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CIRCULAR ECONOMY BUSINESS CASE STUDIES IN SOUTHEAST ASIA

Nam Cau Kien Industrial Park

Hai Phong City, Viet Nam
Industrial infrastructure
namcaukien.com.vn
Analysis period: 2015-2023

Creating an Eco-Industrial Park

Business Spotlight

The Nam Cau Kien Industrial Park (NCK IP) is a project of Shinec Group, a specialist infrastructure provider. The park was established in 2008 and is located in Hai Phong City, which is the most industrialised region in Viet Nam. NCK IP recognises that adverse impacts on both the environment and the community undermine the reputation and competitiveness of an industrial park and its tenant firms. It was therefore decided to develop the park in a more sustainable manner by adopting the concepts and best practices of eco-industrial park (EIP). Between 2021 and 2023 over 50 initiatives were implemented to facilitate that waste from one company would be utilised by another (known as industrial symbiosis), along with other measures contributing to circular economy. These circular innovations have achieved significant economic, environmental, and social benefits for all who are involved – the industrial park itself, the neighbouring communities, and beyond. In 2021 NCK IP won the Viet Nam Fund for Supporting Technological Creations (VIFOTEC) Award, which is Viet Nam's Science and Technology Innovation prize, and in 2022 received awards at the International Exhibition of Science and Technology Innovation in Seoul, Republic of Korea for its circularity achievements. NCK IP's implementation of EIP concepts and practices is a leading example for the adoption of sustainable industrial practices that are paving the way towards a circular and low-carbon Viet Nam.

Keywords

Eco-industrial park, Industrial symbiosis, industrial infrastructure

Innovation

Product/service design, Manufacturing, Distribution, End-of-life management, Resource circularity, Resource efficiency, Resource substitution

Analysis of Nam Cau Kien Industrial Park

Context and baseline

Over the past decades, Viet Nam has emerged as a global manufacturing hub, ranking 36th in 2020 in the global SDG9 industry index, with specific strengths across multiple sectors such as food and beverage, apparel and footwear, furniture and homewares, basic metals, automotive, and electronics.[1] The country is actively pursuing further growth through investment and trade. The Government of Viet Nam prioritised establishment of industrial parks (IP) to accommodate the growing demand for manufacturing in Viet Nam from international brands and investors. Viet Nam has more than 400 IPs, of which over 300 are operational. IPs have played a critical part in Viet Nam's rapid industrial development and are contributing to significant economic and social benefits in the country.

Despite the wealth and jobs generated through industrialisation, negligence with respect to environmental concerns has caused considerable harm not only to natural ecosystems but also to the well-being of local communities. As a result, companies, their international buyers and industrial parks are facing increasingly fierce public scrutiny and criticism on their impact on the environment and public health. Many companies had to bear sizeable costs to clean up and/or compensate for the consequences of environmental damage they had caused.

There is an uncontested need for more conscious and self-motivated interest in instilling more sustainable IP development practices. Moreover, under the ambit of Viet Nam's new Free Trade Agreements (FTA) with the European Union (EU) as well as from an investor/multinational brand perspective, it is important to ensure that Vietnamese industries instil responsible environmental and social business practices and safeguards, and show leadership in addressing today's climate and planetary crises.

NCK IP has committed to leadership and action on sustainability by setting its goal to become the first EIP in Viet Nam and thereby address public concerns, meet international investors' requirements and promote the sustainability of its IP. NCK IP reframed its business and service models to provide consultancy, negotiation and implementation support for the development, implementation and operation of industrial symbiosis[2] solutions for the tenants.

Nam Cau Kien IP provides a role model for continuous improvement and IP transformation into an EIP.

Innovation

The innovations initiated and implemented by NCK IP cover the following approaches.

Keeping materials and resources in use at the park level by encouraging tenant firms to create a symbiotic network and enabling waste and by-product exchanges. NCK IP recognised the prospect for industrial symbiosis in the industrial park and in 2015 conducted systematic research to identify industrial symbiosis opportunities among their tenant firms. The industrial symbiosis projects included firm-to-firm and zone-to-firm types. The examples of firm-to-firm industrial symbiosis interventions in NCK IP related to utilisation of the different by-products generated by the steel manufacturer by several other waste treatment and recycling companies for recycling into construction and building materials, biomedical and magnetic-optical materials, and others. NCK IP was able to interest a number of waste treatment and recycling companies to establish operations in the park. Examples of zone-to-firm industrial symbiosis interventions include a common wastewater treatment plant with 1000 m^3 daily capacity for the entire park, and shared warehousing and logistics services within the park.

Using solar-enegy for NCK IP's office buildings. Solar power is an abundant, reliable and renewable energy resource in Viet Nam. Office buildings are well-suited for solar power as they require large amounts of electricity to power air conditioning systems, lighting and electronics. In 2020 NCK IP switched partially from the electric grid to solar energy. Using solar power for office buildings is a strategic, money-saving decision and provides many benefits for NCK IP, including minimal maintenance, reduced greenhouse gas (GHGs) emissions, decreased energy expenses, and reduction of the company's dependence on the national electricity grid.

Converting green space and the biological pond into recreational facilities. According to the Viet Nam Law on Environmental Protection, an IP must have environmental protection infrastructure, including wastewater collection, drainage and treatment systems, and green space. NCK IP is specifically designed with green spaces, parks, and natural habitats to promote biodiversity and improve the overall environment. In particular, trees and plants act as natural air purifiers, filtering out pollutants and promoting better health for the people working

1 https://iap.unido.org/data/country?p=VNM

2 Industrial symbiosis is the term generally used for an association between industrial facilities or companies in which the waste or by-products (including water, energy and materials) of one facility become an input for another facility, contributing to improved overall resource efficiency and reduced cummulative waste generation by the facilities involved.

in and living around the park. NKC IP integrated an 8-hectare botanical garden and biological ponds (31% of park area), which help improve air quality and provide habitat for local species. The green space, waste water treatment plant and biological pond were all designed to accommodate recreational use of the park for the benefit of IP employees, the local community and visiting tourists.

Green space and biological pond at Nam Cau Kien IP as a tourism destination of Hai Phong city

Creating eco-business club for information exchange. As part of the ongoing enrichment of its value proposition, the company launched the NCK IP Eco-Business Club, which brings together representatives of tenant firms and members of the broader NCK IP community to exchange environmental and related best practices, facilitate learning and create synergies. The club enriches the NCK IP value proposition by promoting new day-to-day services to support the members via development and implementation of industrial symbiosis networks allowing material and by-product exchanges.

Circular Economy impact

The deployment of the eco-industrial park concept at NCK IP with regards to industrial symbiosis in the steel sector is novel in Viet Nam's industrial development journey, and has already had many circular economy benefits. EIP contributes to several circular economy strategies, particularly the circular and efficient use of all natural resources and replacing non-renewable energy and materials with renewables.

First, it converts the previously discarded industrial waste and by-products into valuable inputs for other industries, which exemplifies resource circularity. By-products are now being seen by tenants and neighboring companies as potential resources/ inputs for other industrial production processes. Common by-products from steel production include coal tar, light crude oil, blast furnace slag (BF), basic oxygen furnace slag (BOF), iron oxide powder, desulfurisation slag, residual iron, gases, and dust. The BF slag is granulated and sold to local businesses, and is commonly used to make cement (with lower GHG intensity). It is estimated that 50,000 metric tonnes of BF have been diverted annually from landfills to produce a lower carbon cement. Air-cooled BF slag is much harder and denser, so it can be reused as a construction aggregate; the same re-use holds for BOF slag, which is cooled similarly to air-cooled BF slag. Dust removed from gases will usually contain iron and can be reused in the steel-making process. The recovered iron oxides from gases cannot be reused onsite, but they can be used by other industries for various applications such as adsorbents for the removal of inorganic and organic pollutants, catalysts, and materials for biomedical, magnetic-optical and sensor applications. Coal tar and light crude oil are reused to make electrodes for the aluminium industry.

Second, resource efficiency helps reduce energy required for transportation, because of the proximity of the companies within the symbiosis network. As a spin-off from the EIP development focus, exchanging best practices and lessons learnt among the tenant firms provides motivation and insights for tenant firms to achieve energy and resource efficiency within the boundaries of their own respective firms.

Third, installing solar panels on NCK IP's office building is an eco-friendly alternative to grid electricity, illustrating the strategy of resource substitution. Unlike electricity produced in power plants that burn fossil fuels, solar energy does not generate any GHGs or other air emissions.

Solar power for office building at Nam Cau Kien IP

Business and market impact

There are clear economic benefits for both the NCK IP park operator and its tenant firms from creating or joining the Park's expanding industrial symbiosis network. By means of industrial symbiosis solutions, firms that recover and sell materials ('sending firms') will create revenue streams from their investments, while 'receiving firms' will be able to increase

production and achieve cost savings on their utilities and/or material inputs. For example, industrial symbiosis in the steel sector in NCK IP has diverted 55,000 tonnes of industrial waste annually (of which 50,000 tonnes of furnace slag and 5000 tonnes of rolled steel slag) from landfills by utilising in the production of cement and other materials. This reduces the solid industrial waste treatment costs by 30%, hazardous treatment costs by 25% and the costs of raw material transportation by 44% (valued at VND 40 billion, or about EUR 1.6 million) – and thus reduces energy consumption as well.

Proximity turned out to be a key factor for successful industrial symbiosis. The distances between firms within NCK IP are less than 1 km, well below the 4 km generally considered by experts as the limit for economically beneficial industrial symbioses. NCK IP provides a good opportunity to establish mutually beneficial relationships at scale because firms are located close to one another, and materials and by-products are relatively easy to obtain and exchange in large volumes, which can ensure economic benefits for sending and receiving firms to join the network.

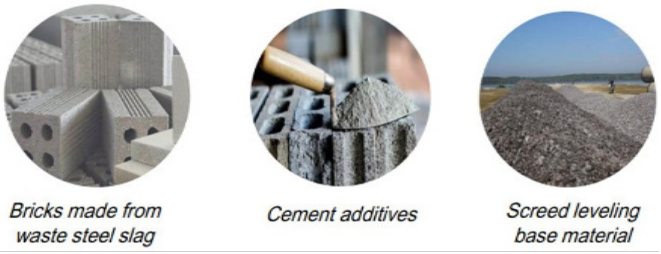
As for NCK IP, substantial benefits were obtained by boosting their business reputation among the investors along with achieving a high occupation rate. Establishing itself in an EIP helps any IP tenant to build a sustainable image and address customers' environmental concerns. The total area of 103 hectares in the first phase of NCK IP was fully occupied in 2019, and an additional area of 163 hectares for the second phase was 80% occupied by 2023. The installation and use of the solar energy system in NCK IP's office building since 2020 has helped reduce energy consumption from the grid, with annual energy cost savings of VND 360 million (approximately EUR 13,000), because the solar panels generate power to meet the demands of office building's energy consumption.

The taxes and other financial contributions of NCK IP to the State budget has increased by 13% annually. During 2019-2023, NCK IP received around 35,000 visitors and students who benefitted from the Park's recreational facilities.

Stakeholders

The EIP measures implemented at NCK IP have a positive impact on local communities. One of the most important social benefits is the creation of job opportunities and stable income for almost 8000 local workers, which is then in turn reflected in local social networks and communities and strengthens them as well.

As a result of the implementation and upscaling of the industrial symbiosis concept, NCK IP is collaborating with companies in the industrial network, so the benefits that NCK IP brings to society is spreading throughout Hai Phong City and surrounding areas.



Made with by-product through symbiotic network of steel industry

Implementation

In the 2010s, NCK IP began to transition away from managing individual, polluting factories towards a policy more in line with sustainable development. NCK IP conducted a preliminary assessment to identify and prioritise potential industrial symbiosis opportunities in 2015, based on the distribution of industry sectors, as well as the types and quantities of materials recoverable within the park. This preliminary assessment helped NCK IP to understand the prospects of the material and resources recovery innovations summarised in this business case, and determine the need for further assessments. It helped identify more concrete opportunities as well as scope the potential economic value to be gained from implementing industrial symbiosis. However, at that time specific criteria and guidance for transition to EIP were lacking.

In 2018, the government of Viet Nam issued Decree 82/2018/ND-CP (since 2022, Decree 35/2022/ND-CP) on Regulations for the Management of Industrial Parks and Economic Zones, which includes criteria for EIPs. This is the first legal document in Viet Nam that lays the foundation for converting conventional industrial parks to ecological ones. NCK IP tries its best to comply with the set criteria for EIP. Currently three industrial symbiosis networks have been identified (steel, plastic, electronics), and more than 50 symbiotic relationships among firms involving either product/by-product transfer or commercial cooperation.

During the process of implementation, NCK IP received significant support from the municipal government of Kitakyushu, one of the leading successful eco-towns in Japan.[3] In 2019, a research study tour was conducted by NCK IP to the Environment Agency of Kitakyushu for environmental management, 5S[4] and

3 https://www.kitaq-ecotown.com/

4 5S, sometimes referred to as 5s or Five S, refers to five Japanese words used to describe the steps of the 5S system of visual management: seiri, seiton, seiso, seiketsu and shitsuke, meaning 'sort', 'set in order', 'sweep', 'standardise', and 'sustain'.

Reduce, Reuse and Recycle (3R) waste-technology training. This partnership helped change the mind set for sustainable IP development and for scaling-up the adoption of the best available recycling technologies as well as attract private investment to construct state-of the art recycling facilities at NCK IP.

Chairman of the board of directors of Shinec, Mr. Pham Hong Diep has always argued that application of scientific/technical know-how is foundational for business success. This know-how guides the company's activities and its journey continues with successive breakthroughs. NCK IP collaborates with Ministry of Natural Resources and Environment (MONRE), Ministry of Industry and Trade (MOIT,) development partners e.g. United Nations Industrial Development Organization (UNIDO), United Nations Development Programme (UNDP), and research institutions including the Institute of Health and Environment for the Communities. The company also worked closely with representatives of business associations and the Viet Nam Union of Science and Technology for technical training on new solutions towards net zero emissions, efficient resource use, and smart climate practices, all of which helped accelerate the adoption of more sustainable development practices at the IP level. In partnership with UNDP and NX Filtration (The Netherlands), NCK IP has in 2024 embarked on a feasibility study for an innovative industrial wastewater reclamation project. Over one year, the respective hollow fiber nano-membrane technology will be deployed, with the initial six months dedicated to establish best operational practices and parameters. This innovative approach to resource recovery will not only facilitate the recycling of wastewater for industrial purposes but also position NCK IP as a frontrunner in Viet Nam's green industrial landscape. NCK is now working with UNIDO and other stakeholders on promoting higher renewable energy generation and use at the park level and achieving carbon neutrality. Moreover, NCK is rethinking business models for improving energy, water, and waste management at the park level, as well as for harnessing digital technologies to increase resource circularity and material exchange. The target of NCK IP's board directors is to scale up the EIP model to the eight other IPs owned by the Shinec Group, based upon the achievements and lessons learnt from NCK IP.

Takeaways

- Circular economy interventions are not just environmentally beneficial, they are also economically viable, and can thus improve the competitiveness of industrial parks and tenant firms.
- Industrial symbiosis solutions and technologies need to be case-specific and reflect conditions on the ground.
- Implementing circular economy principles in industrial parks requires honing in on innovative approaches. In particular, eco-industrial park concepts, as well as the technologies and business models adopted in EIPs, are important building blocks for scaling up the circular economy approach and accelerating green, sustainable, and resilient industry growth.

Acknowledgements

This business case study was prepared within the framework of the Technical Advisory project: Mobilising Business Action for Circular Economy in the ASEAN countries under the EU SWITCH-Asia Policy Support Component for the sole purpose of documenting and analysing business experiences with the circular economy. The case study was produced by Le Ha Thanh (national expert, Viet Nam) and reviewed by Rene Van Berkel and Thomas Thomas (regional experts) on the basis of information provided and validated by Nam Cau Kien Industrial Park, Vietnam.