Egypt's 2030 vision.

## II. RELATED WORK

### 2- Industrial Localization Strategies

Industrial localization strategies began to take shape from the 1950s, when **Walter Isard** gave shape to the concept of **Industrial Complexes** as the first strategy for industrialization in regions and countries in the context of the post-war boom. Then, in the late eighties, **Michael Porter** created a whole concept of "**Industrial Clusters**" to describe the geographic concentrations of industries and observed this in a group of countries he studied where the trend to competition began.<sup>3</sup> Then, with the development of industry's depletion of natural resources, industrial ecology appeared with the late third industrial revolution in the nineties, and then the environmental industrial settlement strategy appeared, which was developed to the name of green industries with the advent of the fourth industrial revolution. The following is a presentation of the concept of each of them and the determinants of its application.

#### 2-1. Industrial Complex Strategy

**Walter Isard** came up with the concept of **Industrial Complexes** as "one or more activities that occur at a particular site and belong to a group of activities which are subject to important production, marketing, or other interrelationships. It is a set of interdependence of activities connected by a matrix of structural relationships."<sup>4</sup> It is consisting of one or a few large payment companies, the industrial complexes have both functional and regional significance, as they bear some basic similarities with growth pole.<sup>5</sup>

**Industrial Complexes Strategy** has a number of application determinants, including:

- A location where the basic factors for industrial settlement are available (near raw materials, near ports and main roads, near energy sources, markets, or near employment)<sup>6</sup> - A relative advantage - Government participation of the private sector in implementation, management and operation - A leading activity of the industrial complex and with complementary industries.

#### 2-2. Industrial Clusters

**Porter** defined **Industrial Clusters** as "a geographically approximate group of closely related firms and associated organizations in a given field, linked by similarities and complementarities. The geographical scope of a cluster can be a city or a state, a single country, or even a network of neighbouring countries."<sup>7</sup> The strategy of **Industrial Clusters** aims to be competitive.

**Industrial Clusters Strategy** has a number of application determinants, including:

A location with secondary industrial localization factors (benefiting from the existence of customers and suppliers on short distances, the availability of services and facilities and a focused labour market) - a geographical location with a competitive advantage according to the cluster orientation - near to research and educational institutions to increase innovation and development - near to urban centres for the possibility of attracting innovative minds and talents and the provision of an appropriate housing environment - cooperation and transfer of knowledge, information and modern technology - protection of intellectual property, patents and registered trademarks - government participation of the private sector in the implementation, management and operation.

#### 2-3. Environmental Industrial Settlement Strategy (Green Industries Strategy)

The United Nations Organization for Industry and Development **UNIDO** has defined **Green Industries** as those economies that strive to achieve a more sustainable path of growth. They are also defined as industrial production and development that do not come at the expense of the health of natural systems or lead to negative consequences for human health. The green industry agenda covers the process of greening industries, according to which all industries are constantly improving resource productivity and environmental performance; as well as the process of creating new green industries.<sup>8</sup>

The green industries strategy has a number of application determinants, including:

A location with the highest industrial localization factors - research and development intensity - transition towards modern technology - use of the cleanest production method or industrial solidarity **IS** - government participation of the private sector in implementation, management and operation - protection of intellectual property, patents and registered trademarks.

### 3- Waves of Innovation

The industry has gone through four industrial revolutions. Each revolution was accompanied by patterns of development and discoveries of new technology called **Waves of Innovation**, which affected the form of industrial localization. The following is a presentation of each of them and the industrial localization strategy followed at that time.

**3-1. First and Second Innovation Wave:** The emergence of the first industrial revolution in the eighteenth century until the middle of the nineteenth century was accompanied by the first and second innovation wave.<sup>9</sup> The form of industrial settlement took the form scattered around the places of natural resources, coal, iron, means of transportation and ports, and at that time no strategy for industrial settlement appeared.



**3-2. Third Innovative Wave:** The emergence of the second industrial revolution at the end of the nineteenth century accompanied the third wave of innovation. Industrial settlement took the form of an organized form in cities and industrial areas, so the strategy of Industrial Complexes for industries integration and organization emerged.

**3-3. Fourth and Fifth Innovation Wave:** With the emergence of the third industrial revolution from the middle of the twentieth century to the beginning of the second millennium accompanied that fourth and fifth innovation wave. Besides, the most important characteristic of this period was globalization and the emergence of cross-border companies that controlled the huge cash flow that increased foreign capital, the strategy of industrial clusters appeared to increase the competitiveness of products and their specialization. With the development of the industry’s depletion of natural resources, industrial ecology emerged with the end of the third industrial revolution in the nineties. Moreover, it aims to reuse and recycle industrial waste using the principle of industrial interdependence, which led to the emergence of the so-called environmental industrial settlement strategy that evolved into the so-called green industries by the fourth industrial revolution.

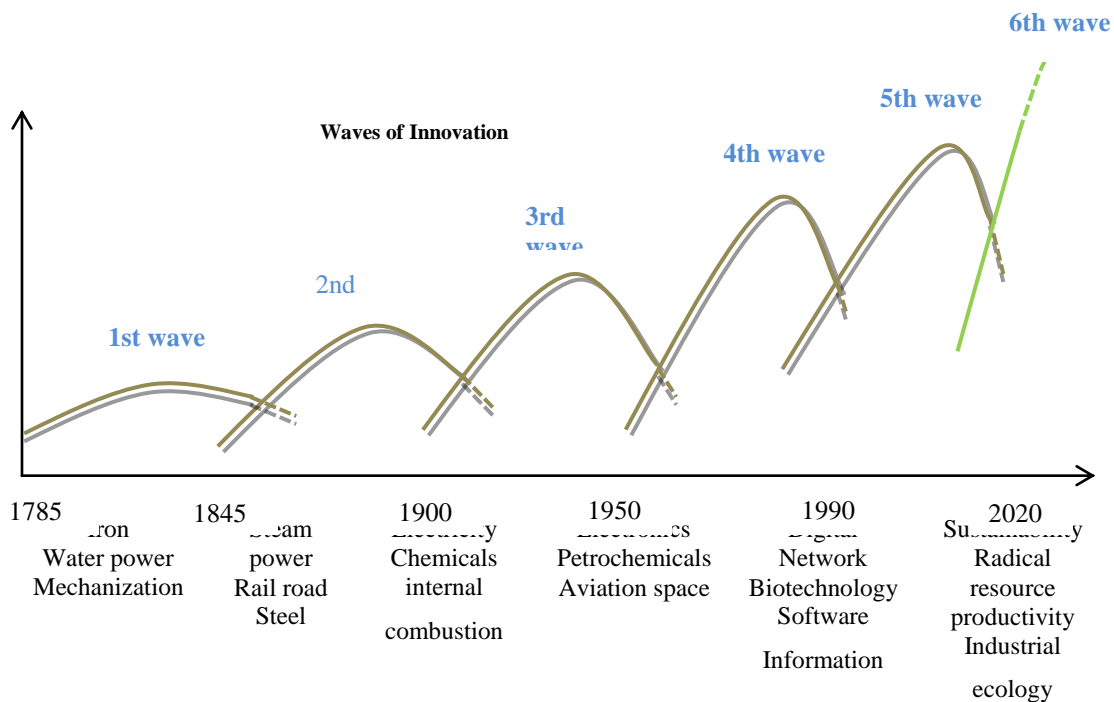
**3-4. Sixth Innovative Wave:** Finally, with the emergence of the Fourth Industrial Revolution, beginning in 2010, where a new technology appeared, Digitization, and the mechanism of self-control appeared. With it, the green industries strategy appeared, where the complete restructuring of the industry into new green industries and the transition towards sustainability.

**IV. METHODOLOGY**

The research conspicuously aims to develop a method to activate the industrial settlement strategies so that it determines the economic stage that the region has reached by identifying the innovative trend that it is going through. This is in addition to deriving the appropriate industrial settlement strategy for it in order to transfer it to the next stage. The research also presents an applied study of this approach on the northern Upper Egypt region and determines the most appropriate spatial sites for implementing the appropriate industrial settlement strategy. It uses the inductive approach, and then follows the analytical, deductive and comparative approach.

**V. EXPERIMENTAL RESULTS**

**Figure No. (1)** illustrates the industrial revolutions and their relationship to the waves of innovation. Besides, **Table No. (1)** illustrates the innovation waves accompanying each industrial revolution and the industrial settlement strategies followed at that time and the determinants of their application.



**Figure No. (1)** Industrial Revolutions and their Relationship to Waves of Innovation

Source: Nicholas. P, Karlson. H, Cheryl, D, Michael. S, 2019



**Table No. (1)**

**Innovative waves accompanying each industrial revolution and the industrial settlement strategies followed at that time**

Point of Comparison	First and Second Wave	Third Wave	Fourth and Fifth Wave	Sixth Wave
Emergence Time	First Industrial Revolution	Second Industrial Revolution	Third Industrial Revolution	Fourth Industrial Revolution
Types of Leading Industries	Textiles, iron and steel	Chemicals, electricity production and distribution	Petrochemicals, electronic and precision engineering industries	New and renewable energy industries and high-tech industries
Industrial Settlement Strategies	—	Industrial Complexes	Industrial Clusters	Green Industries Strategy
Determinants of the application of industrial localization strategies		Basic factors of localization - the availability of a relative advantage - the government's participation in the private sector in the implementation, management and operation - the existence of a pioneering activity for the industrial complex along with it complementary industries.	Secondary localization factors - geographical location with a competitive advantage according to cluster orientation - near to research and educational institutions to increase innovations and development - near to urban centers for the possibility of attracting innovative minds and talents and providing an appropriate residential environment - cooperation and transfer of knowledge, information and modern technology - protection of intellectual property, patents and registered trademarks - government participation of the private sector in the implementation, management and operation.	High Factors of Localization Research and Development Intensity Transition towards Modern Technology Using the Cleaner Production Method or Industrial Solidarity IS Government Participation of the Private Sector in Implementation, Management and Operation Protection of Intellectual Property, Patents and Registered Trademarks

Source: The researcher from previous data analysis

**3-5. Measurement indicators to determine the innovation wave that the region is going through**

The wave of innovation that the region is going through is determined by a set of indicators, which are:<sup>10</sup>

**3-5-1. Relative distribution of industrial labour to the industries of each innovation wave:**

It is measured by: the number of industrial workers in each innovation wave in the governorate or region / the total number of industrial workers in the governorate or region

**3-5-2. Relative distribution of industrial establishments to the industries of each innovation wave:**

It is measured by: the number of industrial establishments in each innovation wave in the governorate or region / the total number of industrial establishments in the governorate or region.

**3-5-3. Relative distribution of the value of industrial production to the industries of each innovation wave:**

It is measured by: the value of industrial production for each innovation wave in the governorate or region / the total value of industrial production in the governorate or region.

### 3-5-4. Relative distribution of industrial capital to the industries of each innovation wave:

It is measured by: the value of industrial capital in each innovation wave in the governorate or region / the total value of industrial capital in the governorate or region.

#### From the previous measurement indicators, the following can be concluded:

There is an inverse relationship between the development in the innovation waves and the number of employment and a direct relationship between it and the capital as well as the value of production. The more development in the innovative wave and the technology used in manufacturing, the fewer the number of employment and the increase in the value of production and capital. Here, the number of industrial establishments remains constant. It is the real force of industrial development to localize this wave in the region or governorate, where it expresses the relative advantage that attracted this target to it. Then, the percentage of workers works in the innovation wave in the region.

## 4- Regional Development Theories

There is not yet a general theory of regional development agreed upon, but there are attempts to formulate theories to explain the growth of the region. The research will tackle regional growth stages theory because it tackles development stages of the region by the industrial intensification approach.<sup>11</sup>

The economist **Walt Whitman Rostow** put forward, at the beginning of 1960, a linear economic development model consisting of five stages. Besides, the model takes the factors affecting development from the socio-economic characteristics of the state. Where the least developed and developing countries pass through a series of stages, starting from the stage of the traditional society to the stage of economic take off depending on the intensification of industrial production, followed by the stage of economic maturity and then the luxury society.<sup>12</sup> The following is a presentation of these stages and their features:<sup>13</sup>

### 4-1. The Traditional Society: the state or the region is in a very backward stage, and it appears in this stage:

"The dominance of traditional agricultural character and self-sufficiency fishing - low productivity due to the lack of the use of modern technology - small average per capita national product" and this stage is usually relatively long and slow in motion. At this stage, the region is not going through any waves of innovation

### 4-2. Pre-take off stage:

In this stage, the level of trade increases, which leads to the development of transportation. This stage is also characterized by the beginning of the development of society through the demand for the introduction of new technology, which causes change on the economic level in:

The increase in the rate of capital formation - the beginning of the overtaking of workers in certain activities - the beginning of the emergence of the industrial sector on one side of the agricultural sector - the emergence of social investments (building roads and transportation)

These regions are considered economically diversified regions and do not have a leading industry or activity. At this stage, the region is going through the first and second wave of innovation.

### 4-3. Take off Stage:

This stage is based on eliminating the obstacles to economic growth and bringing about radical changes in the tools of production through the technological means. This stage is also considered the great source of progress in society. Then, growth becomes a normal condition and the necessary conditions for the starting stage areas follows:

- An increase in net investment from about 5% to no less than 10% of the national income.
- The development of some leading sectors, meaning the need to develop one or more of the main industrial sectors at a high growth rate as a necessary condition for the initiation stage. **Rostow** regards this condition as the backbone of the growth process.

At this stage, the regions are considered regions with major industries or a leading sector. Moreover, at this stage the region is going through the third wave of innovation.

### 4-4. The Drive to Maturity Stage:

**Rostow** defined the maturity stage as the period in which society can apply modern technology on a large scale. This is in addition to the increase in the level of industrialization in society and the emergence of many industries with high added value along with the increase of skilled labour. This is done through the increase of human capital, the rise in the growth of national income over the growth of the population, the increase in national investments, and the achievement of a surplus in foreign currencies due to the increase in the degree of society openness to the outside world. Therefore, countries reaching the stage of technological maturity are linked to the occurrence of the following fundamental changes:

- Changes in the characteristics and properties of the labour force as skills rise and consequently the population tends to live in cities.
- Changes in the characteristics of the class of regulators as employers retreat to be replaced by efficient managers.

At this stage, the country is considered economically advanced. At this stage, the region is going through the fourth and fifth wave of innovation

**4-5. The High Mass-consumption (Luxury) Stage:**

It is the last stage of growth as conceived by Rostow. This stage is also characterized by the population's tendency to concentrate in cities and its suburbs, the proliferation of vehicles, and the widespread use of durable goods. At this stage, society's interest shifts from the supply side to the demand side. Moreover, the country in this stage has reached a great deal of progress. This stage has the following characteristics:

- Increasing income levels significantly, and then becoming the necessities - the community's interest in the sectors that produce consumer goods - direct more of the community's resources to the growth of support for social welfare, and the region is going through at this stage the sixth wave of innovation.

Figure No. (2) shows Rostow Curve

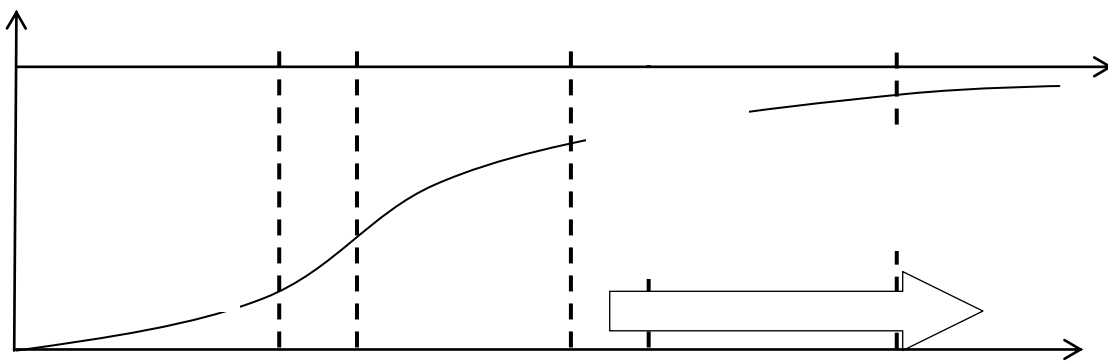


figure no. (2) shows Rostow Curve  
Source: Zahraa Kamal, 2018

**5- An Approach for activating industrial settlement strategies in the Egyptian regions**

From what was previously presented with Rostow's theory of regional development, we find that each economic stage is linked to an innovation wave that it has reached. Besides, every innovation wave is linked to an industrial settlement strategy that emerged with it. The following is a presentation of the stages of the approach:

**5-1- First Stage:** Identifying the innovative wave that the region is going through: the wave of innovation that a region is going through is determined by the above-mentioned innovation wave measurement indicators.

**5-2- Second Stage:** Determining the economic stage that the region is going through: where the economic stage is determined through the innovation wave that the region is going through.

**5-3- Third Stage:** Determining the appropriate industrial localization strategy to deal with the region: After the economic stage that the region is going through is determined through the innovative trend it has reached, the appropriate industrial localization strategy is determined to deal with the region because each innovative trend is linked to an industrial localization strategy that emerged with it and is determined as following

**5-3-1. The Stage of the Traditional Society:** the region is not going through any waves of innovation, as it is still in a backward stage, practicing agricultural activity and did not address the industry. Thus, it needs the strategy of industrial complexes that are based on the economic resources of the region. This is in addition to the strategy of green industries, the approach of greening industries to preserve the pristine region from industrial pollution.

**5-3-2. The Pre-take off Stage:** The region started in the industry, as it contains qualified resources for the industries of the first and second wave, such as agricultural and mining resources. Thus, the most appropriate strategies for dealing with the region are the strategy of industrial complexes that are based on the economic resources of the region. This is in addition to the strategy of green industries, the approach of greening industries to preserve the region from industrial pollution, as well as the introduction of some new green industries such as new and renewable energy, as well as recycling and sewage treatment plants.

**5-3-3. Take off Stage:** the region has become an industrial region with major industries. Consequently, we find that the pattern of innovation in this stage takes the form of the third innovative wave and is heading to the fourth. Thus, the most appropriate strategies for dealing with the region are:

The strategy of industrial clusters in order to help the region to compete in addition to the strategy of green industries, whether by greening industries or introducing new green industries such as modern technological industries

**5-3-4. Maturity Stage:** The regions at this stage are considered regions with a cumulative industrial structure. They also use technology extensively and have a skilled workforce. Besides, we find that the innovation pattern at this stage takes the form of the fourth and fifth innovation wave, where the focus is on the technological industries sector as a basis for the production

process. Here is the gradual transformation of the region to new green industries, where the technological industries sector and the most appropriate strategies to deal with it is the strategy of industrial clusters in order to increase competitiveness.

**5-3-5. High Mass-consumption (Luxury) Stage:** In this stage we find the sustainability of the industry, where the focus is on advanced technology industries and green industries for the sustainability and competitiveness of the industry. The innovation pattern at this stage takes the form of the sixth innovation wave.

**5-4. Fourth Stage:** Determining the proposed locations for the implementation of the industrial complexes strategy: they are determined through the determinants of applying the appropriate industrial settlement strategy to deal with the region.

Figure No. (3) illustrates the proposed approach to activate the industrial settlement strategies in the Egyptian regions.

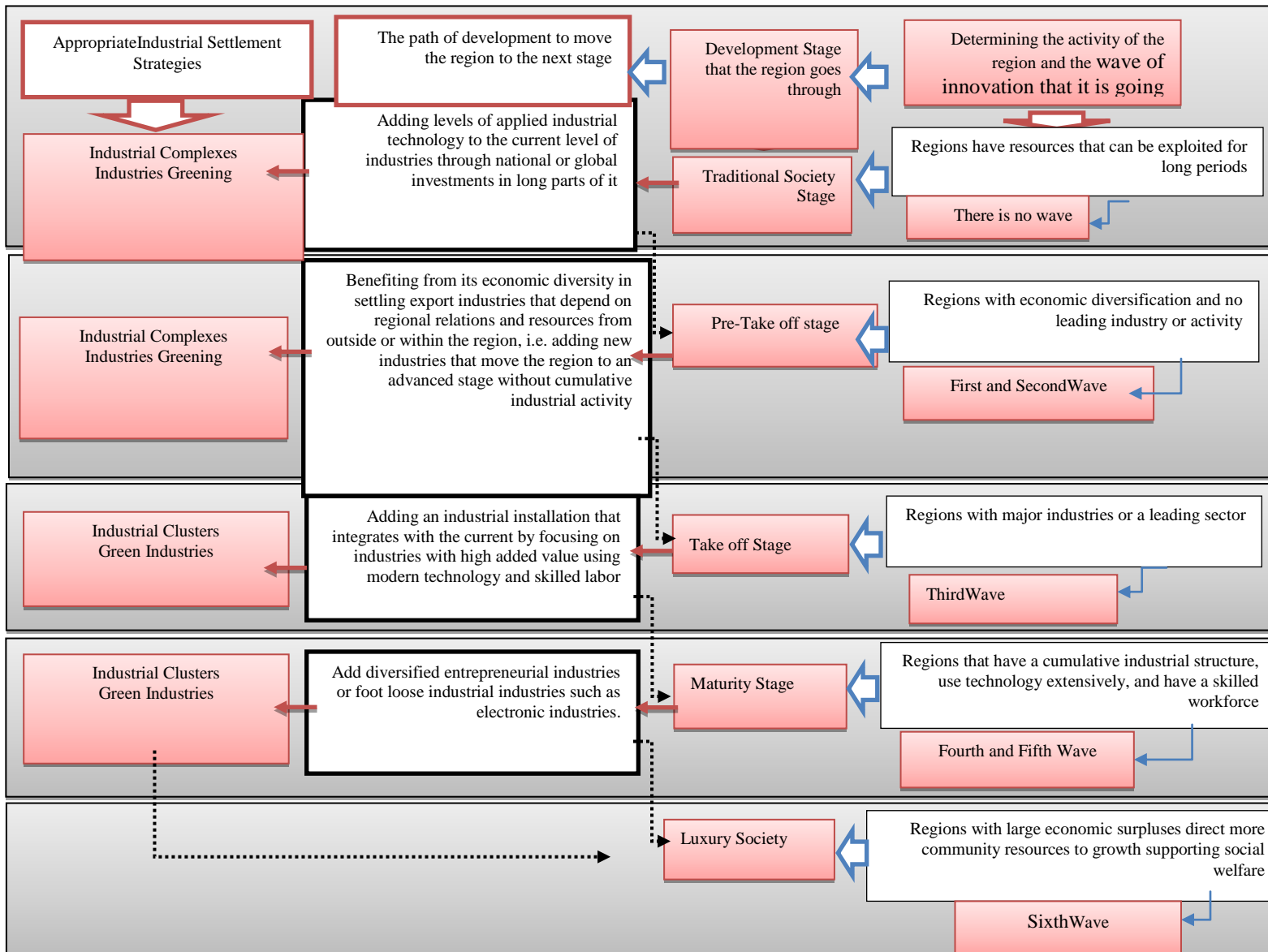


Figure No. (3) illustrates the proposed approach to activate the industrial settlement strategies in the Egyptian regions.

Source: The researcher from previous data analysis





**Figure No. (4)** Northern Upper Egypt region on the map of Egypt's planning regions  
 Source: Ministry of Housing, Utilities and Urban Communities, 2017

**6- Applying the proposed approach to the northern Upper Egypt region**

The North Upper Egypt region is one of Egypt’s planning regions. The region occupies the northern part of Upper Egypt, bordered to the north by the Greater Cairo region, to the south by Central Upper Egypt, to the east by the Eastern Desert, and to the west by the Matrouh region. The population of the region in 2017 was (12.25 million people). The ratio of the population out of the total republic is 12.9%. Besides, the area of the region is 49,301 km<sup>2</sup>, and the ratio of the region's area out of the total republic is 4.9%.<sup>14</sup> **Figure No. (4)** shows the region of northern Upper Egypt on the map of Egypt's planning regions.

By identifying the industrial innovation wave reached by the region, the economic stage it is going through is determined. Then, the appropriate industrial settlement strategy is determined to deal with it. The following is a presentation of how to activate the approach:

**6-1. The First Stage: identifying the innovative wave that the region is going through<sup>15</sup>**

According to the data obtained by the researcher from the Industrial Development Authority for the last year of 2018, they were analyzed and classified according to the industries of each innovation wave in each governorate of the region. Then, the percentage of employment, industrial facilities, production value and capital for each innovation wave were extracted in each governorate separately. It was compiled for the region as a whole. Tables 3, 4, 5, and 6 show the relative distribution of employment, the number of industrial establishments, the value of production and capital in the governorate of the region, which is the governorate of Beni Suef, Fayoum and Minya, as well as the governorate of North Upper Egypt as a whole.

**Table No. (3)**

**Relative distribution of labor, number of industrial establishments, value of production and capital in Beni Suef Governorate**

Innovative Waves	Beni Suef Governorate							
	Number of Employment	%	Number of Establishments	%	Value of Production in Thousands	%	Capital in Thousand	%
First	6102	42	104	39	8296346	32	4550173	42
Second	4448	31	74	29	2959991	11	940567	9
Third	1312	9	48	18	1735435	7	530466	5
Fourth	2625	18	38	14	12991772	50	48111308	44
<b>Total</b>	14487	100	264	100	25983544	100	10832514	100

Source: The researcher from data collection Industrial Development Authority, 2018

**Table No. (4)**

Relative distribution of labor, number of industrial establishments, value of production and capital in Fayoum Governorate

Innovative Waves	Fayoum							
	Number of Employment	%	Number of Establishments	%	Value of Production in Thousands	%	Capital in Thousand	%
First	5247	66	42	41	2428203	47	820351	46
Second	978	12	17	16	869847	17	319251	18
Third	1188	15	29	28	1601878	31	505386	29
Fourth	567	7	15	15	310867	6	1266665	7
Total	7980	100	103	100	5210795	100	1771653	100

Source: The researcher from data collection Industrial Development Authority, 2018

**Table No. (5)**

Relative distribution of labor, number of industrial establishments, value of production and capital in Minya Governorate

Innovative Waves	Minya Governorate							
	Number of Employment	%	Number of Establishments	%	Value of Production in Thousands	%	Capital in Thousand	%
First	3126	52	80	31	327548	39	501723	50
Second	1896	32	111	42	281534	33	293673	29
Third	486	8	29	11	90628	11	149587	15
Fourth	470	8	42	16	144379	17	66682	6
Total	5978	100	262	100	844089	100	1011665	100

Source: The researcher from data collection General Industrial Development Authority, 2018

**Table No. (6)**

Relative distribution of labor, number of industrial establishments, value of production and capital in the total governorates of North Upper Egypt

Innovative Waves	Total Region							
	Number of Employment	%	Number of Establishments	%	Value of Production in Thousands	%	Capital in Thousand	%
First	14475	51	226	36	11052097	34	5872247	43
Second	7322	26	202	32	4111372	13	1553491	11



<b>Third</b>	2986	11	106	17	3427941	11	1185439	9
<b>Fourth</b>	3662	12	95	15	13447018	42	5004655	37
<b>Total</b>	28445	100	629	100	32038428	100	13615832	100

Source: The researcher from data collection Industrial Development Authority, 2018

From the above, it is possible to deduce the innovative wave that the region, its governorates and its leading industries are going through, as shown in Table No. (7).

**Table No. (7)**

**Patterns of the current industry path for the governorates of the region, the innovation wave and the leading industries**

Governorates	The current industry paths of the governorates and the undergoing innovation wave	Leading Industries
<b>Beni Suef</b>	It does not follow a clear path, but it has moved between different waves	First and second wave industries, in addition to the fourth wave industries
<b>Fayoum</b>	It is going through the first industrial wave and is heading towards the third wave	First wave industries
<b>Minya</b>	It is going through the first industrial wave and heading for the second wave	First wave industries
<b>The Region</b>	It goes through the first and second wave industries in addition to the fourth wave industries	First and second wave industries

Source: The researcher from previous data analysis

We find that the North Upper Egypt region is still in the stage of manufacturing the first and second wave. This means that it has a leading industrial sector in the governorates of Fayoum, Minya and Beni Suef in the industries of the first wave. As for the governorate of Beni Suef, its industrial path is diverse in addition to the introduction of some simple technological industries, due to the confusion in the industrial development policies in the governorates.

**6-2 The Second Stage: Determining the economic stage the region is going through**

The economic stage that the region is going through is determined according to the innovative wave it has reached. The northern Upper Egypt region is in the stage of the first and second innovation wave, which is characterized by a focus on natural and agricultural resources as a basis for the production process. Such as extractive industries and manufacturing industries that depend on resources such as spinning and weaving industries, food industries, wood, paper and building materials. These regions are considered, according to **Rostow's Model**, still at some point of the pre-takeoff stage, the North Upper Egypt region is considered one of the regions with economic diversification (agricultural - industrial - touristic) and does not have a leading activity or industry

**6-3 The Third Stage: Determining the appropriate industrial settlement strategy to deal with the northern Upper Egypt region**

The region has reached the first and second wave industries, as it relied on its resources to reach the pre-take off stage, so the region needs two export industries that depend on relationships from inside and outside the region. So the strategy of industrial complexes is appropriate for the region to skip this stage heading to the take off stage where major industries. The region also needs to implement the strategy of green industries, the approach of greening industries, as well as the addition of some new green industries such as new and renewable energy and the introduction of modern technology in industrialization.

**6-4 The Fourth Stage: Determining the proposed locations for the implementation of the industrial complexes strategy**

To determine the spatial locations for the application of the industrial complexes strategy using the GIS program, where the

This is in two stages:

**First:** areas that are not suitable for development at the present time are excluded, such as:

- Areas of torrential streams.
- Active earthquake areas, seismic axes, cracks and faults.
- Mountain highlands and badlands areas.
- Areas of existing and proposed nature reserves.
- Sites of surface water resources.
- Agricultural lands and agricultural reclamation areas that are subject to reclamation.
- Reins of existing cities and villages.
- Sites for wind farms.

**Second:** Despite the exclusion of the aforementioned areas, there will remain large areas of land suitable for development in general and for industrial settlement in particular. At this stage, the determinants of the strategy of industrial complexes are applied, where the basic factors of industrial settlement available in the region are identified, which are:

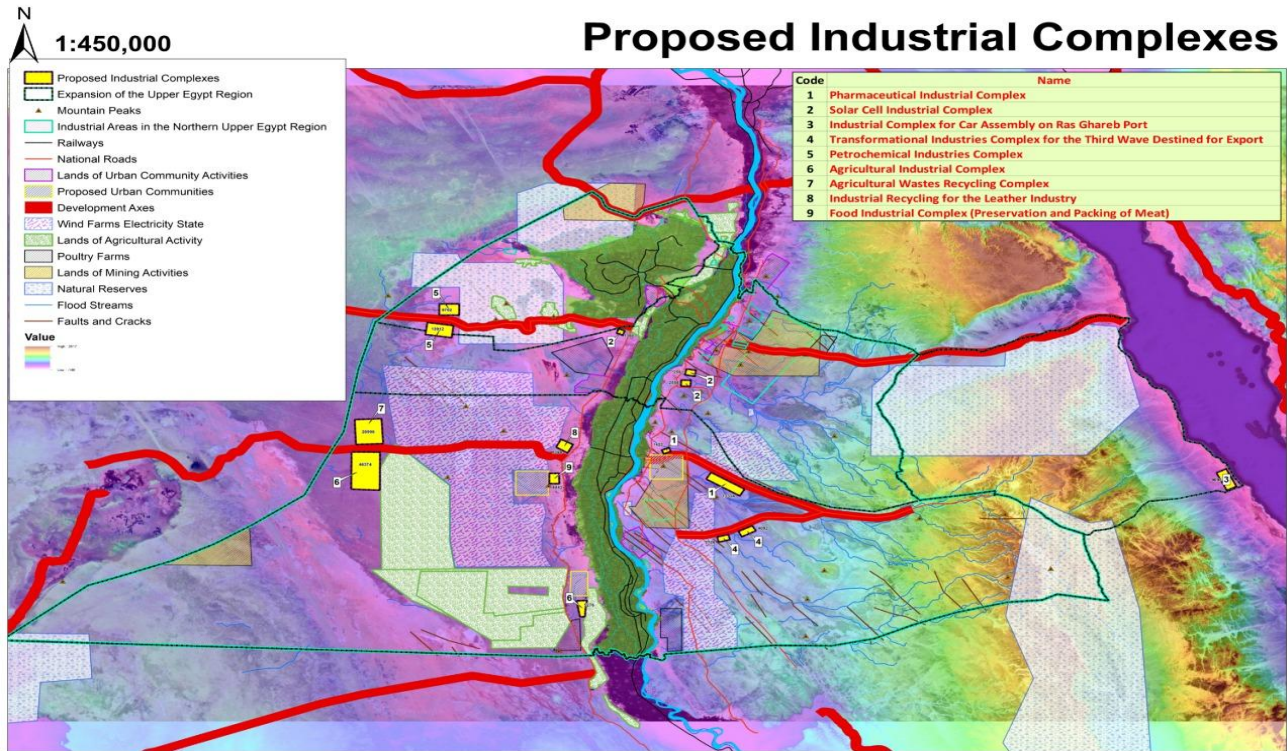
- Near to regional road hubs
- Near to international trade lines and foreign markets, i.e. close to the service scope of ports and airports
- Near to raw materials, whether near them or falling on the roads leading to them
- Near to sources of power generation as well as sources of water supply, sewage systems and waste disposal.
- Near to employment, i.e. urban communities expelling the population and crowded, as well as new urban communities to be an economic base for them.
- Near to markets, near major urban centres and regional capitals.

It was finally concluded that the industries targeted for resettlement in the region are the industries of the third innovation wave. Also, according to the global demand index, the industries targeted for export are chemical industries (pharmaceuticals), advanced engineering industries, new and renewable energy industries, petrochemicals and other manufacturing industries.

As each industry has its own spatial requirements and orientation towards specific markets, these data are entered into the **GIS Program** and it will produce the proposed sites for the industrial complexes to be settled in the region.

- **Industrial complex for chemical industries (pharmaceuticals):** It is located near new and renewable energy sources due to the intensity of energy consumption, as well as near urban communities - ports and main and regional roads for export to markets (Africa - Europe - East Asia).
- **Industrial complex for the production of new and renewable energy "solar cells":** to be settled near urban communities and main roads "the new urban development axes of the region" and internally targeted markets.
- **Industrial complex for advanced engineering industries (cars):** which will be settled near the main roads, urban communities and the port for ease of import and export and to attract foreign investment companies to them, and then competing companies will be attracted
- **Industrial complex for other manufacturing industries** to be settled near the basic localization factors and on the axes of urban development in the region and markets (Euro-Asian - Latin America - Arab Free Trade Zone)
- **Industrial complex for petrochemical industries and their complementary industries:** they are settled near oil sources in the north of Lake Qarun and Wadi El Rayan and near urban communities and main or regional roads, whenever possible, for easy export to European countries.
- **Industrial complex for agricultural industries:** it is based on agricultural crops (**First Wave Industries**) and agricultural waste recycling industries, where they are settled near the proposed 1,000-acre project in the region, as well as near the main roads, "new urban hubs", urban communities and markets" East Asia - Eurasian - Africa - North Africa - Arab Free Trade Area - European - Latin America.
- **Industrial complex for the leather industry:** of the livestock available in the region, settled next to the main roads and existing and proposed urban communities. (**Second Wave Industries**)
- **Industrial complex for food industries, packing and preserving meat:** from the livestock available in the region, as they are settled next to the main roads and existing and proposed urban communities. (**Second Wave Industries**)

Among the determinants of the application of the strategy of industrial complexes in general and the requirements of each industry in particular, **Figure (4)** shows a spatial information model for the proposed sites for industrial settlement in the region and some of the industries proposed for settlement in it according to the third innovative wave.



**Figure No. (4):** A spatial information model to clarify the proposed spatial locations for the industrial settlement of industrial complexes in the North Upper Egypt region in relation to the map of the road network, development axes and ports in the North Upper Egypt region, as well as the economic resources and natural determinants of industrial settlement there

Source: The Researcher

## VI. CONCLUSION

### 7- Results

- The research concluded that the measure of industrial settlement in a region, a region or the country is the percentage of the number of industrial establishments and not the number of workers, as it represents the real force that attracted this industry to the region, territory or country.
- The research found that there is an inverse relationship between the development of the innovative waves and the number of employment and a direct relationship between it and the capital as well as the value of production.
- The regions that are in the stage of traditional society and that do not go through any innovation waves and have the resources that qualify them for industrial development, need a strategy for industrial complexes and an approach to prepare industries to preserve the environment and resources in order to transfer them to the next economic stage.
- The regions that are in the pre-take off stage are going through the first and second innovation wave that requires the introduction of some export industries, which depend on the relations between the neighbouring regions, so it needs a strategy of industrial complexes and the preparation of industries to preserve the environment and resources in order to transfer them to the next economic stage.
- The regions that are in the take off stage are going through the third innovation wave, which needs an industrial installation that integrates with the current, high technology and skilled labour. So, it needs a strategy of industrial clusters and green industries in order to transfer them to the next economic stage.
- The regions in the maturity stage are going through the fourth and fifth wave of innovation, which need entrepreneurial industries, so they need a strategy of industrial clusters and new green industries in order to transfer them to the next economic stage.

- The regions in the stage of the welfare society are going through the sixth innovation wave and the complete restructuring of the industry to the new green industries where the industry is sustainable

#### 8- Recommendations

- The proposed methodology must be applied to activate the industrial settlement strategies in order for the Egyptian regions to overcome the economic stage they are going through to reach the stage of prosperity where sustainability.
- Paying attention to research and development and establishing technology zones and innovation centres, due to the ability of the Egyptian regions to compete in global markets and to reach the sixth innovation wave.
- Paying attention to education and health and improving the level of employment, as well as activating training centres and participating in special programs for this. It leads to raising the social level in the region, which in turn is reflected in the economic level of the Egyptian regions.
- It is necessary to exploit Egypt's geographical location, which overlooks the Red and Mediterranean Seas, and the global navigation route, the Suez Canal, to localize the industries of the fourth, fifth and sixth waves of innovation, to attract foreign investments, learn about modern technology and work on developing it.
- It is necessary to localize the globally required export industries in the Egyptian regions, through the global demand index and the innovative wave industries that make it skip the stage it is going through.

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