

## **SUSTAINABLE INDUSTRIAL NEIGHBORHOODS**

**Mohamed Mahmoud<sup>(1)</sup>; Adel Yasseen<sup>(2)</sup>; Mohamed El Morsi<sup>(3)</sup>  
and Salah El Haggag<sup>(4)</sup>**

1) Post Graduate Researcher, Environmental Engineering Dept. Institute of Environmental Studies and Research, Environmental Engineering, Ain Shams University 2) Institute of Environmental Studies and Research, Environmental Engineering, Ain Shams University 3) Department of Mechanical Engineering -AUC. 4) Mechanical engineering department, the American University in Cairo -AUC.

### **ABSTRACT**

Industrial development is supposed the main engine for economic growth, social development. Nevertheless, manufacturing sectors are directly and indirectly responsible for a large share of overall environmental pressures thus, it was a very important issue to improve the balance between environment, social and economic requirements to ensure sustainability, especially to establish a good sustainable industrial area that could improve balancing between sustainability pillars. Thus, this paper review environmental pressures (directly or indirectly) that could generate from the industrial sector in both developed and developing countries.

**Keywords:** Sustainability, balancing , Industrial Neighborhoods.

### **INTRODUCTION**

During the past decades, industrial neighborhoods focused on economic and social development while neglecting to analyze its negative impact on the environment. Such long-term neglect of environmental concerns caused an evolution of greenhouse gas emissions (GHG), aggravation of pollution and depletion of essential natural resources.

Today, sustainable industrial neighborhoods, companies (small, medium, large enterprises) are seeking to enhance environmental, economic and social performance through collaboration in managing environmental performance and resource use. Industrial park members work together to achieve more benefits than the individual benefit of each company.

The main goal of a sustainable industrial neighborhood is to improve economic performance for member companies while minimizing their environmental impacts. [1][2]

Components of this approach include the green design of industrial park infrastructure; cleaner production, pollution prevention, energy efficiency, and intercompany partnerships.

A sustainable industrial neighborhood also seeks benefits for neighboring communities to ensure that the net impact of its development is positive and thus increasing its interest in corporate social responsibility.[2]

## **ENVIRONMENTAL GOVERNING FACTORS FOR SUSTAINABLE INDUSTRIAL NEIGHBORHOOD**

1. **Enhance environmental protection and required standard:** one of the main a prominent task of the management unit for the industrial neighborhood is to ensure laws and regulations and introduce on-site rules. For that purpose, management members should provide detailed information about existing environmental laws and environmental standards for local /international requirements that give advice on the industrial application in the park and their environmental effect, hiring

training program related to the environment, review best practices related to environmental monitoring and evaluation in the park. and appreciate companies for the most sustainable/environmental-friendly practices that help to improve environmental protection. [3]

2. **Resource Efficiency:** one of the main tasks of the park management unit in the industrial area is to promote resource efficiency especially for energy, water and waste reuse. This option could be developed by enhancing training for companies inside industrial parks, carrying out audits that include resource-efficient technology advice and process option improvements that could enable companies in the park to increase their resource efficiency. [3]
3. **Monitoring and Control of Emissions:** To maintain and enforce the environmental targets the industrial management units have to monitor emissions. such as airborne emissions like partials, aerosols, gases, and odour also noise and light should be registered. Measurements should take place at individual workplaces (important for occupational health and safety), at emitting sources on company premises (e.g. stacks; verification of allowed emission limits) and open spaces within the park area (measuring the ambient pollution of the overall industrial area). These measurements are carried out sporadically, at regular intervals or continuously. They can be carried out by the companies themselves, the

park management, government authorities, or contracted environmental labs. [3]

4. **Protection of soil and groundwater:** to prevent pollution generated from the industrial application and soil and groundwater pollutants occurring during the industrial process causing leakage of fuel, production liquids, or wastewater. The industrial park management unit is in charge of monitoring compliance of companies with laws to prevent soil and groundwater pollution and ensure respecting the limits of the environmental component of sustainability. [4]
5. **Efficient Land Use:** During master planning of new industrial neighborhood efficient land use has to be developed. These concepts take the existing local land use planning into account and make use of the provided space in a sensible manner. [4]
6. **Adaptation & Mitigation with Climate Change:** To achieve sustainability of industrial neighborhood the issues of Adaptation & Mitigation with Climate Change can no longer be neglected. Continuous reduction of greenhouse gases goes in line with measures of energy intensity inside a park and improve resource efficiency so that it requires a long term operability under changing climate conditions. [4]

## **IMPACTS OF ENVIRONMENTAL EMISSIONS FROM INDUSTRY**

### **Impacts of environmental emission from industry:**

Several factors combine to affect the environmental development in sustainable industrial neighborhoods, which usually depend on an industrial framework activity inside these neighborhoods.

This begins with an analysis of the emission intensity generated from certain industrial areas into a series of wastes (solid, liquid and gas) to identify the main drivers of environmental change.[5]

Secondly, by comparing generated waste from an industrial area with a local standard level "settled by environmental authority" to calculate the amount of environmental pressure generated from manufacturing sectors.

Finally, develop all possible environmental solutions into (low, medium and high category) investment without affecting the quality of production, as follows:

### **Resource use**

Resources are among the most important challenges of sustainable industrial neighborhood areas, as they impose a bad effect on the other two sustainability pillars "social and economic ". Emissions' effect could be encountered as:

- 1- Air Emissions
- 2- Water Emissions
- 3- Solid Waste
- 4- Hazardous Waste

Thus, periodic assessment is essential to monitor and verify (M&V) emissions generated from industrial neighborhood and analyze the discharges of water, air and soil.[6][7][8]

**1- Air emissions include:** greenhouse gas emissions, ozone-depleting, SO<sub>x</sub> and other acidifying substances, small particulate releases during industrial process, volatile organic compounds (VOCs), noxious odors. [6][7][8]

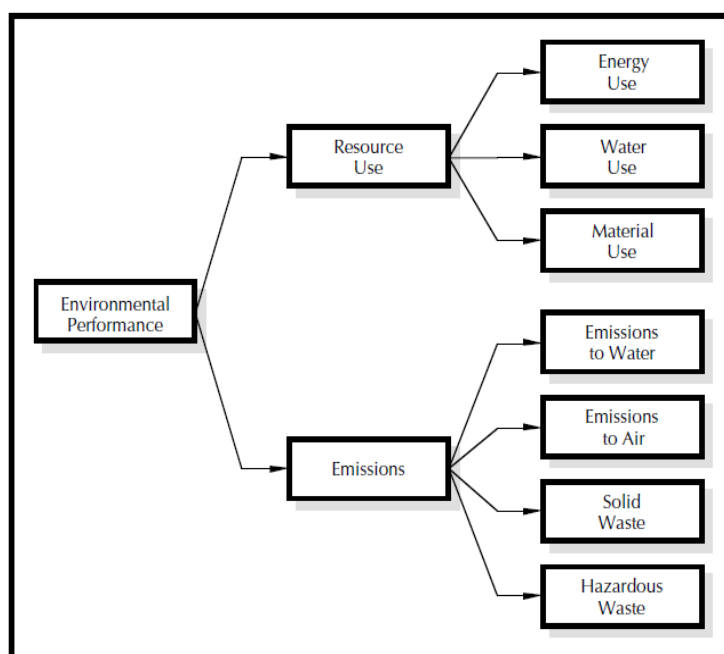
**2- Waste Water:** Water emissions are found in wastewaters containing polluting substances drained in sewer networks and treatment plants and that could affect rivers, oceans or even groundwater. These parameters can be physical (e.g. temperature, volume, oxygen...) or chemical (e.g. pH, substance). [6][7][8]

Chemical parameters include functionalities or groups defined by the measurement method (e.g. total phosphorus, BOD5) and individual substances defined as chemical species clearly identified (e.g. nitrate, mercury), Many pollution parameters and individual substances exist (about 100'000 chemical species are identified) but it is almost impossible to monitor all of them. It is thus recommended to use the existing lists of parameters stemming from the existing legislation. [6][7][8]

**3- Solid waste:** can be re-used in other industrial applications such as food industry waste, paper waste, wood waste. [6][7][8]

**4-Hazardous waste:** Hazardous waste disposal requires special conditions, mostly fulfilled by landfills which are among the most successful, safe and economic ways of disposal of hazardous waste. It is important to preserve

ecosystems while establishing and operating industrial areas by maintaining a parallel infrastructure for effective, maintained and safe disposal of hazardous wastes to ensure sustainability without affecting production development. [6][7][8]



**NEIGHBORHOOD :**

**Figure (1):** environmental performance indicators for sustainable industrial neighborhoods

The previous part highlighted the importance of developing environmental factors for sustainable industrial neighborhoods from the initial design, to implementation and operation. It is important to illustrate the following existing obstacles in new as well as existing parks:

1. **Ensure Master Planning:** Successful implementation of a sustainable industrial neighborhood requires a holistic and detailed planning process that considers equally environmental, social, and economic issues from the outset.[8]
2. **Manage a good structure:** To ensure a sustainable industrial neighborhood, its operation inside the industrial park must be well managed and well organized (food sector, chemical sector, engineering sector, textile sector, and preparing and implementing sustainability measures). In order to implement a good structure, a mandate, a sufficient budget line, and by-laws are compulsory inside the industrial park (e.g. park charter, corporate social responsibility charter, environmental, occupational health and safety, social standards, etc.). In addition, monitoring and evaluation should be carefully followed when applying these rules (e.g. by KPIs = Key Performance Indicators).[8]
3. **Service Orientation:** by establishing a SERVICES Management unit for an industrial neighborhood rather than as administrative units. This needs a clear understanding of the needs of the members.[8]
4. **Networking:** a strong Networking between industrial neighborhoods is a key element to achieve sustainability. This is achieved by ensuring closer



cooperation among companies to enable synergies in doing business, together with an exchange of knowledge on energy and resource efficiency, and fostering the exchange of services, materials, energy and by-products. Secondly, the park management develops business networks with companies outside the park, upstream and downstream, in order to optimize sales or purchasing conditions, Thirdly, it supports the participation of the neighboring community. [8]

5. **Participation in Planning and Operation:** included from the start during master planning then following planning steps. Besides considering economic and environmental aspects, social participation within the park and between the park and the local population.[7]
6. **Maintenance, Retrofitting:** to ensure sustainability for the industrial neighborhoods it is very important to develop mechanisms to maintain the industrial park, which includes infrastructure up-keeping and modernizing/retrofitting infrastructure.[7][8]
7. **Disaster Risk Management:** The management unit of the industrial neighborhood needs to take precautions to face two types of risks
  - Operational risks of the industrial area
  - Natural risks

Operational risks such as prevention and management of emergencies arising from industrial activities (e.g. explosions, fires in chemical processes, adequate and comprehensive transport and storage of dangerous goods, release of hazardous substances).

Natural risks (as acts of God) such as risks not directly related to operations on site (e.g. earthquakes, avalanches, storms, flooding, and landslides).[7][8]

## **SUSTAINABILITY                      BENEFITS                      FOR                      INDUSTRIAL NEIGHBORHOOD**

### **Benefits of sustainable industrial neighborhoods**

The aim of sustainable industrial Neighborhoods is to achieve the three pillars for sustainable development (environmental, economic and social) for the following benefits:

#### **Economic benefits:**

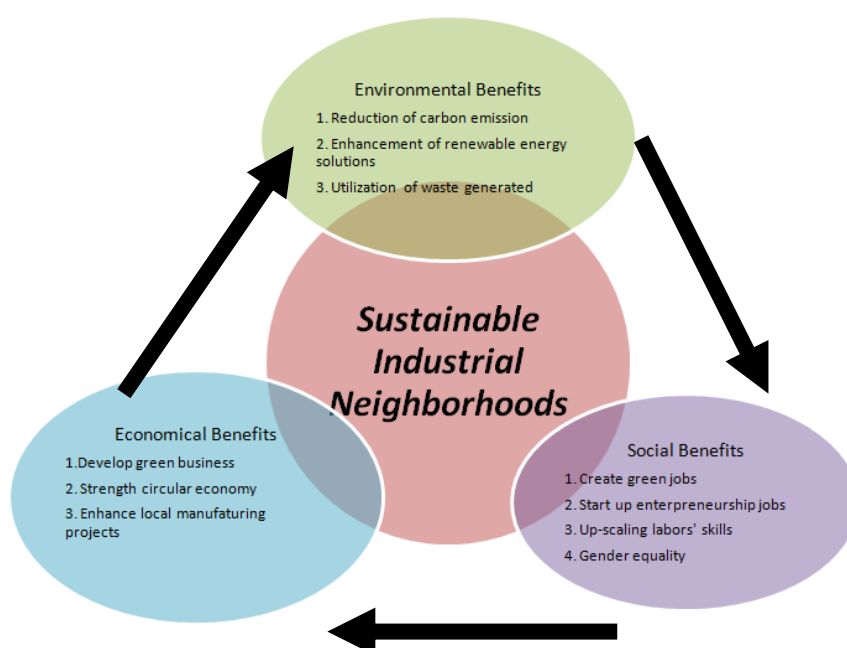
- 1- Develop green business
- 2- Strengthen the circular economy
- 3- Enhance local manufacturing projects

#### **Environmental benefits**

- 1- Reduction of carbon emissions
- 2- Enhancement of renewable energy solutions
- 3- Utilization of waste generated

### Social benefits

- 1- Create green jobs
- 2- Startup entrepreneurship jobs
- 3- Up-scale labor skills
- 4- Gender equality



**Figure (2):** benefits from sustainable Industrial Neighborhoods

## **UP SCALING ENVIRONMENTAL EFFICIENCY OF SUSTAINABLE INDUSTRIAL NEIGHBORHOODS**

Some strategies are set to increase efficiency and reduce risks in the industrial park as follows:

- 1- Production efficiency (Economic up-scaling): by enhancing exchange of material, energy, water resources between industrial facilities
- 2- Environmental management (Environmental up-scaling): by minimizing impacts of emissions produced from industrial process using Monitoring & Verification (M&V) technologies inside facilities to adapt and mitigate carbon emissions generated (air, water, solid waste and hazardous waste)
- 3- Human development (Social up-scaling): Minimizing risks faced by labor inside facilities through training programs for raising awareness of importance of sustainable development. [1-8]

## **MEASUREMENT PERFORMANCE OF SUSTAINABLE INDUSTRIAL NEIGHBORHOODS**

To improve performance for sustainable industrial neighborhoods it is important to develop a periodic measurement report for each company in the industrial park, which may include; Energy consumption per Service Unit (MIPSU), Energy efficiency measures, Environmental impact measures, Material Input per Service Unit (MIPSU) measures, Carbon emissions measurement, Life cycle analysis per Service Unit (MIPSU).[1-8]

These measurements could help industrial park members set an adequate environmental framework and guide the standards of practice for industrial areas.

**KEY DRIVERS FOR SUSTAINABLE INDUSTRIAL AREA:**

The key drivers for sustainable industrial area can be summarized in the following table;

<b>Environmental Keys</b>	<b>Social Keys</b>	<b>Economic Keys</b>
1. Apply climate change commitments by monitoring and verification on global and national levels	1. Apply good labor conditions (inside facility)	1. Create direct and indirect environmental jobs
2. Review policy mechanisms (such as carbon emission from member companies)	2. Create local jobs	2. Skills-upgrading of the labor
3. Apply green supply chain concept for resources (raw material, energy, waste generated) with good management	3. Improve gender equality	3. Upgrade Linkages between small and medium enterprises (SMEs) and big industrial firms
4. Increase demand to improve efficiency and growth	4. Strengthen social infrastructure to community	4. Improve technology transfer through new investments
	5. Provide vocational training	
	6. Improve occupational health and safety	

## CONCLUSION

one of sustainable development goals was improving balance between sustainability pillars "social , economical, environmental " due to chosen of socio-economic development from industry side it was reflects to environment as follows:

1- Resource use

2-Emissions

Thus it was very important to enhance approach to environmental protection and waste minimization must be developed in a consistent manner, by integrate environmental considerations into industrial processes as possible starting from development phase to final product development .

Thus the Integration of all sustainability pillars "social ,economic and environmental" that allows waste disposal to be improved and made more efficient.

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## الأحياء الصناعية المستدامة

محمد محمود<sup>(١)</sup> - عادل ياسين<sup>(٢)</sup> - محمد المرسي<sup>(٣)</sup> - صلاح الحجار<sup>(٤)</sup>

(١) طالب دراسات عليا، قسم الهندسة البيئي، معهد الدراسات والبحوث البيئية (٢) معهد الدراسات والبحوث البيئية (٣) جامعة عين شمس (٤) قسم الهندسة الميكانيكية، الجامعة الأمريكية في القاهرة

### المستخلص

**نبذة مختصرة:** تعتبر التنمية المستدامة أحد أهم مؤشرات التقدم وخاصة في المجال الصناعي وذلك من خلال تحقيق التوازن بين مكونات التنمية المستدامة الاقتصادية والاجتماعية والبيئية وعليه كان من الضروري التركيز على المجمع الصناعي والذي يعتبر أحد أهم المسؤولين عن الضغوط البيئية المباشرة والغير مباشرة والتي تتمثل في زيادة نسبة الإنبعاثات الكربونية والاحتباس الحراري وبالتالي كان من المهم جداً عرض العوامل البيئية الحاكمة للحى الصناعي المستدام وكيفية إدارته والفوائد التي يمكن أن تعود على الحى الصناعي من خلال تحقيق التوازن بين مكونات التنمية المستدامة " البيئية والاجتماعية والاقتصادية"  
**الكلمات الافتتاحية:** التنمية المستدامة، التوازن البيئي، الأحياء الصناعية.