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ECO-INDUSTRIAL PARKS VIET NAM

SOCIO-ECONOMIC REQUIREMENTS
A REVIEW OF INTERNATIONAL AND VIETNAMESE EXPERIENCES

INCLUSIVE AND SUSTAINABLE INDUSTRIAL DEVELOPMENT

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For more information on UNIDO's work on eco-industrial parks in Viet Nam, please visit https://eipvn.org/.

ABBREVIATIONS

EIA	Environmental impact assessment
EMS	Environmental management system
EIP	Eco-industrial park
EPZ	Export processing zone
EVN	Vietnam Electricity
FDI	Foreign direct investment
GSO	General Statistics Office of Viet Nam
HR	Human resources
IE	Industrial ecology
IEAT	Industrial Estate Authority of Thailand
IS	Industrial symbiosis
IP	Industrial park
IPC	Industrial Promotion Limited Company
ISO	International Organization for Standardization
JSC	Joint Stock Company
MONRE	Ministry of Natural Resources and Environment
NPEIPP	National Pilot EIP Program
NPCEZP	National Economic Regeneration Program
QCVN	National technical regulation of Vietnam
SEPA	State Environmental Protection Administration of China
SWTP	Solid waste treatment plant
USD	United States Dollar
VND	Viet Nam Dong
WWTP	Wastewater treatment plant

I. AN OVERVIEW OF INDUSTRIAL ECOLOGY

Industrial ecology (IE) is the study of the sustainability of man-made, industrial ecosystems compared to natural ecosystems (Ehrenfeld, 1994; Nakamura and Kondo, 2009). Industrial processes traditionally function as open ecosystems, exploiting natural resources and returning waste. Final consumption is a small proportion of an industrial ecosystem's environmental impact: its greatest output is waste. This imbalance creates a burden on natural absorption (O'Rourke et al., 1996). To minimize waste and to increase an ecosystem's capacity, IE recommends the development of closed systems, in which one sector's waste products are another's resources.

IE provides an integrated systems framework for managing the environmental impact of energy, materials and capital use in the industrial system (Frosch and Uenohara, 1994). Under this framework, companies are urged to redistribute waste and resources in a manner similar to structures found in natural ecosystems, such as the food chain. To be environmentally sustainable, company practices must consider how their actions affect other companies within their industrial ecosystem (Lowe and Evans, 1995).

The IE's closed system approach supports the development of eco-industrial parks (EIPs). Initially, the parks were created to reduce the environmental impact of increased industrialization and mass production in industrial parks (IPs). Various measures are required to reduce environmental pollution, such as lowering emissions, installing pollution reduction equipment, recycling waste, and applying cleaner production technologies.

The EIP allows the involvement of individual industries through "systematic industrial change" including the physical exchange of materials and products; management, shared utility and infrastructure (Tibbs, 1992; Chertow, 2000; van Berkel, 2006). The EIP connects different processes such as manufacturing waste, factories, and consumers, allowing not only tangible exchanges but also non-material exchanges such as knowledge, human resources, and technology (Mirata and Emtairah, 2005; Chertow, 2007). Community collaboration between EIP businesses forms the "industrial ecosystem". From there, it is possible to find comparative advantage in partnership between business, government, community, and other groups (Lowe, 2001; Veiga and Magrini, 2009).

To reduce IPs' environmental impact, eco-industrial parks promote energy efficiency, a closed loop system and industrial symbiosis (Conticelli and Tondelli, 2014). The parks are a manufacturing and service community in which businesses seek to enhance environmental and economic performance through collaboration in the management of environmental and resource issues, including energy, water, and materials. The energy and materials produced by one industry are absorbed by another industry or business. Industries and processes of exchange are considered systemic interaction rather than isolated in a linear flow system. The idea is to create a network of collaborating companies that function as an ecosystem through the recovery of resource and manufacturing waste through symbiotic relationships to improve environmental performance and promote regional economic development (UNC, 2008). By working together, the business community works towards collective benefits greater than the combined benefits of each company (Lowe et al., 1996; Veiga and Magrini, 2009).

More broadly, eco-industrial parks are business communities that work with the local community to effectively share resources, such as information, materials, energy, infrastructure and the environment. Together, the EIP and the local community target economic interests, improve the quality of the environment, increase job opportunities, promote the use of shared resources and improve socio-economic standards for surrounding communities (PCSD, 1996; Cote 1998). An EIP works to improve the economic interests of participating businesses while minimizing

environmental harm. They adopt environmentally conscious practices, including environmentally friendly infrastructure, cleaner production, pollution prevention, energy efficiency, and partnership building.

Cote and Hall (1995) expanded the concept of an EIP, defining the parks as an industrial system that:

- conserves natural and economic resources
- reduces production, material, energy, insurance and treatments costs, and
- improves operational efficiency, product quality, the companies' public image, and their workers' health and safety.

With EIPs, governments, businesses, and the public can find uses for recycled waste and emissions. This approach benefits the neighboring communities, and includes the green design of the IP and plant infrastructure, cleaner production, energy efficiency, and the prevention of environmental pollution (Roberts, 2004, Lowe, 2014).

On 22 May 2018, Decree 82/2018/ND-CP defined EIP for the purposes of Vietnamese laws and government policies. Article 2 states:

> Eco-industrial park means an industrial park in which enterprises get involved in cleaner production, make effective use of natural resources and enter into manufacturing cooperation and affiliation in order to tighten industrial symbiosis to promote economic, environmental and social efficiency in these enterprises.

Decree 82/2018/ND-CP requires EIPs to:

- (i) comply with the laws on production and business, environmental protection and labor
- (ii) provide adequate essential infrastructure services (electricity, water, information, fire prevention and fighting...) and related services in the industrial park in accordance with the laws
- (iii) ensure that at least 90% of enterprises are aware of efficient use of resources and cleaner production; at least 20% of enterprises apply solutions to efficient use of resources and cleaner production, improved management methods and production technologies to reduce waste, pollutants and reuse wastes and scrap;
- (iv) ensure that at least 25% of the park land area is used for greenery, traffic, and shared service infrastructure