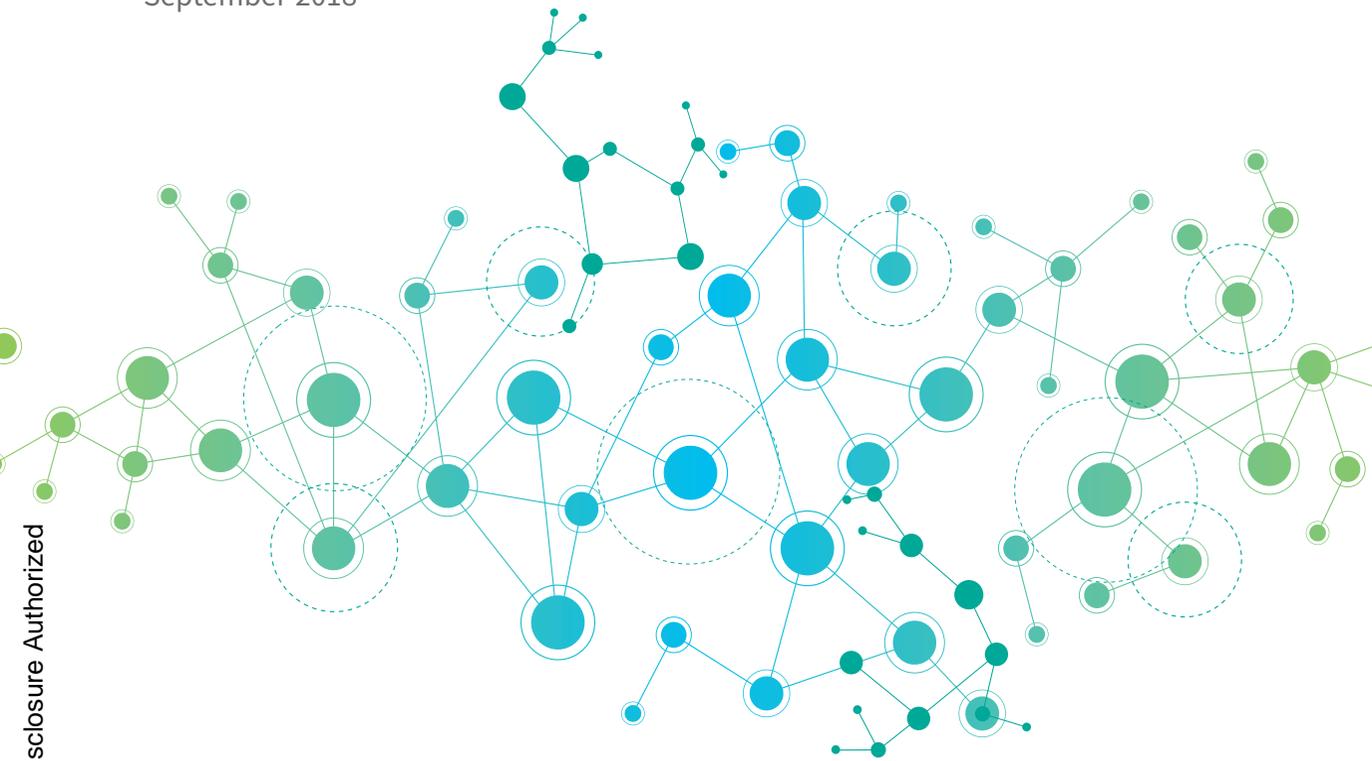


# A Practitioner's Handbook For **Eco-Industrial Parks** Implementing the International EIP Framework

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A Practitioner's Handbook  
For Eco-Industrial Parks  
Implementing the International EIP Framework

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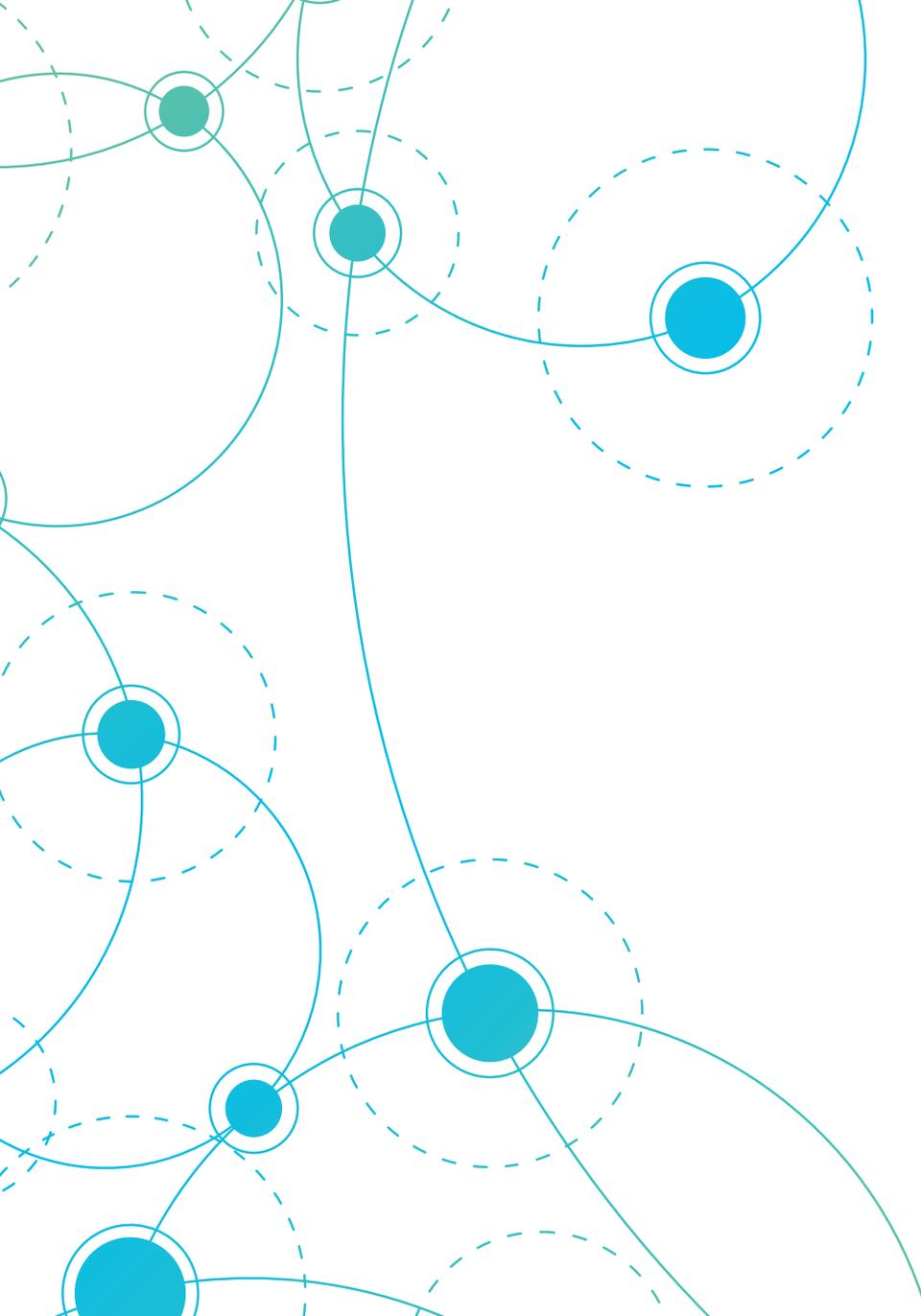
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## List of Acronyms

<b>EIP</b>	Eco-Industrial Park
<b>EMS</b>	Environmental Management System
<b>EnMS</b>	Energy Management System
<b>EPZ</b>	Export Processing Zone
<b>ESCO</b>	Energy Service Company
<b>GHG</b>	Greenhouse gas
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH (German Development Corporation)
<b>IFC</b>	International Finance Corporation
<b>IRR</b>	Internal Rate of Return
<b>KICOX</b>	Korea Industrial Complex Corporation
<b>LCZ</b>	Low-Carbon Zone
<b>MOTIE</b>	Ministry of Trade, Industry and Energy
<b>MoU</b>	Memorandum of Understanding
<b>M&amp;E</b>	Monitoring and Evaluation
<b>MRV</b>	Monitoring, Reporting and Verification
<b>OIZ</b>	Organized Industrial Zone
<b>PaCT</b>	Partnership for Cleaner Textile
<b>PBI</b>	Performance-Based Incentive
<b>PPD</b>	Public-Private Dialogue
<b>PPP</b>	Public-Private Partnership
<b>R&amp;D</b>	Research and Development
<b>ROI</b>	Return on Investment
<b>RECP</b>	Resource Efficient and Cleaner Production
<b>SEZ</b>	Special Economic Zone
<b>SME</b>	Small and Medium Sized Enterprise
<b>UNIDO</b>	United Nations Industrial Development Organization



# Introduction

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This Practitioner’s Handbook is for governmental authorities, industrial park operators<sup>1</sup> and developers seeking to implement the “An International Framework for Eco-Industrial Parks” (UNIDO, World Bank Group and GIZ 2017) [or “the International EIP Framework”]<sup>2</sup>. It is also intended for development agencies to serve as a reference point in helping governments establish their respective national EIP Frameworks. Countries are driven by two motivations to develop and operationalize eco-industrial parks (EIP): competitiveness and differentiation. Competitiveness will be achieved by sustainably utilizing resources, as well as by continuous efficiency improvements, thereby lowering operating costs. As such, enhancing competitiveness can reduce sustainability risks, drive revenues, and may improve product quality. Differentiation is achieved by enabling industrial parks to attract investors by building intangible value, especially brand recognition as investors seek to enter new markets for sustainable production.

## Eco-industrial parks

Industrial parks help facilitate commercial activities and provide collective infrastructure and services, including roads and utilities to resident firms. Industrial parks can be defined as designated, serviced industrial areas where firms are conglomerated. As such, they provide fertile ground for collaboration across sectors and businesses, resulting in efficiency gains. As a result, governments often consider them as policy tools that can help fulfill a country’s national economic development strategy for increasing industrial output and boosting economic growth.

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1 Park operators are sometimes called park managers or park management entities. The park operator in this Handbook is defined as the entity that deals with management and day-to-day operations, resident services, park infrastructure and facilities, promotion and marketing, and interactions with authorities and the community on behalf of resident firms. This is to be performed in line with existing higher-level park governance structures, institutions, and regulating bodies. As such, the park operator executes the EIP framework at the park level, and is in charge of maintenance, improvement and monitoring of the park performance. The park operator is also responsible for performance in the areas of environmental, social and economic management. In addition, the park operator supports resident firms in the maintenance of their own firm level performance to be deemed as an EIP. The term “park operator” will be used throughout the Handbook in reference to, and interchangeably with, the term “park management entity” and “managers” where needed.

2 The International EIP Framework is available in the following webpage: <http://documents.worldbank.org/curated/en/429091513840815462/An-international-framework-for-eco-industrial-parks>.

While industrial parks can contribute to the economic growth and social development of a country or a region, they also have the potential to generate significant negative environmental externalities in the form of air emissions, water pollution, land contamination and over-exploitation of resources. Furthermore, industrial parks that are not properly managed can negatively impact the workforce and communities in which they operate. To address these challenges, industrial parks should be planned and managed sustainably from the outset.

Global buyers increasingly demand sustainably sourced and processed products; governments, regulators, and nongovernmental organizations also pressure industrial parks to operate in a more environmentally and socially responsible manner. Yet, industrial park developers and operators aim to provide differentiated services to tenants in ways that are unlike other types of industrial parks. Many industries and firms are also willing to take voluntary actions to fulfill their perceived economic, social and environmental responsibilities in competitive markets.

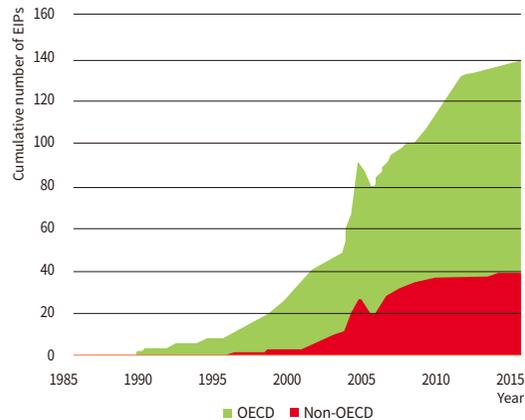
One way to meet this growing demand is to develop an EIP or to transform existing industrial parks into EIPs. EIPs are defined in many ways, depending on the country context. Broadly defined, EIPs are “a dedicated area for industrial use at a suitable site that ensures sustainability through the integration of social, economic, and environmental quality aspects into its siting, planning, management and operations” (UNIDO, World Bank Group and GIZ 2017).

EIPs bring direct and indirect, holistic benefits to the industrial sector in general, and resident enterprises in particular. Firms and industrial sectors in EIPs can improve capital efficiency, achieve utility cost savings, sustain business continuity, produce goods that are preferred by global buyers, attract foreign direct investment, increase exports and generate additional revenues. For example, the EIP model implemented in the Republic of Korea [hereinafter referred to as “South Korea”] prompted firms to invest over US\$691 million in energy efficiency, industrial symbiosis, waste management, and other eco-friendly investments. To date, this has helped firms save over US\$857 million and generate US\$1.3 billion in new revenues (MOTIE 2017). Thus, by implementing the national EIP policy, South Korea was able to reduce 1.7 million tons of oil equivalent (TOE) energy consumed in the industry sector, 8.54 million tons of carbon dioxide (CO<sub>2</sub>) emissions, and 6.85 million tons of waste generated from the industrial sector (KICOX 2017). The EIP initiative in South Korea also helped to create nearly 1,000 new jobs (MOTIE 2017).

EIPs have significant potential to boost economic growth while safeguarding the environment and benefiting social development. With rising global demand for green and sustainable products, EIPs are expected to increasingly attract more investments and establish themselves as the new norm for production and zone management standards.

Governments and the private sector are beginning to recognize the impacts of enhanced resource and energy efficiency on a country's overall industrial competitiveness, including the additional value that EIPs can provide. There are now more than 300 industrial parks globally that consider themselves to be EIPs — and the number is expected to increase (Figure 1). In many countries, including Bangladesh, China, Colombia, Egypt, India, Japan, Morocco, South Korea, Thailand, Turkey and Vietnam, governments have become more conscious of green approaches in combining manufacturing and competitiveness. They are now looking to scale up inclusive and sustainable industrialization by developing a national EIP framework.

**Figure 1: Global Growth of EIPs**



Source: Kechichian and Jeong (2016).

Note: OECD= Organisation for Economic Co-operation and Development

Until recently, there has been no commonly agreed understanding of the key characteristics of EIPs and the ways in which they can be implemented, despite growing demand. The need to develop a comprehensive, cohesive approach that recognizes and encourages improvement in the formation of EIPs has not received sufficient attention. To address this gap, the United Nations Industrial Development Organization (UNIDO), the World Bank Group, and the German Development Corporation (GIZ) have recently developed “An International Framework for Eco-Industrial Parks” (UNIDO, World Bank Group and GIZ 2017). This Framework provides a set of performance requirements to be considered when developing EIPs — or when transforming existing industrial parks into EIPs. It elaborates on issues pertaining to park management, as well as environmental, social and economic performance prerequisites and requirements that an industrial park needs to satisfy to be deemed an EIP. Thus, the International EIP Framework is intended to be adopted by a wide range of emerging economies and applied to all types of industrial parks with distinct characteristics, thereby serving as a critical first step to mainstreaming EIPs.

## About the Handbook

**The EIP Practitioner's Handbook** [or “the Handbook”] is a practical, step-by-step guide that takes stakeholders through the entire process of operationalizing the **International EIP Framework**. It addresses a wide range of practitioners including industrial park operators; firms located in industrial parks; industrial park planners and developers; decision makers; governmental officials and regulators at the central, provincial and local levels; financing bodies; and funding agencies, donor and international development institutions supporting client governments in designing policy frameworks and facilitating the promotion of EIPs. The Handbook is intended to help practitioners operationalize the International EIP Framework at the national and /or park level, as well as specific EIP performance requirements set in the Framework. Readers are encouraged to first review the International EIP Framework prior to using this Handbook.

## The Handbook at a glance

The Handbook is organized as follows:

**Section 1** addresses the demands of practitioners who are interested in developing a national framework to support the implementation of the International EIP Framework. This section highlights ways in which the government and other relevant stakeholders can support industrial park developers and operators in adopting the International EIP Framework through institutional, financial and technical support. It presents a detailed explanation of the four key steps, as well as a range of activities involved in developing and implementing a national-level EIP initiative. This section is presented with a view that national policy makers and regulators have a significant role to play in stimulating efforts to develop an EIP in the long term. It offers recommendations for relevant practitioners on how to best integrate or reform existing policies pertinent to EIPs by providing a detailed “how-to” guideline for

1. Stakeholder engagement;
2. Various types of assessments required to transform existing industrial parks into EIPs based on the performance requirements set in the International EIP Framework;
3. Establishment of a national EIP roadmap that adopts the International EIP Framework, including the design of regulatory, institutional and financial arrangements to support EIP development at the national level; and
4. Monitoring, launching and scaling up of the national EIP framework to promote EIPs.

**Section 2** lays out four key steps and action items involved in implementing the International EIP Framework, including a “how-to” guideline for

1. Developing stakeholder commitment;
2. Establishing an EIP management team, department or unit;
3. Performance auditing; and
4. Reporting and monitoring.

The steps and action items are applicable to both transforming an existing industrial park into an EIP and for establishing a new greenfield EIP. This section will be most useful to park practitioners, namely, park operators, park developers, authorities, and the business sector who are interested in developing or piloting an EIP project — even in the absence of a national policy framework to support EIP development.

Park practitioners can also review Section 2 if no national-level EIP framework is planned or desired. Such park practitioners could communicate with national governments their intention to design and implement an EIP, as well as the need for the central government to create the optimal regulatory and policy environment for EIPs. In this way, interest in generating a national EIP framework could be spurred from the bottom-up.

**Section 3** provides a guideline on how to identify and actively create industrial symbiosis networks— an important strategy for promoting EIPs and operationalizing the International EIP Framework. Based on South Korea's successful experience in creating the industrial symbiosis network projects at the national level, this section highlights how to identify and establish the collaboration system among firms within and across industrial parks, where waste or by-products are circulated and shared to add value, costs are reduced, and environmental impacts are improved.

The Handbook concludes with closing remarks. A set of practical tools has also been developed to help practitioners conduct assessments, make key decisions and develop projects or programs to promote EIPs based on the International EIP Framework. These tools are provided in a separate document available in the World Bank Group's Open Knowledge Repository website.<sup>3</sup>

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3 <https://openknowledge.worldbank.org/>

# ● Section 1. Developing a national approach for eco-industrial parks

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The International EIP Framework can be used as an instrument to help governments enhance the competitiveness of the manufacturing sector and the private sector, while meeting their national and international climate pledges, safeguarding the environment and improving social impact. The successful development of an EIP will require a well-designed policy and institutional framework at the national level that can accommodate various types of industrial parks across a country so that the EIP becomes a part of the wider economic and political strategies to move the country toward a greener path.

Governments have an important role to play in ensuring that EIPs become successful and fully integrated into the broader national policy frameworks. They can develop a comprehensive policy framework that helps stimulate investment to implement their EIP Framework nationwide. They can also introduce a range of policy tools, including regulatory reforms, policy mandates and financial incentives that can facilitate EIP development. Table 1 provides an overview of the step-by-step process for developing a national EIP framework.

**Table 1: Overview of the Step-by-Step Process for Developing National EIP Frameworks**

Steps	Activities	Responsible entities
<b>1. Engage stakeholders and secure commitment</b>	<ul style="list-style-type: none"> <li>▶ Map and categorize stakeholders.</li> <li>▶ Align EIP goals with national policy goals and secure commitment.</li> <li>▶ Develop capacity-building and awareness-raising activities.</li> <li>▶ Engage stakeholders throughout the EIP policy development process.</li> </ul>	<ul style="list-style-type: none"> <li>▶ National and regional government regulators in partnership with regional and local authorities, research institutions, academia, and coordinating agencies.</li> </ul>
<b>2. Diagnostics</b>	<ul style="list-style-type: none"> <li>▶ Select sample industrial parks to conduct technical analysis.</li> <li>▶ Conduct technical analysis.</li> <li>▶ Conduct policy and regulatory analysis.</li> <li>▶ Conduct institutional analysis.</li> <li>▶ Analyze financial needs.</li> </ul>	<ul style="list-style-type: none"> <li>▶ National and regional government regulators in partnership with Ministries, park operators, resident firms, banks, and so on.</li> <li>▶ Park management unit in association with park operators and resident firms.</li> <li>▶ Ministries, park operators, firms and banks.</li> </ul>
<b>3. Develop a national EIP roadmap</b>	<ul style="list-style-type: none"> <li>▶ Conduct policy and regulatory reform.</li> <li>▶ Establish governance structure and coordinating agencies.</li> <li>▶ Determine financing mechanisms.</li> </ul>	<ul style="list-style-type: none"> <li>▶ National government regulators, in partnership with relevant stakeholders.</li> </ul>
<b>4. Launch, monitor and evaluate</b>	<ul style="list-style-type: none"> <li>▶ Monitor, evaluate and verify.</li> <li>▶ Scale up and mainstream the EIP.</li> </ul>	<ul style="list-style-type: none"> <li>▶ National government regulators, in partnership with coordinating agencies, and regional / local entities.</li> </ul>

## Step 1: Engage stakeholders and secure commitment

Stakeholders can assist in the establishment of a national plan for EIPs in different ways. It is therefore important to identify and establish interest among high-impact industry sectors, park operators, and park developers who may have a stake in making decisions, as well as in developing and implementing EIP programs at the national level. The pioneering stakeholder(s) need to identify and engage other stakeholders from the outset (in many cases, in parallel with the process of securing commitment from the client governments and relevant line ministries). Indeed, stakeholders working with industrial policy regulations and national development plans generally have a relatively high awareness of sustainability issues. However, may be much less aware of the concept and the specific benefits to be derived from EIPs. It is also important that all relevant stakeholders are aware of the potential barriers that can hamper the smooth development of EIPs.

Step 1. Engage stakeholders and secure commitment
Step 2. Diagnostics
Step 3. Develop a national EIP roadmap
Step 4. Launch, monitor and evaluate

### 1.1 Stakeholder mapping and categorization

A well-structured and detailed stakeholder mapping is one of the critical first steps to ensuring the effectiveness and inclusiveness of policies to support EIP development. It helps practitioners to

- Identify government agencies or departments that are the most relevant and capable of making decisions, and developing national policies for EIP development;
- Identify interests, positions, influence and perceptions regarding EIP national policy development and implementation;

- Flag potential obstacles and identify any stakeholders who are likely to oppose, thereby enabling better strategic decision-making for effective EIP policy development;
- Understand points that could be leveraged to influence key stakeholders' viewpoints and their power to influence decisions;
- Evaluate the current level of awareness and capacities of stakeholders;
- Design and develop awareness-raising activities and training tailored to stakeholders; and
- Secure commitment from key stakeholders.

Stakeholder assessment and mapping may be conducted prior to engaging an extensive list of stakeholders, using a variety of suggested tools (Box 1).

### Box 1: Stakeholder Mapping Tools

- Stakeholder mapping templates (see Tool 1.1)
- Checklist of questionnaires for stakeholder analysis (see Tool 1.2)
- Public-Private Dialogue (PPD) Stakeholder Mapping Toolkit: A practical guide for stakeholder analysis in PPD using the net-map method.  
(<http://documents.worldbank.org/curated/en/842721467995900796/Public-Private-Dialogue-PPD-stakeholder-mapping-toolkit-a-practical-guide-for-stakeholder-analysis-in-PPD-using-the-net-map-method>)

Stakeholders can be categorized based on their interest in and potential influence over EIPs (see the stakeholder mapping and categorization templates included in Tool 1.1). Practitioners should summarize the key findings of stakeholder mapping exercise with special attention to the following questions:

- How can stakeholders help develop the national EIP framework?  
Stakeholders can have a direct influence on modifying and/or amending regulations and

national policies. They can also influence other stakeholders. Thus, understanding the relationships among the stakeholders and their roles can be very useful. It is recommended to first obtain the commitment of such influential stakeholders (for example, through face-to-face meetings) before organizing a group event, such as a study tour or a workshop.

- What are the current interests of the stakeholders regarding EIP development?  
This fundamental question allows for an evaluation of the efforts required to raise awareness of EIP benefits. International experience has demonstrated that stakeholders can be much more aware of EIPs than expected. As such, answering this question can lead to significant time and resource savings.
- What can be leveraged to change the viewpoints of different stakeholders? How can practitioners convince stakeholders that an EIP national approach is worthwhile and secure their commitment?

Answers to these questions can be very useful for developing strategies to position EIPs in alignment with other national policy goals, as well as in designing various awareness-raising activities. For instance, if the stakeholder mapping unveiled that a stakeholder is particularly concerned by air pollution originating from industrial parks, it is important to highlight the expected reduction of emissions with EIP approaches rather than starting a conversation on socioeconomic gains to be made.

Box 2 shows the list of key stakeholders involved in the UNIDO-World Bank Group project to support the Government of Vietnam in developing and implementing the national EIP framework.

## Box 2: Stakeholder Engagement and UNIDO-World Bank Group's Support for the Development of a National EIP Framework in Vietnam

In Vietnam, UNIDO and the World Bank Group engaged multiple stakeholder groups to help the government develop and implement a national EIP guideline, in effect, similar to a national framework. Three main categories of stakeholder groups were involved: regulators and governmental institutions; industrial park developers; and participating enterprises.

As a regulator, the *Ministry of Planning and Investment (MPI)* is the focal ministry responsible for overseeing the development of EIPs in Vietnam. The World Bank Group together with UNIDO have helped the MPI develop a national EIP guideline (launched in July 2018) with the approved Decree No.82/2018/ND-CP. The MPI's roles and responsibilities at the central level include: introducing policies and a legal framework related to the EIP program; allocation of budgets for providing financial support to both existing and new industrial parks; and commissioning independent third-party studies for evaluation and data validation of the EIP program. According to the National EIP Guideline, there are four complementary bodies with responsibility for EIPs.

The *EIP Regulatory Authority (NERA)* coordinates with the industrial park management boards to oversee the functioning of EIP Centers. It reports on the status and achievements of the EIP program on an annual basis. It also provides final approvals for EIP accreditation applications processed by EIP Centers, as well as for the utilization of allocated budgets based on mobilization requests from EIP Centers. In addition, it provides inputs for the approval of new EIPs planned in Vietnam.

*The National Steering Committee (NSC)*. The Committee is to be led by the Deputy Prime Minister, including representatives from the Ministry of Natural Resources and Environment (MONRE), the Ministry of Industry and Trade (MOIT), the Ministry of Construction (MOC), the Ministry of Science and Technology (MOST), the Ministry of Finance (MOF), bilateral and multilateral development institutions, and selected academic institutions. The major roles and responsibilities of the NSC will be to receive industrial park-level data from EIP Centers across the nation, and evaluate the data to determine the overall impact of the EIP program on the country. The NSC will also suggest EIP-related policy and regulatory changes to the MPI, among other functions.

[Box content continued]

*Provincial Economic Zone Authorities (PEZAs)* are responsible for encouraging industrial parks to check their eligibility to meet the minimum requirements to participate in the EIP program. If the PEZA finds that it has industrial parks willing to meet the minimum requirements and participate in the program, the PEZA shall report this to the MPI. An EIP Center shall then be established as a department within the PEZA.

*EIP Centers* are responsible for coordinating with the EIPs in the respective industrial parks regarding data and knowledge management, as well as in identifying financing requirements.

*Industrial park developers and operators* will be one of the main beneficiaries of the national EIP framework. The industrial park developers and/or the management boards of Industrial Parks will play a critical role, particularly in collaborating with participating enterprises for data collection, project identification, capacity building and other activities to maintain the EIP Guidelines. To proactively implement the EIP Guidelines, they will also provide support to the participating firms in carrying out resource efficient and cleaner production (RECP) audits, as well as assessing the feasibility of initiatives that will contribute to the performance of the EIP against firm level indicators.

*Participating enterprises of industrial parks* actively participating in developing the national EIP framework will also be key beneficiaries. Indeed, they will drive most of the initiatives related to knowledge exchange, industrial symbiosis, resource efficiency and green infrastructure.

*Source: IFC 2018.*



## 1.2 Align EIP goals with national policy goals and secure commitment

Based on the stakeholder mapping exercise, practitioners need to align EIP goals with national policy goals to secure their commitment and establish a national framework for promoting EIPs. In particular, EIPs should be understood as a critical tool to achieving national policy goals and investment plans for improving industrial competitiveness and sustainability. When securing buy-in from government stakeholders, practitioners should introduce the concept of EIPs. It is advised that practitioners build a common understanding of the concept of EIPs and the International EIP Framework and develop proposals, using questions such as those available in Box 3 (see Step 1.3 for the details of the methods used in designing awareness raising activities).

### Box 3: Sample Questions for Raising Awareness and Building a Common Understanding of EIPs

- What are EIPs?
- Why promote EIPs?
- How can EIPs help address and advance other national priorities and promote growth in the following areas:
  - industrial competitiveness (for example, an increase in exports of manufactured products, an increase in FDI and competitiveness of SMEs)
  - regional development
  - job creation and employment
  - improved access to technology, research and development (R&D), and skills
  - gender/social equality
  - climate change mitigation and adaptation
  - improvement of environmental quality
- What are the challenges associated with undertaking the adoption of the International EIP Framework in the country?
- Benchmarking: Where have EIPs been used globally? What goals have they delivered? What lessons can be learned? What are the drawbacks to be avoided?
- What is the level of motivation of industrial park developers, park operators and business associations/enterprises to participate in an EIP program?
- How can the International EIP Framework's performance requirements be best applied to the country context?

Specifically, they should describe the potential economic, environmental and social benefits associated with EIP development, using the International EIP Framework. In this context, it will be important to highlight the benefits that are in line with stakeholders' priorities (Table 2). In addition, potential barriers that can hamper the smooth development of EIPs should be also delineated, as described in the International EIP Framework.

**Table 2: Drivers and Benefits of Developing a National-Level EIP Framework**

Category of drivers and benefits	Specific benefits	Examples of EIP performance requirements that will help lead to the stated benefits
Economic	<ul style="list-style-type: none"> <li>▶ Direct and indirect employment creation.</li> <li>▶ Skills-upgrading of the labor force.</li> <li>▶ Linkages between industrial park firms, small and medium sized enterprises (SMEs), and communities outside of the industrial parks.</li> <li>▶ Technology and knowledge transfer through foreign direct investment (FDI).</li> <li>▶ Demonstration effects arising from the application of good international industry practices and regional development approaches.</li> <li>▶ Minimization of operating costs and improvement in resource efficiency and productivity.</li> <li>▶ Assurance provided to domestic and international stakeholders regarding environmental and social concerns associated with existing industrial parks and parks.</li> </ul>	<p>Economic performance requirements (example):</p> <ul style="list-style-type: none"> <li>▶ The park operator must have plans to contribute to generating local jobs in line with government targets.</li> <li>▶ Tracked by the park operator, the industrial park fulfills relevant government targets, including domestic, FDI and tax revenue targets.</li> </ul>

Category of drivers and benefits	Specific benefits	Examples of EIP performance requirements that will help lead to the stated benefits
<p><b>Environmental</b></p>	<ul style="list-style-type: none"> <li>▶ Meeting climate change commitments at the global and national levels.</li> <li>▶ Meeting global demands for a green supply chain and reduction in resource constraints through improved resource management and conservation.</li> <li>▶ Meeting increased demand to improve resource and energy efficiency.</li> <li>▶ Ensuring infrastructure is resilient to higher resource costs and adaptable to climate change risks.</li> <li>▶ Transitioning to more sustainable land use.</li> </ul>	<p>Environmental performance requirements (example):</p> <ul style="list-style-type: none"> <li>▶ A program is established to monitor, mitigate or minimize greenhouse gas (GHG) emissions.</li> <li>▶ Supportive programs are in place to improve the resource and energy efficiency of resident firms.</li> </ul>
<p><b>Social</b></p>	<ul style="list-style-type: none"> <li>▶ Improved working and labor conditions.</li> <li>▶ Creation of local jobs.</li> <li>▶ Improvement of gender equality.</li> <li>▶ Improved occupational health and safety.</li> </ul>	<p>Social performance requirements (example):</p> <ul style="list-style-type: none"> <li>▶ Essential primary social infrastructure (for example, on-site childcare programs and sanitation facilities) are adequately provided in the site master plan and are fully operational in the park.</li> </ul>

Sharing international experience is useful in highlighting the benefits of EIPs, as well as in learning about the potential implementation challenges. Box 4 presents an international experience showcasing the benefits of EIPs.

#### **Box 4: The World Bank Group's Project in Bangladesh Illustrating the Environmental and Economic Benefits of EIPs**

In Bangladesh, the World Bank Group helped implement elements of the International EIP Framework under the Partnership for Cleaner Textile (PaCT) Program. This Program enabled local SMEs in the textile sector to obtain global market access through the implementation of best practices for reducing resource consumption and water pollution. The PaCT Program helped the textile sector to achieve cleaner production objectives by influencing product design and water and energy use by textile suppliers and improving stakeholder and government engagement in sustainability opportunities in the sector.

Within three years, the program helped textile firms save over 13 million cubic meters of water—while avoiding 170 thousand cubic meters of CO<sub>2</sub> emissions equivalent per year. Global buyers in the textile industry often require that their sustainability standards for wastewater treatment and labor standards be strictly met. If a local textile SME is operating within the EIP that is satisfying the performance requirements described in the International EIP Framework, by default, it would have already met major global buyers' environmental and social sustainability standards.

The World Bank Group also helped resident firms in the Chittagong Export Processing Zone (EPZ) develop a roadmap for low carbon growth. As a result of this project, the Chittagong EPZ authority expects to save around US\$25,500 in electricity costs per year as a result of lowering energy consumption equivalent to 331 megawatts (Mwh). The project is also expected to yield the abatement of 244 tons of carbon dioxide equivalent (tCO<sub>2</sub>e) GHG emissions on an annual basis (Kechichian and Jeong 2016).

In short, EIPs can help provide park operators and resident firms with greater opportunities to attract global buyers and sell their “green” products, thereby increasing their competitiveness in the global market.

The development and implementation of a national EIP roadmap takes a long time. Therefore, once a common understanding about the benefits of EIPs has been achieved, establishing step-by-step objectives in alignment with other national policy priorities could be a useful strategy in implementing a national EIP framework. This is a critical building block and a prerequisite to steps that follow, such as stakeholder engagement, diagnostics (including the analysis of technical, regulatory, institutional, and financial gaps and needs), and establishing the national EIP framework. The case of South Korea, summarized in the box below, illustrates this point (Box 5).

### **Box 5: The South Korean Case: Developing a Vision to Establish a National-level EIP Framework**

Facing pressing calls to meet both national and global demands to make the industrial sector more sustainable and competitive, South Korea's Ministry of Trade, Industry and Energy (MOTIE) set a long-term vision to develop a national EIP framework. It was a part of its overall strategy to promote innovative industrial development while simultaneously achieving environmental and economic sustainability.

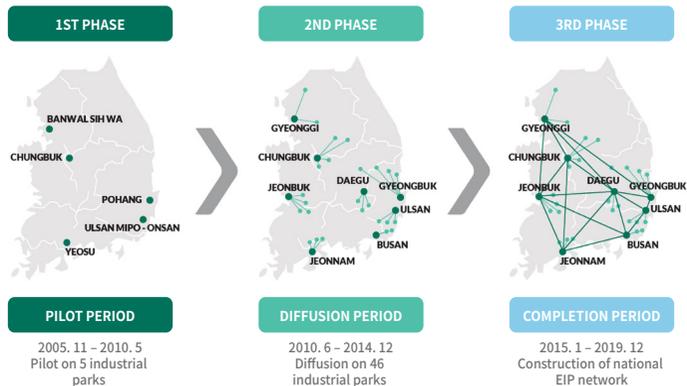
Industrial parks have played a significant role in the South Korean economy in terms of their contribution to the national gross domestic product (GDP) (63 percent as of 2017), creating jobs, and promoting economic growth. However, they also generated considerable environmental, social and public health problems. The costs associated with these problems were borne by tenant firms within the parks and local communities living adjacent to the parks. To address these problems in a holistic approach, MOTIE set a goal of transforming existing industrial parks into EIPs. It accomplished this by identifying opportunities for resource circulation and industrial symbiosis networks under the national initiative on environment-friendly industrial growth. Under this initiative, MOTIE piloted 5 industrial parks and developed a 15 year-plan. The plan was divided into three phases leading to the transformation of industrial parks into EIPs, as shown in the figure below. This plan was implemented along with a series of regulatory and institutional reforms, including the reform of the Act on the Promotion of the Conversion into Environment-Friendly Industrial Structure.

[Box content continued]

### Three phases of transforming industrial parks into EIPs in South Korea (2005-2019)

<b>Vision</b>	<b>Smart eco-society where industrial parks and local communities coexist</b>
Goal	Establishment of 300 EIP networks by 2019
Sub goals	<ol style="list-style-type: none"> <li>1. Total value of KRW 500 billion (US\$ 488 million equivalent) resource savings and additional income</li> <li>2. Annual reduction of 2 million tons of GHGs</li> <li>3. Creation of 800 jobs per each 5-year phase</li> <li>4. 1,500 companies benefit from resource sharing in each implementation phase</li> </ol>

#### Implementation phases



Source: GGGI (2017).

Note: EIP= Eco-industrial park; GHG= Greenhouse gases; KRW= South Korean Won

Source: GGGI. 2017. Greening Industrial Parks – A Case study on South Korea’s Eco-Industrial Park Program.

### 1.3 Develop capacity-building and awareness-raising activities

In conjunction with aligning EIPs with national priorities, practitioners should also begin to raise awareness among stakeholders about EIP concepts and the International EIP Framework. Training and awareness activities should be tailored to the different categories of stakeholders, and adapted to the local and national context. They should be carefully selected to maximize the impact of activities. So too, the benefits of using the International EIP Framework must be clearly described. In this context, a variety of activities can be developed to reach as many concerned stakeholders as possible.

Capacity-building programs and training activities are best developed when based on the results of the stakeholder mapping exercise—in particular, the evaluation of the current level of capacities. Both technical and non-technical capacities must be enhanced because the development of eco-industrial parks requires a variety of skills and knowledge. Using UNIDO’s Implementation Handbook for Eco-Industrial Parks (UNIDO 2017), Table 3 provides an overview of issues that should be considered in designing awareness-raising and capacity-building activities, which are differentiated by stakeholder group.



**Table 3: Awareness and Capacities Required by Key Stakeholders**

Stakeholders	Important issues for stakeholders	Potentially suitable activities to raise awareness
<b>Park operators</b>	<ul style="list-style-type: none"> <li>▶ Advantages of EIPs (economic, social and environmental) and international trends.</li> <li>▶ Pollution issues that can be caused by poorly designed and operated industrial parks</li> </ul>	<ul style="list-style-type: none"> <li>▶ Meetings</li> <li>▶ Conferences</li> <li>▶ Workshops</li> <li>▶ Interviews with other EIP managers</li> <li>▶ Official events (kick-off meeting, inauguration of infrastructure, and so on)</li> <li>▶ Website and newsletters</li> <li>▶ Social networks</li> </ul>
<b>Resident firms</b>	<ul style="list-style-type: none"> <li>▶ Advantages and the business case for EIPs, including mitigating environmental and social risks.</li> <li>▶ Practical approaches to implementing Resource Efficient and Cleaner Production (RECP) and industrial synergies.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Meetings</li> <li>▶ Conferences (for instance, from already assessed companies)</li> <li>▶ Workshops</li> <li>▶ Newsletters</li> <li>▶ Information material (brochures, factsheets, and so on)</li> <li>▶ Social networks</li> </ul>
<b>Governments and regulators</b>	<ul style="list-style-type: none"> <li>▶ Advantages and the business case for EIPs.</li> <li>▶ Interest from government agencies will depend on their specific function (for example, energy and climate change, industrial development, job creation, occupational health and safety (OH&amp;S))</li> </ul>	<ul style="list-style-type: none"> <li>▶ Meetings</li> <li>▶ Official events (kick-off meeting, inauguration of infrastructure, and so on)</li> </ul>

Stakeholders	Important issues for stakeholders	Potentially suitable activities to raise awareness
<b>Governments and regulators</b>	<ul style="list-style-type: none"> <li>▶ Characteristics of EIPs and possible challenges related to industrial regulations.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Website</li> <li>▶ Information material (brochures, factsheets, and so on)</li> </ul>
<b>Local communities</b>	<ul style="list-style-type: none"> <li>▶ Advantages of EIPs, including well-being of local communities, clean air, and so on.</li> <li>▶ New infrastructure or services that will be constructed and potentially used by local communities.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Website</li> <li>▶ Invitation of representatives to meetings and workshops</li> <li>▶ Official events (kick-off meeting, inauguration of infrastructure, and so on)</li> <li>▶ Information material (brochures, factsheets, and so on)</li> <li>▶ Social networks</li> </ul>
<b>Financial institutions</b>	<ul style="list-style-type: none"> <li>▶ Advantages of EIPs, mainly economic and financial, but also environmental and social benefits. A sound business case also entails mitigating such environmental and social risks.</li> <li>▶ Financing mechanism requirements for EIPs.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Meetings</li> <li>▶ Workshops</li> <li>▶ Conferences (for instance, presentation in a business school)</li> </ul>

Source: UNIDO (2017).

Awareness-raising and capacity-building activities can be conducted during events such as meetings, conferences and workshops, or through different communications methods, such as websites, newsletters, online training and social media networks. The following table gives an overview of the different communication and capacity-building methods that can be used, as well as their advantages and limitations (Table 4).

**Table 4: Awareness-raising and Capacity-building Activities**

Activities	Advantages	Limitations	Comments
<b>One-to-one meeting</b>	<ul style="list-style-type: none"> <li>▶ The easiest way to customize messages for ease of understanding.</li> <li>▶ Ideal to establish trust and good working relationships with stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Time consuming</li> </ul>	<ul style="list-style-type: none"> <li>▶ Only for awareness raising.</li> <li>▶ Recommended for the most important stakeholders (for example, a government representative).</li> </ul>
<b>Official events (for example, a kick-off meeting)</b>	<ul style="list-style-type: none"> <li>▶ Can be used to reach different stakeholders.</li> <li>▶ A relaxing and positive atmosphere can be created, allowing for informal and constructive discussions between participants.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Except during the formal/scripted part, it is impossible to keep control of the discussions during the event.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Usually, it is recommended to allocate time for networking during the event.</li> </ul>
<b>Study tours</b>	<ul style="list-style-type: none"> <li>▶ Very useful to learn from national or international best practices.</li> <li>▶ Can strengthen team spirit among participants.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Expensive</li> <li>▶ Time consuming</li> </ul>	<ul style="list-style-type: none"> <li>▶ Both for capacity building and awareness raising.</li> </ul>
<b>Workshop</b>	<ul style="list-style-type: none"> <li>▶ Can be very efficient to raise awareness of EIP benefits and to increase capacities.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Can be considered as time wasted, if poorly organized.</li> </ul>	<ul style="list-style-type: none"> <li>▶ It is important to foster an environment in which participants can freely share their opinions.</li> </ul>

Activities	Advantages	Limitations	Comments
<b>Workshop</b>	<ul style="list-style-type: none"> <li>▶ Usually not too costly.</li> <li>▶ If correctly organized, stakeholders will consider that they are participating in the development of a national EIP approach.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Organization can be time consuming.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Various activities during the workshop (lectures, group exercises, networking, and so on).</li> <li>▶ Sessions for sharing international experiences are recommended during a workshop.</li> </ul>
<b>Conferences</b>	<ul style="list-style-type: none"> <li>▶ Can be useful to increase capacities and awareness of EIP benefits.</li> </ul>	<ul style="list-style-type: none"> <li>▶ No or few interactions.</li> <li>▶ Can be seen as “elitist”.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Networking activities (for example, visit to an industry/infrastructure, cocktail, lunch) should be planned at the end of the conference.</li> </ul>
<b>Website, newsletter, social networks</b>	<ul style="list-style-type: none"> <li>▶ A large number of people can be reached.</li> <li>▶ Relatively easy to implement.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Depending on the method selected, it may be difficult to keep control of information (for example, comments, re-tweets).</li> </ul>	<ul style="list-style-type: none"> <li>▶ Must be regularly updated.</li> </ul>
<b>Academic training</b>	<ul style="list-style-type: none"> <li>▶ Participation of universities usually contributes to the credibility of the training.</li> <li>▶ Easy access to updated information and technologies.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Expensive</li> <li>▶ Time consuming</li> </ul>	<ul style="list-style-type: none"> <li>▶ Online training can be a good option to increase the number of participants and decrease the cost of organization.</li> </ul>

Sharing international experiences is of particular importance in promoting EIP concepts. Inviting stakeholders of neighboring countries to present their own experience of creating national EIP approaches can be especially instructional. Cooperation with academia and international organizations can also be very useful to learn from international best practices. International workshops and conferences bringing together stakeholders from the public and private sectors within a country are also effective venues for exchanging such international best practice examples.

### 1.4 Engage stakeholders throughout the EIP policy development process

In parallel with awareness-raising activities, practitioners need to engage all relevant stakeholders from the outset. The design of a national policy framework often requires the involvement of a broad set of stakeholders from the public and private sectors, academia and civil society. Therefore, when establishing the national EIP framework, practitioners are advised to identify and work with an effective champion, such as the President's Office or Prime Minister's Office that has the authority to convene key policy makers and the private sector to the table.

Once stakeholders have been engaged, practitioners must also ensure that they are continuously involved throughout the processes of developing and implementing the institutional frameworks for EIPs at the national level. As stakeholders (particularly government representatives) can change, it is recommended to regularly repeat the stakeholder mapping, for example, on an annual basis. In parallel, the results of the awareness-raising and capacity-building activities must be monitored, and if possible measured. Likewise, these activities should be repeated or adapted, if necessary.

Figure 2 provides an overview of stakeholder engagement activities corresponding to the development and implementation processes involved in creating a national EIP framework. For each step of Section 1, practitioners should identify the purpose of the dialogue and the consensus to be built; whom to invite to the table; the format of stakeholder engagement; facilitators or mediators who could manage the dialogues; and potential outcomes to which stakeholder engagement will contribute.

In countries where the concept of stakeholder engagement and consensus-building for designing a national framework or roadmap is perceived as relatively new, practitioners can seek help from

professional mediators.<sup>4</sup> In some steps, practitioners can act as facilitators or mediators themselves. However, in such cases, they should focus on helping stakeholders voice their interests rather than taking a particular position. Practitioners should prepare key background documents and materials relevant to EIP policy development (for example, regulatory documents, descriptions of the situation in industrial parks, national CO<sub>2</sub> emission targets, and so on) in collaboration with stakeholders. Participants should be informed prior to, or at least in parallel to, engaging them in discussion.

In Step 1, practitioners should work toward engaging stakeholders and helping them to build a shared vision and understanding of EIPs and their key characteristics, the International EIP Framework and global benchmark. This can be done using the list of questionnaires available in Tool 1.2 to structure the dialogue. The common understanding of EIPs can help practitioners clearly identify stakeholder interests regarding EIP development, as well as enhance the sense of collaboration among the participating stakeholders.

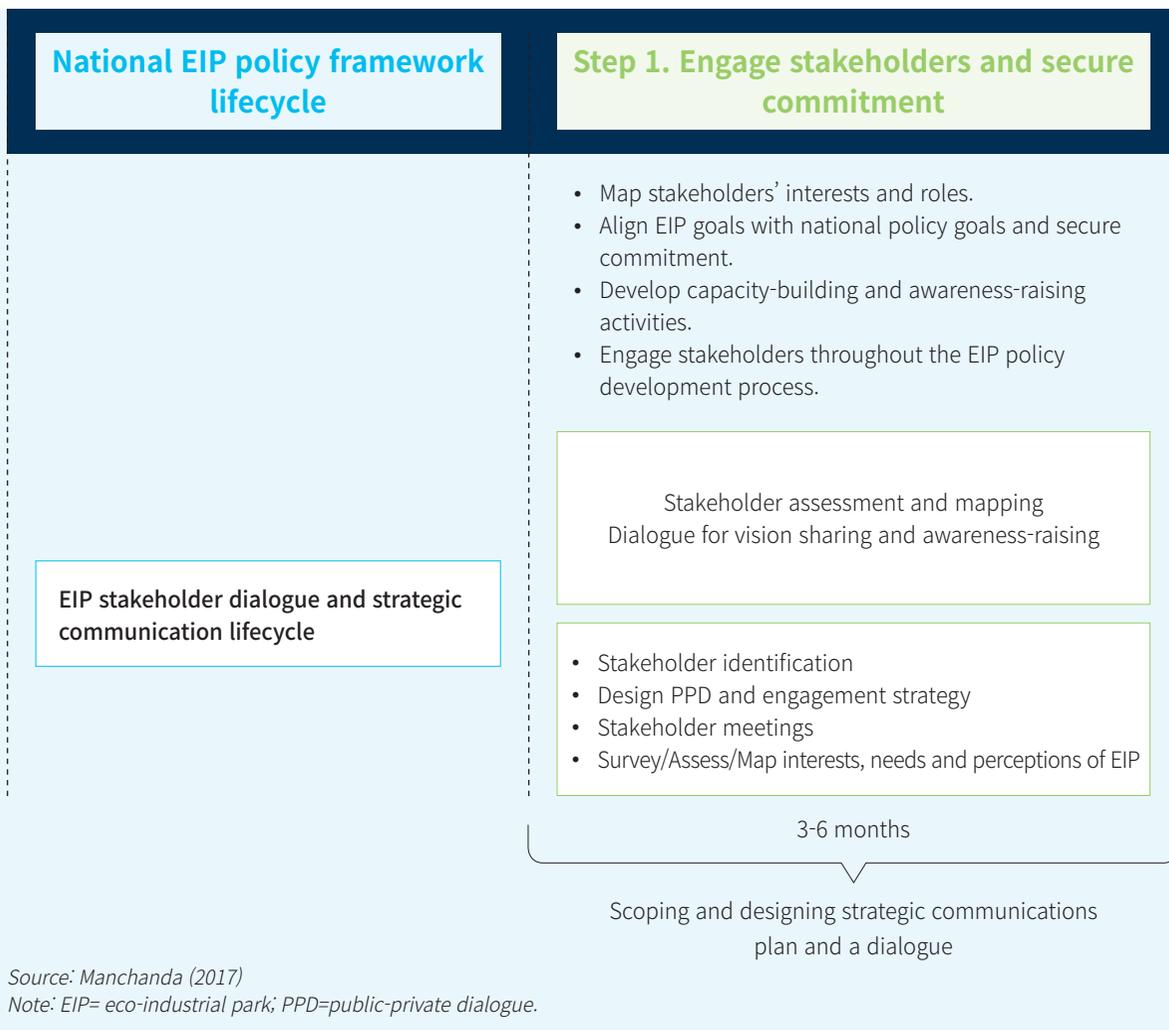
In Step 2, practitioners should actively engage stakeholders in both consultations and consensus-building processes to obtain information that will enrich the conduct of the diagnostics. For example, key decision-makers and law-makers should become engaged in identifying existing regulatory documents related to promoting EIPs, as well as gaps between the existing regulatory framework and international best practices. The results of stakeholder engagement and discussion should factor into deciding which industrial parks to choose for diagnostics. Results should also factor into analyses of the technical potential for EIPs, as well as the need for regulatory change and financing.

A wide range of stakeholders should also be engaged in Step 3 to jointly develop a feasible national roadmap. In Step 4, stakeholders need be engaged and informed about monitoring EIP performance through the use of indicators. The monitoring process should also include an evaluation of the validity of data collected and an assessment of progress on the implementation of the roadmap.

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4 Professional mediators can be hired from various professional organizations, such as the Consensus Building Institute (CBI), a nonprofit organization that has extensive experience and expertise in facilitation, mediation, stakeholder engagement and capacity building. For example, CBI helped the Chilean government to formulate *Energía 2050*—a shared roadmap for a cleaner, cheaper, and universally accessible energy policy that was adopted by the Energy Ministry. Agreement was achieved through a long-term participatory planning process that integrated the core interests of government, the private sector, civil society leaders, and citizens. The CBI also facilitated the year-long deliberation of the 28-member, multi-stakeholder steering committee empowered to draft an Energy Road Map to 2050 (The Consensus Building Institute, <https://www.cbi.org/>).

Figure 2: EIP Stakeholder Engagement, Dialogue and Strategic Communications



Source: Manchanda (2017)

Note: EIP= eco-industrial park; PPD=public-private dialogue.

### Step 2. Diagnostics

- Select sample industrial parks for diagnostics.
- Conduct various assessments and gap analysis (technical, regulatory, institutional and financial).

Dialogue for conducting diagnostics and developing a national EIP roadmap

- Stakeholder meetings, workshops, conferences, and training workshops
- Round table discussion
- Consultations and consensus-building processes

### Step 3. Develop a national EIP roadmap

- Policy and regulatory reform
- Establish governance structures and coordinating agencies.
- Determine financing mechanisms.

### Step 4. Launch, monitor and evaluate

- Establish a Monitoring, Reporting and Verification (MRV) mechanism.
- Scale up and mainstream EIP.

Dialogue for operating, managing, and monitoring the implementation of the national EIP roadmap and EIPs

- Stakeholder meetings
- Round table discussion
- Consultations and consensus-building processes

3-5 years

EIP Strategic Stakeholder Dialogue

The detailed sequencing of stakeholder engagement and consensus-building processes may change depending on the existing situations of a given country. For example, in some cases where dominant stakeholders are foreseen, practitioners may have to start with a quantitative and qualitative analysis of the existing situation, including the corresponding market trends, before extensively engaging with stakeholders. Such strategic sequencing of analysis and stakeholder involvement will allow practitioners to engage stakeholders more effectively, with better awareness of predictable assumptions by the dominant public and private actors.

Public-Private Dialogue (PPD) is a well-known mechanism for bringing together governments, the private sector, and other relevant stakeholders in a formal or informal process. PPD has been applied to various policy-making processes, including industrial policy and climate policy design. Indeed, it is a proven tool for positive change, with a long track record of success (World Bank 2017). Box 6 presents key guiding principles to inform the design of stakeholder engagement in the EIP context.

#### **Box 6: Key Guiding Principles to Inform the Design of Stakeholder Engagement in the EIP Context**

- **Evidence-based discussions**
  - Stakeholders should be engaged in various analyses and provided with background materials (for example, international benchmark information, regulatory analysis reports) so that they can have informed discussions and formulate evidence-based recommendations.
- **Inclusiveness**
  - All relevant stakeholders promoting EIPs should be involved.
- **Transparency**
  - All relevant stakeholders should have equal access to key documents and results of diagnostics.
  - All relevant stakeholders should be informed about key EIP decision-making processes.

[Box content continued]

- **Increased awareness**

- As a result of the stakeholder engagement process, all stakeholders should have a common understanding of EIP concept and the International EIP Framework, as well as objectives, benefits of and barriers to adopting the Framework in the national context.
- Knowledge creation should be promoted, and the flow of information should be facilitated through various awareness-raising and capacity-building tools, such as the formation of research partnerships.

- **Efficiency**

- EIPs may require the simultaneous launching of multiple dialogues. Therefore, efficient channels of communication between these dialogues — as well as communication and coordination about actions and outcomes — must be established. The informal structure of dialogue should be used to full advantage if it is to be effective.
- Dialogue should be professionally facilitated to include dedicated staff, as well as resources to efficiently manage all aspects of the dialogue process relevant to developing and implementing the national EIP framework.
- Efficiency needs to be carefully balanced with the inclusion principle, noted above.

- **Accountability**

- Practitioners should ensure that discussions and recommendations for developing the national EIP framework are fact-based and data-driven so that impacted parties can be confident they are based on a solid foundation.
- The results of recommendations should be monitored in order to assess the performance and achievements resulting from the dialogue.

*Source: World Bank Group (2017)*

## Step 2. Diagnostics

As indicated in the International EIP Framework, an EIP should go beyond national compliance requirements to approach or surpass international best practice. It is therefore important that when setting the performance requirements for a national framework, both national policy and technical potential are taken into consideration.

Diagnostics can be conducted according to the following sequence of steps:

1. Select sample industrial parks to conduct diagnostics.
2. Perform technical analysis to establish national EIP performance requirements and guidelines.
3. Conduct regulatory and policy analysis.
4. Conduct institutional gap analysis.
5. Analyze financial needs and feasibility.

Diagnostics can help practitioners obtain a good snapshot of the current situation, and better design and implement the national EIP framework.

The diagnostics may entail the following four types of assessments: technical; policy and regulatory; institutional; and financial analyses (Table 5). Practitioners should examine existing situations to identify opportunities for EIPs. This entails reviewing the country's relevant strategies, conducting technical surveys on site at existing industrial parks, and consulting with key stakeholders. The analyses should be done through extensive stakeholder consultation and utilization of documentation of existing national and local level regulatory provisions and financial mechanisms that can support the development and implementation of the national EIP framework. A range of domestic experts or

Step 1. Engage stakeholders and secure commitment
Step 2. Diagnostics
Step 3. Develop a national EIP roadmap
Step 4. Launch, monitor and evaluate

expert committees can also conduct diagnostics using this Handbook — especially if the EIP dialogue platform has already been established to allow these experts to communicate their findings to public and private stakeholders. Practitioners can leverage stakeholder engagement/PPD platforms to conduct diagnostics, using the sample templates and questionnaires suggested in Tools 1.3, 1.4 and 1.5.



**Table 5: Overview of Diagnostics for the Design of a National EIP Roadmap**

Analysis	National level	
	Purpose of analysis	Sample questions and checklists
<b>Technical analysis (Step 2.2)</b>	<ul style="list-style-type: none"> <li>▶ Understand technical potential and gaps in promoting EIPs.</li> <li>▶ Design appropriate technical guidelines at the national level, benchmarking the International EIP Framework.</li> <li>▶ Establish national EIP performance requirements tailored to local context.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Does an EIP or similar concept exist in the country?</li> <li>▶ Are there parameters defined for EIPs or similar Sustainable Industrial Parks? If so, what are they?</li> <li>▶ Are there any reference documents or standards available that are relevant to EIPs?</li> <li>▶ Do the current conditions and practices in existing industrial parks meet the prerequisites described in the International EIP Framework? (see the checklist in Tool 1.4)</li> <li>▶ In case the prerequisites are not met, what kinds of technical guidelines and standards should be prepared to meet the prerequisites?</li> <li>▶ Detailed questions for establishing the national EIP performance indicators and technical guidelines are available in Table 2 and Tool 1.5.</li> </ul>
<b>Policy and regulatory analysis (Step 2.3)</b>	<ul style="list-style-type: none"> <li>▶ Understand industrial park-related policy frameworks.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Are there any policies that can be helpful in promoting EIPs or similar sustainable industrial parks?</li> </ul>

Table 5 (continued)

Analysis	National level	
	Purpose of analysis	Sample questions and checklists
<b>Policy and regulatory analysis (Step 2.3)</b>	<ul style="list-style-type: none"> <li>▶ Identify and collect policy documents, legislative acts, and implementing regulations such as decrees, circulars, ministerial and inter-ministerial decisions.</li> <li>▶ Identify gaps between good practices and current legislative acts and regulations for existing policies.</li> <li>▶ Identify any missing legislative acts and regulations.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Which policies are missing/outdated/not effectively implemented? Why? Are capacity constraints articulated by discussants? What are they?</li> <li>▶ Are parameters defined for EIPs or for similar Sustainable Industrial Parks in any enforceable way? Are there any relevant legislative acts and/or implementing regulations?</li> <li>▶ Have all the organizations foreseen in legislation and regulation been established and funded?</li> </ul>
<b>Institutional analysis (Step 2.4)</b>	<ul style="list-style-type: none"> <li>▶ Identify gaps between identified good practices and current governance systems in terms of capacities to operationalize the national EIP framework.</li> <li>▶ Identify corrective actions to close the gaps.</li> </ul>	<ul style="list-style-type: none"> <li>▶ What institutional structures exist to oversee the planning and development of EIPs?</li> <li>▶ Do the existing governmental bodies or organizational units have authorities and capacities to promote and coordinate the requisite public, private, and institutional collaboration across EIPs and sectors?</li> <li>▶ What kinds of corrective actions are required to close any gaps identified in the existing institutional system?</li> </ul>
<b>Financial analysis (Step 2.5)</b>	<ul style="list-style-type: none"> <li>▶ Identify availability and access to financing for EIP interventions.</li> </ul>	<ul style="list-style-type: none"> <li>▶ Are there any funding programs or schemes that can help promote EIPs?</li> <li>▶ Is financing available to promote EIPs?</li> </ul>

## 2.1 Select sample industrial parks to conduct technical analyses

A variety of criteria should be considered in the selection of industrial parks. Diagnostics and pilots are mainly related to the identification of significant characteristics among the industrial parks that can be taken as representative of the average industrial park in the country. In countries such as Vietnam, where there are more than three hundred industrial parks, practitioners are encouraged to select a number of industrial parks for on-site surveys and technical and financial diagnostics to structure the EIP framework before developing a nationwide EIP model.

First, practitioners need to prepare a selection matrix to shortlist industrial parks for diagnostics, leveraging stakeholder consultation forums led by the national government. The selection criteria should reflect the local context, such as the profile of key industries in the country. The following criteria set can be used in developing the matrix:

- Size of the industrial parks (preferably large industrial parks)
- Ownership structure (mix of privately-owned/operated and government-owned/operated industrial parks)
- Occupancy rate (total number of firms and/or an occupancy rate greater than 60 percent)
- Geographical location
- Sectoral breakdown (reflecting the profile of the industrial structure in the country)
- Employee numbers, if available (preferably industrial parks with a large number of employees)
- Energy consumption, if available (highly energy-consuming industrial parks)
- Water consumption, if available (highly water-consuming industrial parks)
- Waste and wastewater generation, if available (industrial parks with a large amount of waste and wastewater generation)
- Availability of information about the level and patterns of water and electricity consumption, waste generation, and reuse of wastewater
- Industrial park operators' willingness and interest in developing a park-level EIP program
- Feasibility of field surveys (for example, financial capacity to conduct on-site surveys)

In Vietnam, UNIDO and the World Bank Group shortlisted large industrial parks with occupancy rates greater than 60 percent, and land area greater than 100 hectares (ha) because they were expected to have larger spillover effects than small industrial parks. The number of selected industrial parks can range from as few as 2 or 3 to as large as 10 or 15, depending on the budget set aside for diagnostics.

## 2.2 Technical analysis

Once the selection process is complete, practitioners should examine the existing situation and practices of the selected sample industrial parks. The purpose of the technical analysis is to understand the technical potential and any gaps in promoting EIPs. This can be done by testing the applicability of EIP performance targets to create benchmarks for a national framework and program, and by designing appropriate technical guidelines at the national level according to standards in the International EIP Framework.<sup>5</sup>

The International EIP Framework, recently developed by UNIDO, the World Bank Group and GIZ, includes two kinds of requirements: prerequisites and performance requirements/indicators. The prerequisites highlight the basic requirements for EIPs and may serve as a screening tool. The performance requirements provide indicators and targets about expected performance levels that an EIP must meet. Performance indicators can also be used to measure and monitor accomplishments and/or the performance of industrial parks (see Step 4 of Section 1).

Practitioners should compare selected industrial parks and their existing practices against the park management, environmental, social and economic prerequisites indicated in the International EIP Framework. The preliminary findings and collected information can be used in assessing the readiness of existing or selected parks to become EIPs. A checklist and list of questions to assess the readiness of selected parks, developed based on the International EIP Framework's performance prerequisites, are available in Tool 1.3. Practitioners need to implement some corrective actions (available in Tool 2.4: Table 1) first if the selected industrial parks do not satisfy the prerequisites.

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5 Technical assessments may be conducted at the park levels to better understand the potential and gaps for transformation to an EIP. Findings can then be used to develop an action plan. This type of assessment is described in detail in Step 1 of Section 2.

Once practitioners have assessed whether the existing situation and practices meet all the prerequisites, practitioners should then conduct an assessment to establish targets for the 33 performance indicators available in the International EIP Framework, including their target values. Practitioners are advised to conduct the assessments following the steps detailed in Table 6 and Tool 1.4.

Performance indicators are grouped into 4 specific categories: park management, environmental, social and economic. It is recommended that all performance indicators in the International EIP Framework be included in the national EIP framework. As such, stakeholders would be in a better position to benchmark the performance of existing industrial parks and their transformation to EIPs in comparison to industrial parks and EIPs in other countries. Practitioners could then take a tailored, phased approach to setting up the target value for each performance indicator to align with real-life practices in the country. The ultimate objective would be to reach and surpass the targets set in the International EIP Framework.

Practitioners should engage and consult key stakeholders during the process. They should also take into consideration trusted data availability, measurability (including the capacity to collect additional data), and assurances for anonymity should it be needed, as well as emerging issues and new priorities that arise both at the national and park level.

EIP performance indicators can be set in a relatively efficient manner, leveraging available metrics and data as required by national law. Compliance with existing regulations is one of the fundamental prerequisites in developing an EIP program, as described in the International EIP Framework. Industrial parks and resident firms have established data acquisition, management plans, and/or some strategies to meet these regulatory requirements. As such, the required information can be collected. If the information is not readily available, practitioners can conduct a local survey of selected industrial parks, including interviews with park operators and representatives of resident firms to obtain specific information about each indicator. In order to obtain the available data/information from selected industrial parks, a data collection form can be prepared and sent to the assigned focal points within the selected industrial parks (also see Step 1.1 and Step 1.2 of Section 2, as well as Tool 2.2 and Tool 2.6 for the sample interview questions and data collection templates).

A detailed guideline is provided in Table 6, and can be used in tailoring the EIP performance targets to each indicator at the national level. The guideline is structured in terms of:

- Information required to set up EIP performance targets for each indicator. For example, intermediate targets may be established using a phased approach, with the ultimate aim of achieving at least those targets set in the International EIP Framework, if not beyond
- Steps involved in setting the indicators and obtaining relevant information
- List of potential stakeholders to contact
- How to set up the target value using readily available information
- What needs to be done or assessed, if credible information is not readily available



**Table 6: Selective List of EIP Performance Indicators and Steps Involved in Establishing Target Values<sup>6</sup>**

	Topic	Indicator	Information required to set targets	Steps involved in setting the indicators/ Where and how to obtain information
Park management	Park management services	Proportion of firms in the industrial park that have signed a residency contract/ park charter/code of conduct, <sup>7</sup> as well as any additional legally binding arrangements.	Documentation related to industrial park management and tenant membership; local norms and regulation regarding park management, and tenant contracts.	<ul style="list-style-type: none"> <li>▶ Assess legally binding documentation between the park entity and tenants (for example, rental contracts at pilot parks) and park governance regulations at the national level.</li> </ul>
		The resident firms are satisfied with the provision of services and common infrastructure by the park management's entity.	Industrial park statistics collected by the park management entity.	<ul style="list-style-type: none"> <li>▶ Assess data provided by park operators regarding firm satisfaction.</li> </ul>
	Monitoring and risk management	The park management entity regularly monitors and prepares consolidated reports regarding the achievement of target values.	Report provided by the park operators.	<ul style="list-style-type: none"> <li>▶ Check reporting requirements, park operators' monitoring system, and the frequency of reports.</li> </ul>

<sup>6</sup> See the full list of the indicators and how to set their target values in Tool 1.4.

<sup>7</sup> In most developing countries, a park's charter or code of conduct may not be a legally binding instrument. Therefore, it would not provide the park operator with the necessary powers.

Potential stakeholders to consult	Setting the target values (minimum, medium, and maximum)	What needs to be done if the information is not readily available, or if there is no relevant regulation
Park operators, zone authority	Work with park operators. <sup>8</sup>	<ul style="list-style-type: none"> <li>▶ Perform surveys to check park governance and resident membership contracts. Work with park operators to set the target value.</li> </ul>
Park operators, zone authority	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Perform surveys to assess resident firms' satisfaction with social infrastructures provided by park operators.</li> <li>▶ Work with park operators to set the target value.</li> </ul>
Park operators, zone authority	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Work with park operators to create a reporting management system in line with EIP performance indicators.</li> <li>▶ Work with park operators to set the target value.</li> </ul>

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8 In some cases, negotiations among stakeholders may be required to set target values for EIP performance indicators.

Environmental	Topic	Indicator	Information required to set targets	Steps involved in setting the indicators/ Where and how to obtain information
	Management and monitoring	Proportion of resident firms with more than 250 employees that have an Environmental / Energy Management System (EMS and EnMS, respectively) in place in line with international standards.	Annual national statistics on firms and statistics published by the park operator (in pilot parks).	<ul style="list-style-type: none"> <li>▶ Check with management firms that provide certification to identify firms with more than 250 employees who have an EMS/EnMS to get a sense of the national picture.</li> </ul>
	Energy	The park management entity sets and works toward achieving ambitious (beyond industry norms) maximum carbon intensity targets. Targets should be established for the short, medium, and long term.	Information about national good practice within industry sectors that have significantly reduced carbon intensity. Use sandbox or similar tools provided by international development banks to calculate carbon intensity index.	<ul style="list-style-type: none"> <li>▶ Set the benchmark by identifying international/regional best practices that align with national policy goals.</li> <li>▶ Involve the main industrial park entities in roundtables to identify feasible targets beyond national industry sector benchmarks.</li> </ul>
	Water	Proportion of industrial wastewater generated by industrial parks and resident firms, which is treated to appropriate environmental standards.	Quality of water from national lakes, rivers, sea, groundwater in proximity of industrial parks.	<ul style="list-style-type: none"> <li>▶ Check regulatory documents to see whether resident firms are required to treat wastewater by law.</li> </ul>

Potential stakeholders to consult	Setting the target values (minimum, medium, and maximum)	What needs to be done if the information is not readily available, or if there is no relevant regulation
Ministry of Environment, Ministry of Industrial Development, Certification body, Large firm representatives	40% or $\geq$ national average	<ul style="list-style-type: none"> <li>▶ Conduct a survey of selected industrial parks to examine whether resident firms with more than 250 employees have an EMS/EnMS in place in line with international standards.</li> <li>▶ Work with park operators to set a reasonable target value.</li> </ul>
Ministry of Industrial Development, Ministry of Environment, and park management entities	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Establish a system to identify national benchmarks by sectors, using tools and information provided by international development banks.</li> <li>▶ At the national level, collect data across industrial parks for 1 or 2 years.</li> <li>▶ Talk to industrial park entities to agree on targets beyond national benchmarks.</li> </ul>
Ministry of Environment, Ministry of Industrial Development, national agency for the protection of rivers, lakes and groundwater sources, and park operators	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Map water systems located near industrial parks.</li> <li>▶ Analyze the quality of water from national lakes, rivers, sea, and groundwater in proximity of industrial parks.</li> <li>▶ Convene the Ministry of Environment and park operators to set the target value.</li> </ul>

Environmental	Topic	Indicator	Information required to set targets	Steps involved in setting the indicators/ Where and how to obtain information
	Waste and material use	Proportion of solid waste generated by firms, that is reused by other firms, neighboring communities, or municipalities.	Data on national waste management with a focus on landfill, recycling and incineration capacities.	<ul style="list-style-type: none"> <li>▶ Examine national targets, regulations and local norms on waste management.</li> </ul>
Climate change and the natural environment	Proportion of firms in the park that have pollution prevention and emission reduction strategies to reduce the intensity and mass flow of pollution/ emission release beyond national regulations.	National environmental laws and regulations on emissions; regional and international best practices on emissions targets.	<ul style="list-style-type: none"> <li>▶ Check the existing national targets to reduce the list of pollutants and GHGs including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), sulfur oxides (SO<sub>x</sub>), and nitrogen oxide (NO<sub>x</sub>) emissions.</li> <li>▶ Check countries' mid-term targets to reduce the emission of the list of afore-mentioned pollutants.</li> <li>▶ Conduct a survey of selected industrial parks to set a benchmark for the target value.</li> </ul>	

Potential stakeholders to consult	Setting the target values (minimum, medium, and maximum)	What needs to be done if the information is not readily available, or if there is no relevant regulation
Ministry of Environment, Ministry of Industrial Development, and park operators	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Map national landfill and incineration and recycling capacity.</li> <li>▶ Set medium- to long-term plans to incentivize recycling over landfill and incineration.</li> <li>▶ Work with park operators to set the target value.</li> </ul>
Ministry of Environment, Ministry of Industrial Development, and park operators	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Identify international/regional best practices in setting mid-term targets to reduce the emission of the listed pollutants.</li> <li>▶ Conduct a scenario analysis.</li> <li>▶ Work with park operators to set the target values.</li> </ul>

Social	Topic	Indicator	Information required to set the target value	Steps involved in setting the indicators
	Social management systems	Percentage of all firms in the industrial park with more than 250 employees that have a well-functioning occupational health and safety (OH&S) management system in place.	National statistics; industrial park statistics; and data on industrial parks from main certification bodies.	<ul style="list-style-type: none"> <li>▶ Analyze national and park statistics or assess data available from certification bodies.</li> </ul>
Social infrastructure	Percentage of the surveyed employees reporting satisfaction with social infrastructure.	Industrial park statistics and reports.	<ul style="list-style-type: none"> <li>▶ Assess data provided by park operators regarding the level of employee satisfaction.</li> </ul>	
	Percentage of female workforce who benefit from available infrastructure/ programs for skills development.	Industrial park statistics and reports.	<ul style="list-style-type: none"> <li>▶ Assess data provided by park operators on infrastructure/programs for skills development grouped by gender.</li> </ul>	

Potential stakeholders to consult	Setting the target values (minimum, medium, and maximum)	What needs to be done if the information is not readily available, or if there is no relevant regulation
Certification bodies, Ministry of Labor, and park operators	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Assess annual data on injuries, occupational diseases, absenteeism, as well as the total number of work-related fatalities by industrial sector.</li> <li>▶ Conduct a survey among the resident firms with more than 250 employees within the parks to examine whether they have an OH&amp;S management system in place.</li> <li>▶ Work with park operators to set the target value.</li> </ul>
Park operators, Ministry of Equality or Social Welfare	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Conduct surveys at the park level to assess employee satisfaction with social infrastructure provided by park operators.</li> <li>▶ Work with park operators to set target value.</li> </ul>
Park operators	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Conduct surveys at the park level to assess infrastructure/programs for skills development and gender statistics.</li> <li>▶ Identify international best practices and benchmarks.</li> <li>▶ Work with main park operators to set the target value.</li> </ul>

	Topic	Indicator	Information required to set the target value	Steps involved in setting the indicators
<b>Social</b>	Local community outreach	Percentage of the surveyed community members that are satisfied with the community dialogue.	Survey data conducted by park operators with local communities in the region. Communications and marketing plans or strategies implemented by the national or regional park management entities.	<ul style="list-style-type: none"> <li>▶ Analyze data collected by park operators from local communities within a reasonable radius from the industrial parks.</li> <li>▶ Assess communications and marketing plans provided by the main industrial parks.</li> </ul>
<b>Economic</b>	Employment generation	Percentage of total firm workers in the industrial park employed through direct employment (that is, not employed on a fee-for-output basis or provided through a labor supply firm) and permanent contracts.	National and provincial-level employment statistics (for example, employment rate); industrial park-level targets and employment statistics.	<ul style="list-style-type: none"> <li>▶ Examine reports, statistics, documentation and targets set both at the national and local levels that are relevant to increasing direct employment.</li> <li>▶ Check with park operators regarding long-term industrial strategies related to market expectations, growth and profitability.</li> <li>▶ Check with park operators regarding the selection criteria of the main firms in the park for employment. Conduct a gap analysis of skills and competences in the region.</li> </ul>

Potential stakeholders to consult	Setting the target values (minimum, medium, and maximum)	What needs to be done if the information is not readily available, or if there is no relevant regulation
<p>Local communities within a reasonable radius from the industrial parks related to the activities of the parks, local municipalities, and park operators.</p>	<p>Work with park operators.</p>	<ul style="list-style-type: none"> <li>▶ Conduct surveys with local communities within a reasonable radius from the industrial parks to assess their satisfaction with park efforts to inform and engage communities on matters that affect them.</li> </ul>
<p>Ministry of Industry, Ministry of Labor, and park operators</p>	<p>Work with park operators.</p>	<ul style="list-style-type: none"> <li>▶ Assess the long-term industrial growth forecasts for the industries in the industrial parks;</li> <li>▶ Verify the direct employment rate with park operators and the Ministry of Labor.</li> <li>▶ Define a program or areas of intervention to support technical education to better serve industrial park needs.</li> <li>▶ Work with park operators on medium - to long-term plans to support the employment of local workers with the proper skills and competences in relation to their growth expectations.</li> </ul>

	Topic	Indicator	Information required to set the target value	Steps involved in setting the indicators
Economic	Local business and SME promotion	Percentage of resident firms using local suppliers or service providers for at least 80 percent of their total procurement value.	Industrial park statistics on resident firms' procurement strategies, or strategies to engage local suppliers or service providers; and national statistics.	<ul style="list-style-type: none"> <li>▶ Analyze region's industrial activities and available services relevant to selected industrial parks' specialized/priority sectors and procurement strategies.</li> <li>▶ Analyze outsourcing/procurement strategies of the industrial parks; conduct a gap analysis of the satellite/subcontracting activities in terms of competitiveness (cost versus quality versus technology).</li> </ul>
	Economic value creation	The ratio of rented or used space by resident firms compared to the total amount of available space earmarked for resident firms within Industrial Parks.	Documentation or data collected by the park operator on the status of resident firms' rental contracts.	<ul style="list-style-type: none"> <li>▶ Assess technical documentation and information on rental contracts and/or occupancy rates.</li> </ul>

Potential stakeholders to consult	Setting the target values (minimum, medium, and maximum)	What needs to be done if the information is not readily available, or if there is no relevant regulation
Ministry of Industry, and park operators	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Assess the regional satellite /subcontracting activities that are relevant to industrial parks' specialized / priority sectors and procurement strategies.</li> <li>▶ Develop long-term plans to assist the development of qualified and sustainable local industries, while setting the target value through negotiation with park operators.</li> </ul>
Ministry of Industry, and park operators	Work with park operators.	<ul style="list-style-type: none"> <li>▶ Conduct a technical assessment to check existing ratios regarding rented space in the industrial parks, and work with Industrial park operators to set the target value.</li> </ul>

The target values may need to be adapted to the local context and situation through round table discussions of relevant information to agree on benchmarks and indicator target values, as indicated in Step 2. The round tables should be facilitated by neutral parties, for instance, professional facilitators (Step 1 of Section 1). Each indicator will be evaluated considering the following aspects:

- Current situation, following steps described in Table 4.
- Costs associated with and investment needed for implementing short-, mid- and long-term goals related to each performance indicator, such that targets achieve or surpass those in the International EIP Framework (if this is chosen by the country).
  - The method relevant to this assessment is detailed in Step 1.2 of Section 2, as well as in the Example of Prefeasibility Assessment for Specific Resource Efficiency Processes available in the Tool 2.3.
- Potential financing opportunities associated with the acceleration of adopting challenging targets based on national/regional and mid- to long-term goals (see Step 2.5 of Section 1).

The adaption of the performance indicators' target values can take place through stakeholder discussions grouped around four different topics (park management, and environmental, social, and economic performance). Each session can consist of a specific number of meetings (2-4) over a determined time frame (for example, from a few weeks to 3 months). If no agreement is reached in terms of setting the target values during the proposed time frame, practitioners will refer to the target values listed in the International EIP Framework.

Ideally, the process of setting the national-level EIP performance requirements should be a mix of both top-down and bottom-up approaches. It is important to note that a common interest and approach may be identified and created through a dialogue between the central governments and the industrial park operators. Together, they can work to adopt challenging target values with adequate financial support to stimulate the implementation of an EIP program. The EIP performance indicators that should be monitored at the park level are further elaborated in Section 2.

## 2.3 Policy and regulatory analysis<sup>9</sup>

Practitioners should review existing laws and regulations to identify gaps. Such information will facilitate the better design of the national EIP framework, including various supporting standards and policy programs. Regulatory mapping and analysis can help practitioners identify regulatory barriers that can hinder the implementation of the national EIP framework, including:

- A lack of appropriate and enforceable policies and regulations to encourage EIPs;
- Potential conflicts between existing regulations and policy initiatives;
- A lack of transparency surrounding industrial regulation and enforcement; and
- The limited ability of stakeholders to transpose privileged regulatory frameworks into industrial parks.

Regulatory analysis also helps practitioners identify the needs for modification of the regulatory framework and/or legal provisions.

Practitioners should begin the analysis by forming a team to conduct background research and hold consultations with policy and law makers. If the assessment is not being conducted internally by a government agency, it is recommended that the team include at least some representatives of the line ministries responsible for regulating industrial parks or overseeing the economic, environmental and social performance of the industrial sectors. Practitioners should identify, collect, and review documents on the following:

- Park management issues:
  - Regulations about park operators, including those that may contain provisions about the empowerment of park operators, for example, export and/or investment promotions, customs, and tax legislation that may provide park operators with additional responsibilities and/or powers.

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9 This regulatory and policy analysis method can also be used in creating an industrial symbiosis network.

- Socioeconomic issues:
  - Job creation and provision of training/skills for resident firms and work force, including specific provisions related to industrial parks
  - FDI/exports, R&D/investments in or facilitation of technological developments and tax laws
  - Regulations affecting gender equality within the industrial parks
  - Community support and corporate responsibility requirements, including those that may be specifically applicable to industrial parks
- Industrial competitiveness issues:
  - Industrial growth
  - SMEs, Zone development (Special Economic Zones (SEZs)/ Export-Processing Zones (EPZs)/ industrial park regulations)
- Financial issues:
  - Market-based incentives for promoting technological innovation, industrial growth, and climate change
- Environmental issues:
  - National and local regulations related to climate change, sustainability, energy and resource efficiency, water treatment, ecosystem services, environmental impact assessments, and disaster risk management (DRM), with a focus on those regulations relevant to industrial parks, if available
- Land-use issues:
  - Zoning, urban and regional planning, and infrastructure development.

Laws and regulations generate many requirements and administrative procedures related to industrial park operations, ranging from authorization to registration, and licensing and information disclosure measurements. Some of these requirements may have to be streamlined for effective implementation of the national EIP framework.



Informed by both the findings from the background research of regulatory documents and the stakeholder mapping exercise in Step 1, practitioners should then consult with policy and law makers, local experts, private sector representatives and academics. Consultations with private sector stakeholders are particularly useful in identifying specific barriers to introducing the national EIP framework.

Based on the background research and consultations, practitioners should be able to create a chart that highlights existing regulations, technical guidelines, corresponding government bodies, and decision-making processes relevant to promoting EIPs. Practitioners are encouraged to use the regulatory mapping template available in Tool 1.5. This chart will help practitioners identify any missing indicators and guidelines, as well as potential obstacles. It will also highlight any reforms needed to legal provisions (types and examples of regulatory reforms and policy interventions will be described in detail in Step 3 of Section 1). Moreover, together with the results of the technical diagnostics, the flow chart will enable practitioners to develop secondary regulations (for example, technical standards and guidelines), allocate oversight responsibilities and establish reporting lines.

Figure 3 provides a high-level guideline for conducting a regulatory assessment.

**Figure 3: How to Conduct a Regulatory Assessment**



A review and assessment of existing legal and regulatory frameworks can be carried out in consultation with stakeholder groups, as illustrated in Box 7. This example demonstrates how the regulatory assessment helped structure the national EIP framework in Vietnam.

## Box 7: Stakeholder Engagement in Developing a National EIP Guideline in Vietnam

### Good Practice Example – Stakeholder Engagement and Regulatory Reform in Support of EIPs: Introducing EIP principles in Vietnam through Decree 82



#### Overview:

With the support of UNIDO and the World Bank Group, the Vietnamese Ministry of Planning and Investment (MPI) drafted Decree 82, introducing EIP principles, industrial symbiosis as well as incentives and criteria for industrial zones to be considered as EIPs. This new decree was approved in June 2018 and entered into force in July 2018.

#### Important considerations:

- Members of the project management unit based in Hanoi participated in the discussions and provided technical inputs.
- An environmental guideline was developed by the World Bank Group in agreement with MPI and in cooperation with UNIDO.
- Social and economic guidelines supporting the implementation of Decree 82 will be developed under the UNIDO project.

#### Key activities:

- Under the UNIDO project, a review and assessment of the existing legal framework, policies and regulations on industrial parks was completed in November 2016 and informed the development of Decree 82.
- An expert group meeting brought together all key stakeholders from the local and national levels to learn about international good practice examples of EIPs organized under the project.

[box content continued]

### Good Practice Example – Stakeholder Engagement and Regulatory Reform in Support of EIPs: Introducing EIP principles in Vietnam through Decree 82

- The environmental technical guideline on EIPs developed under the MPI-the World Bank Group partnership is expected to be available by the end of 2018
- Numerous capacity-building and awareness-raising events for EIP authorities and the private sector were organized in provinces and in Hanoi.

#### Applied tools (not all-inclusive):

- International good practice examples of EIPs: 30 international experts from Austria, China, France, India, South Korea, Switzerland, the United Kingdom, and the United States of America, as well as leading international organizations, shared their EIP experience with 110 national Vietnamese experts from policy making agencies, academic organizations and provincial authorities. The meeting included 23 presentations and was divided into five sessions with 12 discussion groups.
- Following the expert group meeting, bilateral meetings were conducted to ascertain the status quo. Participants also discussed international policy examples in terms of EIP planning.
- Study tours of groups of industrial park practitioners and government representatives were conducted in China and Japan in 2017 and in Austria and Denmark in 2018.
- Pilot academic curricula on EIP were developed and tested.

#### Benefits to date:

Approval by the Prime Minister of Vietnam of the Decree 82 that introduces eco-industrial parks and industrial symbiosis in the Vietnamese legislation. This enactment of the decree resulted from intensive consultations with relevant ministries as some elements, such as the reuse of waste, required a revision of environmental regulations.

*Source: UNIDO (2017)*

## 2.4 Institutional analysis

After conducting policy and regulatory gap assessments, practitioners should also examine whether and where institutional gaps may exist. Examples of institutional gaps include:

- Organizations with a weak mandate and insufficient capacity that are required to manage compliance and encourage and support improvements toward EIP goals, which may lack:
  - Resources (a sufficient number of people with requisite skills and experience, operational and investment funding, tools and equipment, etc.);
  - Appropriate decision-making and operational procedures and processes;
  - Stakeholder communication channels for various reasons, including resources, mandate, etc.;
  - Monitoring and evaluation systems, including indicators and guidelines.

In addition, there may be difficulties pertaining to overall awareness, demand, and motivation across authorities, developers, park managers and resident businesses for continuous improvements in moving toward an EIP.

In general, assessors who conduct regulatory analysis can also manage institutional analysis. Practitioners or external assessors should identify and review international best practices regarding the establishment of the governance system and a national oversight unit (see Step 3.2 of this section). By consulting and conducting light surveys with relevant line ministries and other stakeholder groups, practitioners or external assessors should evaluate the following indicative institutional parameters:

- Organization: Evaluate the efficiency of the industrial park management and oversight structure (this can be informed by both stakeholder mapping and regulatory analysis, as conducted in the previous steps).
- Staffing: Assess the staffing capacity and human resource needs in the line ministries / government agencies that are relevant to operationalizing the national EIP framework.

- Authorities and technical capacities: Assess whether existing government agencies or oversight units/organizations are empowered to
  - Coordinate public-private partnerships to promote EIPs across industrial parks and sectors; and
  - Audit, monitor, verify and evaluate the economic, environmental and social performance of industrial parks.

Based on this evaluation, practitioners need to then identify gaps and weaknesses in terms of the suggested parameters, as well as areas for interventions that can close those gaps. High-level steps to conduct institutional analysis are presented in Figure 4.

**Figure 4: How to Conduct Institutional Analysis**



## 2.5 Analysis of financial needs

Regarding EIP financing, it is vital to identify and introduce appropriate financing mechanisms to stimulate industrial players' interest in investing in EIP development. Their participation is key in mobilizing sufficient financial resources toward the implementation of EIP projects. Practitioners should also review existing and new financing tools that can support EIP projects to determine the most suitable alternatives. A substantial amount of financial resources is required to implement various activities during the initial phases of EIP development, including a park-level diagnostic, feasibility assessments, piloting EIPs with various EIP technologies, and awareness-raising and capacity-building initiatives. Furthermore, EIP programs could require substantial investment to implement the actions related to resource efficiency indicators.

Typically, the line ministries empowered to develop a national EIP framework, such as the Ministry of Industry or the Ministry of Planning and Investment, would be responsible for identifying appropriate financial schemes. Fund allocation to support an EIP program requires a strategic approach to funding sources. Potential financing mechanisms for EIP development can be broadly classified into three categories: the public-private partnership (PPP) model, fiscal-incentive-driven financing, and market-based financing (Table 7).

**Table 7: Typical Financing Mechanisms used for Promoting EIPs**

Types of financing	Description
<b>Public-Private Partnership (PPP)</b>	Joint financing of long-term investments in green infrastructure (for example, street-lighting and solar rooftop panel installation within the parks, and industrial symbiosis network projects).
<b>Fiscal-incentive-driven financing</b>	Preferential tariff for renewable energy technologies, and technologies that reduce material and water use.
	Capital subsidy on equipment/goods related to energy efficiency, renewable energy, and material and water use reductions.
	Creation of government funds to promote climate change mitigation and energy conservation investments, and resource efficient and cleaner technologies.
	Performance-based incentives (PBI) that grant access to finance based on the performance achieved in energy savings, GHG emissions, material and water use reductions, and use of by-products.
<b>Market-based financing</b>	Debt financing by banks for energy, materials, water efficiency and renewable energy, and production of secondary material projects categorized as priority sectors. Further debt schemes, such as refinancing or soft loans, can be catalysts to such financing opportunities.
	Equity financing or pooling funds from private equity investors available through energy, material and water efficiency and renewable energy projects, including the installation of a solar photovoltaic energy system.
	Creation of a consortium of investors to invest specifically in energy, materials and water-efficient technologies or renewable energy technologies, as well as those projects and technologies that intervene to improve circularity in supply chains. The members of the consortium may be banks, government bodies, vendors, other financial institutions, energy service companies (ESCOs), and so on.

Sources: Kechichian and Jeong (2016); World Bank (2014); and recommendations provided by GIZ and UNIDO.

## Public-Private Partnerships (PPP model)

A PPP is defined as “a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility and remuneration is linked to performance”.<sup>10</sup> PPP contracts help mobilize additional sources of funding and financing for infrastructure. In the EIP context, the PPP model can be particularly helpful in supporting and facilitating long-term investments in green infrastructure (for example, street-lighting and solar rooftop panel installation within the parks and common facilities, the energy from which can be used to treat waste water, and produce secondary materials from waste within the park and from the locality) and industrial symbiosis network projects. In particular, it can help ensure that risk associated with capital-intensive infrastructure development is shared among public and private sector participants. It can also help practitioners ensure that resident firms are provided with accountable service delivery.

The PPP model is not without risks, however. PPPs often requires an upfront commitment by the private sector to the whole-of-life cost of providing adequate maintenance for the asset over its lifetime. As a result, investment costs, the financing expenses of private companies, and the public guarantee risk ratio can pose challenges to the creation of PPPs.

It is recommended that practitioners benchmark international best practices to apply PPP models strategically. A project that created steam networking in Ulsan, South Korea is an example of a successful PPP model applied to supporting industrial symbiosis network projects (Box 8).

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10 World Bank Group. “Establishing the PPP Framework.” Available from <https://pppknowledge.org/guide/sections/5-establishing-the-ppp-framework>

### Box 8: PPP Industrial Symbiosis Infrastructure Investment in South Korea

As the first successful EIP industrial symbiosis project in Ulsan, the case of steam networking demonstrates the impact of a systematic strategy based on research and development (R&D) and the PPP model.

Steam is produced and supplied by using residual heat from a waste-to-energy incinerator to chemical plants. The process usually entails high energy costs. This project aimed to increase energy efficiency by reducing the burden at the Sungam landfill, while promoting the growth of energy-efficient industries. It did so by increasing the value of incineration heat through steam networking. Specifically, the project involved two steam flows established sequentially between Sungam's two waste-to-energy incineration plants (steam producer) and Hyosung's three factories (steam user) during the 3 phases of the project. Implementing the steam network involved the construction of pipelines connected between the incinerator and the chemical plants approximately 1 kilometer (km) apart, as well as associated infrastructure investment. The infrastructure investment from the public sector benefited companies that could not afford to invest in this project individually.

The Energy Saving Company (ESCO) Fund financed the construction of pipelines and related facilities requiring a total US\$ 5 million in investments. The operator of the incinerator, Halla Energy & Environmental Co., Ltd., took responsibility for providing technical services for the incinerator and steam pipelines, as well as security for the loan. Hyosung could therefore save on costs without making an excessively huge amount of investment, or assume associated economic and technical risks.

As a result, steam sales have generated a total revenue of US\$ 3 million for the Sungam incinerator and its owner, Ulsan Metropolitan city, and this revenue has increased every year. Hyosung saved a total of US\$ 3.7 million in fuel costs by switching from fossil fuels to steam. In addition, it achieved savings associated with the boiler shutdowns. This reduction in fuel can be translated into emission reductions of 45,500t of CO<sub>2</sub> and 427t of sulfur dioxide (SO<sub>2</sub>) per year, which is equivalent to US\$

[box content continued]

275,000 (KICOX 2013). Without the steam networking project, Ulsan City may not have been able to attract the facility which drew in new investments of US\$ 150 million, leading to the creation of 140 jobs.

### Direct revenue and cost savings as a result of the project

Participating entities	Revenue or cost items	Changes between 2006 and 2012	
		(in billion KRW)	(in million US\$ (approximated))
Incinerator (Ulsan City)	Revenue from the sale of medium-pressure steam	6.5	5.78
	Revenue from the sale of high-pressure steam*	0.8	0.71
	<b>Total revenue</b>	<b>7.3</b>	<b>6.49</b>
Chemical plants (Hyosung)	Savings on fuel cost	3.7	3.29
	Savings from the boiler shutdown	0.48	0.43
	<b>Total cost savings</b>	<b>4.18</b>	<b>3.71</b>

\*Note: High-pressure steam has been sold since October 2012. The revenue presented in the table presents 3 months of data.

Source: Figures were adopted from: Park, Joo Young, and Hung-Suck Park. 2014. "Securing a Competitive Advantage through Industrial Symbiosis Development." *Journal of Industrial Ecology* 18, no. 5, p.679.

Source: KICOX (2013), Park and Park (2014)

## Fiscal-incentive-based financing

Fiscal incentives can be used as a supportive tool of a government's national strategy for energy efficiency and/or renewable energy projects. They can also be used as part of a strategy to promote resource efficient and cleaner production (RECP). They are utilized to leverage investments by businesses for their transition to a low-carbon future. A well-known form of fiscal incentive is the performance-based incentive (PBI). PBIs are paid based on the work performed or improvements made in a thematically selected area, such as renewable energy production or the energy-saving performance of industries. For example, for electricity production from solar energy utilization, typically incentives are paid based on the actual energy production of the solar system (dollars per kilowatt hour) over a specific period of time.

A PBI is often used for firm-level RECP projects. In this context, a PBI can lessen the financial burden on firm-level RECP project developers who need to procure new, more energy efficient machinery and equipment, and reduce material and water use. However, to benefit from this type of fiscal incentive, the equipment and production line performance should be measured, and equipment and production line specifications and parameters monitored. In short, they should be tested to prove their energy savings and performance.

Feed-in tariffs<sup>11</sup> for grid-connected renewable energy are another typical type of national-level PBI. Such tariffs can be helpful to financing EIP investments. In Egypt, for example, the government announced its commitment to reform and transform the energy sector through the issuance of a prime ministerial decree. The decree provided a roadmap for electricity tariffs in the country's industries for the next five years, gradually increasing the tariffs and phasing out the subsidies (Kechichian and Jeong 2016).

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11 A feed-in tariff is a policy instrument that is commonly used to stimulate market demand for renewable energy. Under a feed-in tariff scheme, governments set prices often at a premium for different types of renewable power to compensate producers for the higher cost of producing clean energy. Utilities must purchase power from renewable resources at this price. However, they can either spread the additional costs across their entire customer base or receive compensation from the government to recover the incremental costs. Essentially, feed-in tariffs work as subsidies to renewable energy to make it cost competitive relative to fossil fuel-based technologies (Zhang 2013).

## Commercial financing /market-based financing

Commercial financing plays a key role in supporting EIPs. Indeed, EIPs require different financing options for the implementation of EIP indicators (Kechichian and Jeong 2016). As part of raising awareness about climate action and cleaner production, greening industrial production is becoming more important. As such, market based-financing opportunities to support EIPs are gaining in importance. However, they are implemented at sub-optimal levels due to their novelty and perceived high risks.

A number of existing green financial products offer better conditions to support EIPs. These include: targeted credit lines in Egypt<sup>12</sup>; the Swiss State Secretariat for Economic Affairs (SECO) Green Credit Trust Fund in Colombia, Peru and Vietnam<sup>13</sup>; green funds in the United States (Climent and Soriano 2011); green electronic-traded funds (Poterba and Shoven 2002); socially responsible funds (Mallett and Michelson 2010); index funds; mutual funds; seed capital; and vendor financing. They are borrower-friendly and offer a number of benefits, including a sound debt-to-equity ratio, lower interest rates, and longer maturities. Financial support ranges from large-scale projects to micro-credit loans. Likewise, insurance markets (Mills 2009) and pension funds (Della Croce, Kaminker and Stewart 2011) are starting to become active in the market place.

International financial institutions are also pivotal in commercial bank lending for thematic projects. They issue credit lines so that commercial banks offer borrower-friendly terms like those of financing facilities for green projects or SMEs<sup>14</sup> that otherwise would not have access to such terms.

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12 Agence Française de Développement (AFD), France's development agency, awarded €142 million to the National Bank of Egypt to foster industrial clear technology. Kablan (2013).

13 The Green Credit Trust Fund (GCTF) deploys Cleaner Production Centers as technical advisor to firms. <https://vncpc.org/en/project/green-credit-trust-fund-gctf/>

14 SMEs in developing countries face a multitude of financial constraints in the development of industry. These include inadequate availability of working capital, banks insisting on collateral and third-party guarantees, and a risk averse banking system for small projects, and so on. Furthermore, banks generally perceive small projects as being high risk due to non-disclosure by the borrowers, and a lack of reliable information about technology, markets, and investment potential. UNIDO. 2011. UNIDO Green Industry: Policies for supporting Green Industry. Vienna. [https://www.unido.org/sites/default/files/2011-05/web\\_policies\\_green\\_industry\\_0.pdf](https://www.unido.org/sites/default/files/2011-05/web_policies_green_industry_0.pdf).

Financial institutions are essential to the support of greening the industrial sector. Projects that include green technologies or green infrastructure need alternative sources of financing depending on their state of maturity, the borrowing capacity of the client, and the scale of the project. In the initial stages, an appropriate source of funding could be equity, and then debt. As the project evolves, it could be more appropriate to use operational refinancing (such as infrastructure bonds).<sup>15</sup> In terms of uncertainty, venture capital financing could be a better fit for relatively new and un-tested green technologies, whereas project financing could be a better option for tested technologies, such as wind and solar power projects. The creation of a consortium of investors focused on eco-friendly production could leverage private investment by including banks, governments and other stakeholders. Vendor financing could be used in situations in which the project developer has limited borrowing capacity.

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15 For more information, see Kalamova, Kaminker and Johnstone (2011).

## Step 3. Develop a national EIP roadmap

The results of the comprehensive assessment of technical, institutional, regulatory and financial needs, capacities, and gaps should be shaped into a roadmap, including a set of selected actions required to operationalize the national EIP Framework in a country. The roadmap should include the following:

- Details about the EIP performance targets (available from Step 2.2 of Section 1), which will then be incorporated into the regulatory framework in the form of technical standards
- Actions to achieve the established targets such as:
  - regulatory reform (enactment of laws or modification of lower-level legal provisions)
  - institutional reform, including the establishment of governance structures
  - financial mechanisms
- Complementary activities to be conducted as part of each action item
- Responsible stakeholders to conduct the relevant activities
- A timeline
- Estimated costs and benefits associated with each action, including the budget required to complete each.

A template for the national EIP roadmap is outlined in Table 8.

Step 1. Engage stakeholders and secure commitment
Step 2. Diagnostics
Step 3. Develop a national EIP roadmap
Step 4. Launch, monitor and evaluate

**Table 8: The National EIP Roadmap Template**

<b>A. Policy/ Regulatory Reforms</b>		
<b>Category of action</b>	<b>Identified gaps</b>	<b>Activities</b>
Develop proposals for regulatory reforms/ revision of legal provisions.	Potential conflict with existing regulations	
Revise existing legal provisions to help initiate and operationalize the national EIP framework.		
Improve or modify lower-level regulations to reflect EIP performance indicators and target values (this can be done through the piloting of EIPs).	No agreements reached on target values	Conduct additional technical and feasibility assessment (if necessary), including issues related to park management; environmental, social and economic performance; final issuance of technical guidelines; monitoring (6 months to 2 years); and awareness raising and capacity building.
Capacity building and training		Start early in building the capacity of public agencies responsible for setting regulations and monitoring performance.
<b>B. Institutional Reforms</b>		
<b>Category of action</b>	<b>Identified gaps</b>	<b>Activities</b>
Establish management/governance structure.	Absence of coordinating, enforcement and supporting agencies	Hold discussions and decide on roles within the new governance structure.
Provide additional human resources.	Lack of personnel and capacity	
Establish reporting lines.		
Capacity building and training	Lack of capacity to coordinate, enforce and support agencies implementing the national EIP framework	Establish working groups and processes for dealing with changes and adjustments associated with the new governance structures.
<b>C. Financial mechanisms</b>		
<b>Category of action</b>	<b>Identified gaps</b>	<b>Activities</b>
Set the type and scale of incentives required.	Lack of financial support	

<b>Responsible stakeholders</b>	<b>Potential collaborator</b>	<b>Cost/benefit</b>	<b>Timeline</b>
Line ministers, national assembly, and technical working groups	National and local-level governmental officials and politicians		
<b>Responsible stakeholders</b>	<b>Potential collaborator</b>	<b>Cost/benefit</b>	<b>Timeline</b>
Line ministries and park operators	Park operators and local government	Outlining how much budget is needed to deliver EIP changes in the government by utilizing the full set of operational and management levers	
Line ministries and park operators			
Line ministries and park operators			Identify a realistic timeline for working on the regulatory reforms to be put forward.
<b>Responsible stakeholders</b>	<b>Potential collaborator</b>	<b>Cost/benefit</b>	<b>Timeline</b>

In Table 8:

- *Category of action* refers to the type of actions that are required to implement the National EIP framework, as well as to address gaps identified during Step 2. It includes additional technical and feasibility assessments (if needed), regulatory and institutional reforms, identification of financing mechanisms, dialogue among stakeholders, monitoring, and capacity building and training.
- *Identified gap* refers to the barriers identified in Step 2.
- *Activities* include the list of activities that can help meet performance requirements of the International EIP Framework for that specific topic.
- *Responsible stakeholders* refer to the line ministries or other stakeholders who are either responsible for or have a stake in implementing the action. It needs to include the list of stakeholders who have committed to implementing the action. In the event of a lack of stakeholder commitment, the action plan should also include strategies to ensure the involvement and commitment of key players during the implementation of the framework.
- *Cost/benefit* refers to investments needed to proceed with the implementation of the action and the projection of estimated benefits. It should also highlight the potential beneficiaries of the actions.
- *Timeline* refers to the estimated time required to complete activities.
- *Budget* refers to the budget required to complete each action item.

In some cases, the gap analysis may help practitioners identify a list of actions (policy interventions) that could include major regulatory reform or the rearrangement of the existing institutional setup. However, in most cases, creating an overarchingly new regulation or implementing a major regulatory reform can cause unnecessary conflicts and contradictions among existing regulatory frameworks. A step-by-step approach to create good practice examples and demonstrate benefits to the private sector, politicians, and communities may be a preferred strategy. It would also help to encourage parks and resident firms to go beyond the ‘compliance plus’ at a comfortable pace, and ultimately trigger large-scale reforms.

Each action in the roadmap is subject to an evaluation of resources in terms of personnel and investments, expected returns and timing of completion. Thus, practitioners should take into consideration scarcest available resource, the maximization of benefits, and the timing of implementation when developing actions included in the roadmap. Practitioners are also advised to assist stakeholders in developing and applying criteria that can be used to identify key gaps and prioritize a course of action that can best address those gaps.

### 3.1 Policy and regulatory reform

Regulatory flexibility to adapt industrial and environmental regulations to induce green growth is fundamental to enhance the establishment of EIPs and enable the transformation of the industrial parks into EIPs. Having an appropriate and integrated regulatory framework that reconciles industrial development and green practices plays a key role in supporting the development of EIPs (Sertyseilisik and Sertyseilisik 2016) and helps facilitate successful implementation of the International EIP Framework at the national level. For instance, a regulatory framework that is compatible with EIPs could support industrial symbiosis by modifying waste disposal practices; incentivize resource efficiencies in industrial activities (Moreau et al. 2017); enable an evaluation-prone environment for EIPs (UNIDO 2016), as well as green infrastructure and shared service, within the industrial parks of a new type. Examples of key policy interventions and regulatory action items to support the implementation of the national EIP framework are described in Table 9. Successful examples of regulatory reforms to implement the elements of the EIP Framework are illustrated in Box 9.

**Table 9: Areas for Key Policy Interventions to Support the Implementation of the National EIP Framework (focused on environmental performance indicators)**

Policy framework and typical regulatory action items		
<b>Policy framework governing energy performance</b>	Electricity and other energy regulations	▶ Performance requirements for energy management systems
	Energy efficiency law and associated implementing regulations and governance structures	▶ Performance indicator for energy efficiency intensity
	Minimum energy performance standards	▶ Performance indicator for energy efficiency intensity
	Energy audit	▶ Performance requirements for energy consumption
	Standards and labeling	▶ Performance requirements related to energy efficiency and energy consumption
<b>Policy framework governing environmental performance</b>	National pledges for GHG emission reduction	▶ Performance requirements related to climate change and the natural environment
	National environmental law and associated policies	▶ Performance indicators related to waste and material use, water use and disposal, climate change, and the natural environment
<b>Policy framework governing energy pricing</b>	Energy and resource tariff regulations	▶ Performance requirements for energy, including renewable and clean energy use in the industrial park
	Incentives and budgetary support	▶ Applicable to both environmental and economic performance indicators

Source: Kechichian and Jeong (2016).

<ul style="list-style-type: none"> <li>▶ Overarching legal framework establishes the definition and pricing of energy and guides the behaviors of relevant authorities governing and participating in energy transactions.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Provides framework for implementing energy performance standards across the country, including business enterprises within Special Economic Zones (SEZs) and industrial parks.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Generally implemented in conjunction with energy labeling program.</li> <li>▶ Guides or mandates energy consumers to move toward a more energy efficient future.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Represents the basic first step toward energy management.</li> <li>▶ Sets forth energy audit processes.</li> <li>▶ Certifies energy auditors.</li> <li>▶ May mandate periodic energy audits at select or all business enterprises.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Stimulates best practices for improving energy and environmental performance of appliances (for example, lighting, fans, and air conditioning) and industrial equipment (for example, boilers).</li> <li>▶ Extends the overarching energy efficiency.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Represents the minimum emission reduction standards for all business enterprises within the country.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Sets the standards for management and discharge of waste, water, and other effluents from business enterprises.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Sets the tariff computation mechanism for energy and other resource transactions.</li> <li>▶ Allocates subsidies to select resources.</li> <li>▶ Introduces incentive mechanisms, such as feed-in tariffs for renewable energy.</li> </ul>
<ul style="list-style-type: none"> <li>▶ Allocates capital subsidies or grants toward “promoted” industries, or initiatives to improve competitiveness and overcome market failures.</li> </ul>

### Box 9: Examples of Regulatory Reforms to Implement EIPs in Bangladesh and Vietnam

In Bangladesh, the World Bank Group's pilot study to transform the Chittagong Export Processing Zone (EPZ) into a Low Carbon Zone triggered a move toward national policy reform. During the study, cogeneration of steam and electricity was identified as one of the most promising technical interventions to reducing GHG emissions within the zone.

The initiative involved the generation of steam from the waste gas of the power generation unit, and then supplying it to other enterprises. However, it was found that neither the EPZ rules and regulations nor Bangladesh's then-energy regulations had legal provisions for commercial transactions involving the buying and selling of steam between two companies.

After detailed consultation with the zone enterprises, the Bangladesh Export processing Zones Authority (BEPZA) approached the Bangladesh Energy Regulatory Commission and the Ministry of Power to develop a regulatory framework that could provide incentives to scale up industrial cogeneration at the national level. BEPZA also developed an Environmental Management System (EMS) to improve the environmental performance of the enterprises in its eight EPZs. In addition, it created a Green Cell (GC), an executive body that is authorized to plan, implement and evaluate environmentally sustainable practices in the EPZs and oversee the EMS counselors. This effort to close the institutional gap enabled BEPZA to embrace the broader environmental dimensions of the International EIP Framework, including energy efficiency, GHG mitigation, and waste and water management.

In Vietnam, the World Bank Group and UNIDO recently helped the Ministry of Planning and Investment (MPI) introduce a legal framework to establish an EIP program at the national level through the minimum requirements for EIPs, incentives offered to enterprises in EIPs, and procedures for registration of EIPs. The objective of the regulatory reform is to encourage enterprises in EIPs to cooperate with one another or with third parties for the use of joint service infrastructure, and/or for the exchange of raw materials and other resources such as recycled waste, scrap and excess energy.

*Source: World Bank (2014)*

The design of the regulatory reform should be also accompanied by plans or mechanisms to monitor and evaluate the implementation of the new legal framework for EIPs (see also Step 4 of Section 1). In the case of Vietnam, the MPI would periodically assess the effectiveness of the framework and propose suitable revisions to ensure that any regulatory barriers faced by the EIP program are overcome. The MPI will also need to facilitate the formation of the National Steering Committee, an autonomous committee with representation from multiple ministries and institutions (including bilateral, multilateral and academic institutions), as well as the National EIP Regulatory Authority (NERA), which will be formed as a department within the MPI.

### 3.2 Establish governance structures and coordinating agencies

The planning, implementation, management, and monitoring of the national EIP framework entails cross-sectoral and cross-functional activities. It will also require active communication and coordination among a diverse set of agencies and institutions, both at the national and park levels. This presents a governance and enforcement challenge that needs to be addressed through comprehensive institutional strengthening, development, and reform.

Successful implementation of the national EIP framework will depend on the presence of a strong governance system. Such a governance system will include government departments, ministerial bodies, park developers, operators, and resident firms, as well as business service providers, engineers, consultants, operations and maintenance professionals, equipment suppliers, financiers, academic institutes, and vocational training centers. As such, it is important to establish a dedicated governance structure at an early stage of the implementation process, which could benefit from stakeholder engagement and awareness raising. Importantly, to enhance the efficiency of this structure, it is desirable to have a separate organization or unit, duly authorized, that is dedicated to coordination. The core function of this organization or coordinating unit is to:

- Facilitate and coordinate stakeholder perspectives and interests regarding the implementation of the national EIP framework and/or development of an EIP project;

- Oversee and monitor implementation progress by industrial parks located across the country;
- Manage the planning and budget (for example, R&D, operational, and capacity-building budgets) required for implementing the framework (see Step 2.5 for different types of funding mechanisms and resources that can support an EIP); and
- Evaluate the feasibility studies prepared and submitted by industrial park developers and operators to implement an EIP project within the park.

The coordinating agency can help reconcile top-down and bottom-up (pilot) approaches to implementing the national EIP framework. When identifying EIP opportunities with an intention to scale up, practitioners can take one of three approaches. They can take a top-down approach – in which the national government, local governments, and a group of technical experts assume responsibility. Alternatively, they can adopt a bottom-up approach – in which resident firms suggest their EIP needs to corresponding agencies, or a mixed approach depending on the situation in the country.

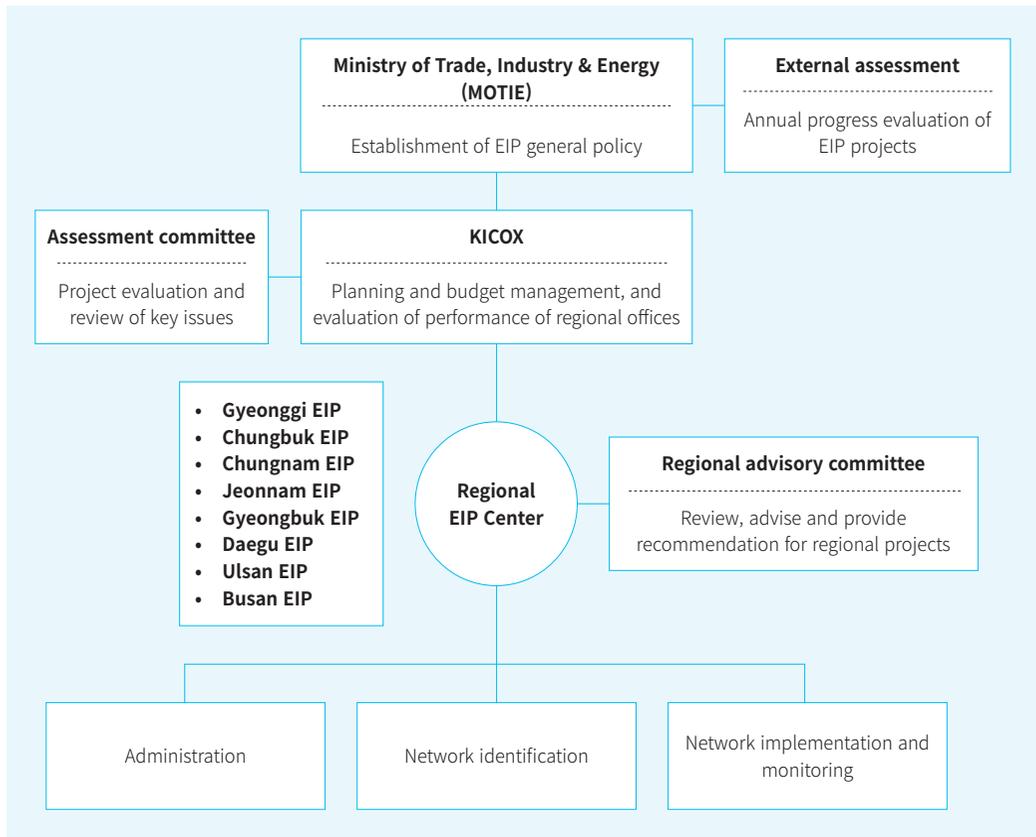
In some cases, in conjunction with establishing the coordinating agency, it may be also useful to establish a number of EIP centers across regions with different industrial parks. The location, distribution and key characteristics of the parks within a country, as well as the political and administrative system of that country, need to be considered in setting up these EIP centers. The key function of the EIP centers is to help identify EIP opportunities, and evaluate their alignment with the national EIP framework and feasibility studies submitted by industrial park operators and/or developers.

In South Korea, regional EIP centers played key roles in identifying opportunities for the industrial symbiosis network. They sought information on the waste and by-products generated from an industrial park, and identified firms with high linkage opportunities in the demand and supply of EIP resources. A regional EIP operation committee evaluated and screened identified opportunities and held consultations regarding project implementation, using evaluation criteria available in the table below.

Figure 5 shows the governance structure and organizational reform that took place in South Korea after the change of supervisory body from the Korean National Cleaner Production Center to the Korea Industrial Complex Corporation (KICOX). While KICOX plays a supervisory role for the entire process, five regional EIP centers perform administration of the overall project development process, cooperating

with an advisory board. All projects approved for implementation at a regional center are evaluated on a monthly basis by the assessment committee.

**Figure 5: EIP Governance Structure in South Korea**



Source: Park et al. (2016)

### 3.3 Determine financing mechanisms

After analyzing the potential financial arrangements to support the implementation of an EIP program (see Step 2.5 in Section 1), practitioners need to determine financing strategies following the guidelines and examples suggested in this step. Typically, energy efficiency projects and industrial symbiosis are among the most significant and capital-intensive activities related to enhancing sustainability and resource efficiency. In determining financing solutions for energy efficiency projects, practitioners may refer to the *Green Incentives for Climate Competitive Industries: A Practitioner's Handbook*<sup>16</sup> published by the World Bank Group in 2016. It provides a guide to bolstering the adoption of renewable and high-efficiency thermal solutions through taxes on resource use, tax preferences, tariff exemptions for resource-efficient products, grants, vouchers, subsidy reforms, green finance (loans and associated instruments), and trading schemes to lower CO<sub>2</sub> emissions and fossil fuel consumption.

This Handbook will help practitioners understand: (i) why incentives should be used; (ii) the kinds of incentives that are available; (iii) how incentives can be combined; (iv) how to diagnose the resource-efficiency issues and potential for action in the country; (v) what the key considerations are in the selection and design of an incentive; and (vi) which institutional processes are required to support implementation of an incentive. It also sets out the key considerations in designing and implementing an incentive for resource efficiency.

Determining financing mechanisms to support industrial symbiosis projects could be a real challenge because they are usually related to creating a network of firms and are very diversified (see Section 3 for a further description about how to develop and implement an industrial symbiosis network as a strategy to implementing the national EIP framework). While the financing of energy efficiency projects involves mainly single firms as borrowers, financing industrial symbiosis project requires two or more firms or entities to cooperate to achieve a common interest. This intrinsic complexity — mainly related

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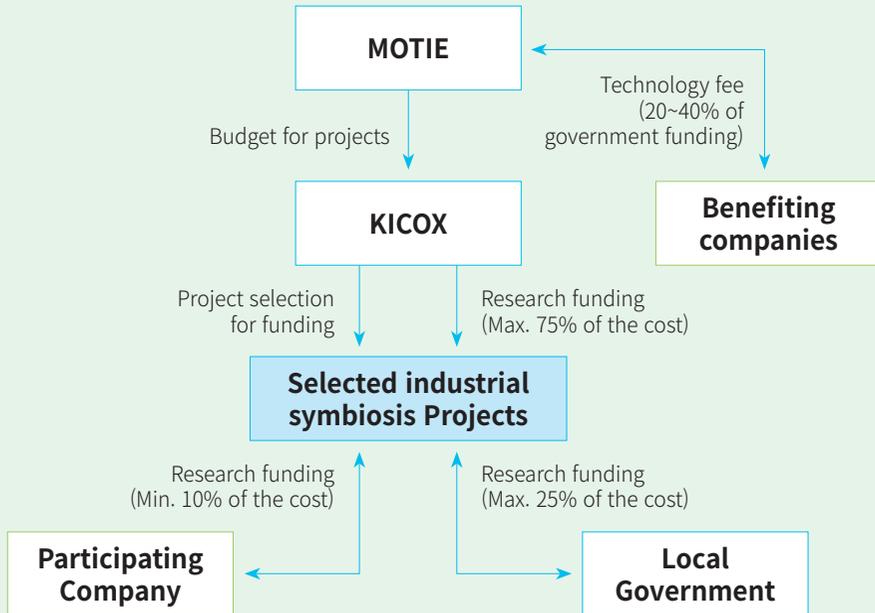
16 World Bank Group. 2016. *Green Incentives for Climate Competitive Industries: A Practitioner's Handbook*. Washington, DC.: World Bank Group. <http://documents.worldbank.org/curated/en/771681470127138842/Green-incentives-for-climate-competitive-industries-a-practitioner-s-handbook>

to the identification of the best integration process and the number of firms involved in the initiation of industrial symbiosis projects — needs to be described in more detail to understand what financing schemes could be applicable. Box 10 provides an example of best practice that helped support the financial development of industrial symbiosis projects in South Korea.

#### **Box 10: South Korea: Support for an Industrial Symbiosis Network**

In South Korea, selected industrial symbiosis project proposals for feasibility research can receive funding for research and development (R&D). Upon a successful approval of the proposals, the Korea Industrial Complex Corporation (KICOX) — the project management agency established under the Ministry of Trade, Industry and Energy (MOTIE) — approaches the regional EIP center to collect the R&D funds required to start the project. The amount of funding supported by KICOX ranges from 33 to 75 percent of the total R&D cost, depending on the assessment results and based on the size of the implementing companies, technological importance and scale of impact. The participating companies (including resident firms) are required to invest a minimum of 10 percent of the total R&D budget. In cases where a particular symbiosis project has a significant local or regional environmental impact, the local government provides funding on an ad-hoc basis to the companies that are unable to bear the higher costs. For small and medium enterprises, the government provides a double proportion of R&D budget to encourage their participation.

[Box content continued]



Source: KICOX EIP website (<http://www.kicox.or.kr/home/mwrc/invSport/procssInfo.jsp>)

After the project implementation is complete, KICOX performs a final evaluation to verify whether the project has actually achieved the economic and environmental benefits anticipated in the proposal. This evaluation determines the amount of technology fees (20-40 percent provided from government funding) to be paid back to MOTIE. In this way, the government funding for R&D of selected projects mitigates the financial risks for companies. At the same time, it avoids undermining motivation and accountability among funding recipients.

Source: GGGI (2017).

## Step 4. Launch, monitor and evaluate

Practitioners need to integrate monitoring and evaluation (M&E) as part of the national EIP framework. Specifically, they need to assess the EIPs in terms of the management, environmental, and social and economic performance indicators that have been developed as part of the International EIP Framework. By improving the design and implementation of M&E schemes, it is possible to curtail the high levels of non-compliance which could hamper the effectiveness of an EIP Program. Moreover, M&E provides benefits for park operators and policy makers to improve the effectiveness of their EIP programs and determine where improvements should be made. Without systematically measuring individual performance indicators, it is difficult to evaluate and improve EIP performance.

Step 1. Engage stakeholders and secure commitment
Step 2. Diagnostics
Step 3. Develop a national EIP roadmap
Step 4. Launch, monitor and evaluate

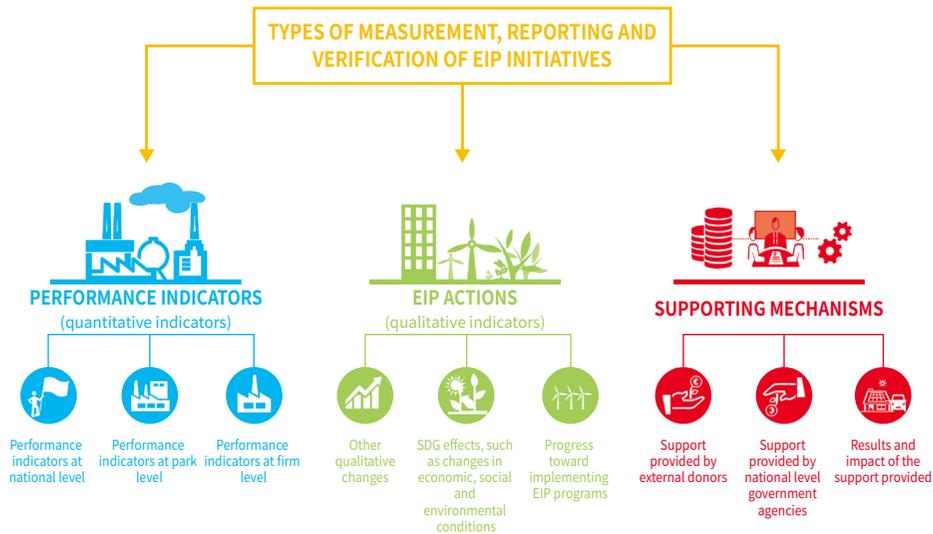
### 4.1 Monitoring, reporting and verification

The practice of M&E incorporates three different processes of measurement: monitoring, reporting and verification (MRV). This includes the following steps and procedures (Figure 6).

- Monitor or measure: Data and information on EIP performance indicators, actions, and supporting mechanisms/programs. This may entail direct physical measurement of the performance indicators utilizing target values and EIP activity data, calculating changes relevant to the improvement of EIP status, and collecting information about supporting mechanisms for industrial parks.
- Report: The report compiles the above information in inventories and other standardized formats, making it accessible to a range of users — and facilitating public disclosure of information.

- **Verify:** Verification helps to ensure accuracy, and relevance with the established procedures. It can also provide meaningful feedback for future improvements. In addition, it periodically verifies the reported information and subjects it to some form of review, analysis or independent assessment to establish completeness and reliability.

**Figure 6: Types of Measurement/Monitoring, Reporting and Verification of EIP Initiatives**



Source: Adapted from the World Resources Institute (“3 Types of Measurement, Reporting, and Verification (MRV)”).<sup>17</sup>

Note: SDG= Sustainable Development Goal.

17 World Resource Institute. “3 Types of Measurement, Reporting, and Verification (MRV).” World Resource Institute website, <https://www.wri.org/resources/charts-graphs/3-types-measurement-reporting-and-verification-mrv>.

Practitioners can also use the following suggested questions to understand which types of MRV are the most relevant and appropriate to be implemented at the national level:

- Why undertake measurement, reporting and verification? Address the purpose and objectives, which are critical aspects in creating ownership of related EIP initiatives at the national level.
- How will measuring, reporting and verifying be performed? Focus on the methodological and technical guidelines and processes involved in MRV.
- When will the MRV be performed? Define the appropriate time frame for undertaking MRV.
- Who will conduct the monitoring, reporting and verification procedures? The entities and individuals responsible for undertaking MRV should be identified.
- How much will it cost to conduct MRV?

The governance structure created in Step 3.2 is crucial to implementing the MRV process. The coordinating agency should have a regulatory mandate to oversee the implementation of the national EIP framework. It should also regularly monitor progress toward EIP performance targets. At the same time, stakeholders (park operators, firms, utility service providers, and so on) need to be mobilized to collect various levels of data and feedback. They should then evaluate and analyze the progress of programs, and decide on a communications and reporting strategy.

By monitoring the progress of policy actions to support an EIP program and verify achievement of performance targets, practitioners can tackle existing barriers that stakeholders may encounter and encourage industrial parks to participate in EIP projects. Furthermore, practitioners may determine indicators to monitor the progress for each intervention action item and performance as described in Step 3 of Section 1. This can be achieved by using the list of monitoring and evaluation indicators/criteria suggested below (Box 11). These criteria can support practitioners in monitoring the progress of national EIP programs. They can also serve as a starting point to determine the reference points for monitoring, such as indicators, baselines, risks, and annual targets — locking them into monitoring information systems.

### Box 11: Suggested List of Monitoring and Evaluation Indicators

- Validity of performance targets set within the national EIP framework
  - Access to relevant data
  - Consistency of data aggregation (timing, source, conversion, and so on)
  - Clear procedure for data collection (who, when, what, where)
  - Clear procedure for calculation of numerical values
- Awareness raising
  - Number of programs/capacity building workshops launched
  - Participation rates of beneficiaries
  - Number of distribution channels used for information
  - Presence of an information-sharing platform
- Institutional and operational capacity (national and local)
  - Number of EIP opportunity cases identified
  - Number of pilot projects implemented to demonstrate feasibility of EIP initiatives
  - Presence of coordination agencies in EIP development
- Opportunity identification and technology R&D
  - Number of patents registered for newly developed EIP-relevant technologies
  - Number of academic papers released

[Box content continued]

- Financing
  - Presence of joint projects in the existing energy efficiency and environmental improvement programs in EIPs or industrial parks
  - Amount of funding for the related feasibility studies to embark on various EIP projects in EIPs or industrial parks
  - Other governmental and external funding support
  
- Regulatory provisions
  - Presence of communications channels that help to improve the efficiency of consultation between public and private sector stakeholders
  - Presence of inter-ministerial committee that helps coordinate actions taken by various government agencies
  - Feedback process after the establishment of a new regulation or improvement of an existing regulation
  - Feedback from national stakeholders on activities (questionnaires)
  - Number of laws/regulations improved and/or created

The fundamental principles of good MRV practice are described in Table 10 in alphabetical order.

**Table 10: Fundamental Principles of Good MRV Practice**

<b>Accurate</b>	<p>MRV reports should be as accurate as the M&amp;E budget will allow:</p> <ul style="list-style-type: none"> <li>▶ MRV costs should normally be low relative to the monetary value of the performance indicators being evaluated.</li> <li>▶ MRV expenditures should be consistent with the financial implications of over-/under-reporting of target value performance.</li> </ul>
<b>Complete</b>	<p>MRV activities should use measurements where applicable to quantify significant effects, while estimating all other effects of performance indicators at the national level.</p>
<b>Conservative</b>	<p>MRV procedures should be designed to underestimate performance indicators, when judgement is made about uncertain quantities.</p>
<b>Consistent</b>	<p>MRV reporting of performance indicators at the national level should be consistent* to avoid inconsistencies arising from lack of consideration of important dimensions, such as:</p> <ul style="list-style-type: none"> <li>▶ Different types of prerequisites and performance indicators</li> <li>▶ Different EIP professionals responsible for performance indicators</li> <li>▶ Different periods of time for the same performance indicators</li> <li>▶ Existing performance indicators and newly added indicators</li> </ul> <p>**‘Consistent’ does not mean identical, since any empirically derived reporting involves judgments.</p>
<b>Relevant</b>	<p>The determination of target values should measure the performance indicators of concern, while other less critical or predictable indicators may be estimated.</p>
<b>Transparent</b>	<p>All MRV activities should be clearly and fully disclosed. In terms of transparency, verification ensures that the reported information is accurate, clear and detailed enough to enable readers to assess both EIP progress and impacts. Full disclosure should entail a presentation of all the elements of an MRV Plan, as well as a performance indicator report (link to the sections).</p>

Source: De Vit and others (2013); and Efficiency Value Organization (2012).

## 4.2 Scale up and mainstream EIP programs

To scale up EIP programs and benefits, practitioners must ensure that the national EIP framework is implemented successfully at the park level, including at the pilot sites.<sup>18</sup> They should also ensure that these best practices are well disseminated and supported. Suggested steps include:

- Identify and select the best EIP practice case and disseminate it.
- Based on the initial results from output monitoring, the best performing industrial parks and their practices in terms of meeting EIP performance indicators can be selected and disseminated to non-complying industrial parks (see Step 4.1 of Section 2 for the guidelines to structure business cases and best practices).
- Various methods can be used for disseminating the best practices, including the awareness-raising methods described in Table 1. Box 12 illustrates one of the best methods of disseminating and scaling up EIPs.
- Modify the national roadmap from Step 3 to include investment in high-priority EIP technologies or infrastructure development (for example, utilize a common laboratory for demonstration of recycling technologies) and training support.
- Help park operators to create innovative management strategies and structures. Policy makers can encourage park operators to develop innovative joint management systems or ventures to motivate firms, which will help facilitate the process of building EIP business cases. Joint management systems for EIPs can incorporate joint green purchases, and joint development and logistics. These can be implemented among and between the firms that participate in the EIPs, as well as with firms located outside the parks (see Step 2.2 of Section 2).
- Communicate continuously with relevant stakeholders (through training, investment forums, technology platforms, and so on). It is critical for practitioners to maintain cooperative relationships through active stakeholder engagement, such as PPDs (see Step 1 of Section 1).

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18 Steps to implement the national EIP framework at the park level are described in detail in Section 2.

### Box 12: The Hub-Spoke Method of Scaling up EIPs

The “Hub-Spoke” method introduced by the Korean government was proven effective in scaling up the transformation of existing national, traditional, and/or urban high-tech industrial parks into EIPs. Using this method, industrial parks were grouped in terms of their location and proximity. From each group, large industrial parks that had high potential were designated as “Hub-EIPs” (9 hubs in total). Then, 3 to 4 industrial parks that met the geographic condition (relatively close to the Hub-EIP) were selected as the “Spoke-EIPs” (37 Spoke EIPs in total). In this way, the Korean government was able to increase connectivity across industrial parks and expand the network of physical exchanges. This was achieved by disseminating knowledge and experience to industrial parks connected to the pilot sites. As a result, 46 industrial parks were transformed into EIPs within 5 years.

*Source: KICOX; Park, Kim and Park (2014).*

## Section 2: Implementing the EIP Framework in industrial parks

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Step 3: Performance audits .....	131
Step 4: Reporting and marketing .....	139



This section provides guidance on how to implement the International EIP Framework at the industrial park level. An overview of the steps involved in the implementation of the EIP Framework for an industrial park is illustrated in Table 11.

**Table 11: Overview of the Step-by-step Process for Implementing an EIP Framework at the Park Level**

Steps	Activities	Responsible entities
<b>1. Develop stakeholder commitment</b>	<ul style="list-style-type: none"> <li>▶ Conduct a preliminary assessment to apply the International EIP Framework</li> <li>▶ Conduct a pre-feasibility assessment and secure the commitment of stakeholders</li> <li>▶ Develop a park-level action plan</li> </ul>	<ul style="list-style-type: none"> <li>▶ Park operators, coordinating agencies, park/firm level representatives, and local governments</li> </ul>
<b>2. Establish an EIP management team</b>	<ul style="list-style-type: none"> <li>▶ Assess the needs for an EIP management team and human resources</li> <li>▶ Roles and responsibilities of the EIP management team</li> <li>▶ Functions of EIP management</li> </ul>	<ul style="list-style-type: none"> <li>▶ Local government, and EIP management team</li> </ul>
<b>3. Performance audits</b>	<ul style="list-style-type: none"> <li>▶ Establish an internal audit system</li> <li>▶ Monitor and evaluate the performance of EIP programs taking place within the park</li> </ul>	<ul style="list-style-type: none"> <li>▶ EIP management team</li> </ul>
<b>4. Reporting and marketing</b>	<ul style="list-style-type: none"> <li>▶ Build business cases</li> </ul>	<ul style="list-style-type: none"> <li>▶ EIP management team in partnership with park- and firm-level representatives</li> </ul>

## Step 1. Develop stakeholder commitment

Developing and securing commitment from resident firms is an important first step in transforming an existing industrial park into an EIP. Other stakeholders such as local government entities, utility service providers, and so on, need to be involved throughout the EIP development process. Involving all stakeholders helps in building trust, developing a common understanding of an EIP, and securing a commitment of the firms about the application of the International EIP Framework or national EIP framework. If a national EIP Framework or roadmap has been developed and become mandatory following implementation of Step 1, it would be important to pursue that framework. If such a framework is absent at the national level, the performance requirements available from the International EIP Framework should be followed.

The first step in the application of the International EIP Framework at the park level is to seek stakeholder commitment. In order to secure stakeholder commitment to develop an EIP, practitioners need to:

### Arrange preliminary meetings

- Clarification of the International EIP Framework or national EIP framework, specific requirements of those frameworks, and on how the Frameworks can be applied at the park level
- Overall idea of scope, potential activities, benefits, roles of stakeholders, and so on.

To obtain an overall idea about the scope of application of the EIP Framework for the industrial park, a preliminary assessment should be conducted. In the

Step 1. Develop stakeholder commitment
Step 2. Establish an EIP management team
Step 3. Performance audits
Step 4. Reporting and marketing

preliminary assessment, the actual situation at the park level is compared with the requirements of the national or International EIP Framework. The prerequisites and data necessary to evaluate performance with respect to indicators are also identified. In addition, a general assembly meeting should be convened with all potential stakeholders to reach agreement on the principles of the EIP Framework and transformation of the existing industrial parks into EIPs.

### Ensure stakeholders' involvement in the process

- Practitioners should arrange meetings to understand whether the application of the EIP Framework is feasible and agreements possible, for example a Memorandum of Understanding (MoU) between stakeholders for the transformation of the industrial park into an EIP. For this purpose, a preliminary assessment should be conducted, followed by a pre-feasibility assessment, which will examine the list of actions and investments required as a result of the preliminary assessment for an EIP program at the park level.

### Engagement in steering processes

- Engage the stakeholder representatives in steering the process of developing an action plan for the implementation of the EIP Framework.
- Regarding general methods for engaging stakeholders, those methods described in Step 1 of Section 1 should be referenced. Stakeholder engagement can also help to facilitate the data collection process required to set targets and monitor EIP performance indicators at the park level.
- The key technical steps for obtaining stakeholder commitment include:
  - Preliminary assessment
  - Pre-feasibility assessment
  - Steering processes

## 1.1 Conduct a preliminary assessment to apply the International EIP Framework

The national EIP framework, or in its absence, the International EIP Framework, should be used to assess the performance of an industrial park and determine what is needed for the park to be deemed an EIP. See Box 13 for an example of such an assessment conducted in Colombia.

The preliminary assessment helps practitioners obtain a good snapshot of the existing operations and practices within the parks. These, in turn, should be compared with the prerequisites and performance requirements described in the International or national EIP Framework (if available). The preliminary assessment will also provide a preliminary gap analysis of the four main areas (park management, and environmental, social, and economic performance) of the International EIP Framework.

The preliminary assessment is also instrumental for park operators to broadly prioritize their actions, based on their budget and capacity, required for transforming the park into an EIP. This stage starts with comparing current conditions of the industrial park against the prerequisites (as defined in the International EIP Framework). Prerequisites are a set of “Yes/No” questions as specified in the Framework, which can be quickly assessed. Once the comparison with prerequisites is complete, the performance indicators (as defined in the International EIP Framework) need to be checked against the current conditions and operations of the industrial parks. This analysis may require more time when compared to the assessment of prerequisites.

### Box 13: Preliminary Assessment Conducted by UNIDO in Colombia

#### A Comparative Review of Colombia's PIMSA (Industrial Park Malambo) and the International EIP Framework

##### Overview:

In Colombia, UNIDO, the Colombia National Cleaner Production Centre and Dick van Beers Sustainability Engineering are working with park management of the Industrial Park of Malambo (PIMSA). This industrial park is situated in the rapidly developing urban metropolitan area of Barranquilla, and is strongly committed to the vision of transitioning itself into an eco-industrial park. In 2018, UNIDO started a comparative review of PIMSA and the International EIP Framework.

##### Important considerations:



- Park management has a clear vision and commitment to implement EIP projects and initiatives with a dedicated team of approximately 50 employees.
- PIMSA's ideal location makes it an attractive investment and relocation area for residents.
- UNIDO developed a tool to support the assessment of industrial parks according to the International EIP Framework, including the identification, prioritization and monitoring of EIP improvement opportunities.

##### Main results:

The review demonstrated that PIMSA performs and compares favorably against large parts of the benchmarks in the International EIP Framework. In summary, about 80 percent of the applicable international benchmarks are fully or partly met by PIMSA. Only 6 benchmarks are not met by PIMSA, and 3 benchmarks are not applicable to PIMSA. The performance against 3 other benchmarks needs to be confirmed through additional data validation.

[Box content continued]

**A Comparative Review of Colombia's PIMSA (Industrial Park Malambo) and the International EIP Framework**

**Selected Results (1 per category) of the Assessment against the International Framework for EIPs (work in progress)**

International EIP Framework (UNIDO, World Bank, GIZ, 2017)			Step 1. Assessment of industrial park		
Topic	Sub-topic	EIP prerequisites and performance indicators (including target values)	Does the park meet the EIP benchmark?	Notes and evidence on current performance of industrial park	EIP opportunity / initiative for industrial park
<b>Park management performance</b>					
Park management services	Park management empowerment	100% of firms in the industrial park have signed a residency contract/ park charter/code of conduct.	Yes	100% of the tenants signed a residency contract. The code of conduct is currently being updated.	Finalize the updating of the PIMSA Code of Conduct with resident companies.
<b>Environmental performance</b>					
Water	Water efficiency, reuse and recycling	At least 50% of total industrial wastewater from firms in the park are reused responsibly within or outside of the industrial park.	No	To our knowledge, only one tenant reuses treated wastewater for irrigation.	Evaluate available sources and possible utilization of wastewater treated in PIMSA.

[Box content continued]

### A Comparative Review of Colombia's PIMSA (Industrial Park Malambo) and the International EIP Framework

#### Social Performance

Social infrastructure	Primary social infrastructure	At least 80% of the surveyed employees' report satisfaction with social infrastructure.	Likely yes	No survey yet, but PIMSA tries to stay ahead with pro-active services.	Prepare and distribute questionnaires to employees.
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#### Economic Performance

Employment generation	Type of employment	Park operator has plans to generate specific numbers and types of jobs in line with government targets.	Not applicable	The targets developed by the government are not applicable to PIMSA.	Not applicable
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#### Next steps (opportunities for improvement):

Based on the review of PIMSA against the International EIP Framework, a set of EIP opportunities was identified covering park management as well as environmental, social and economic performance. In collaboration with PIMSA, 8 EIP opportunities were prioritized based on their likely achievability, potential benefits and expressed interest from park management and companies.

Source: UNIDO (2018).

Steps involved in undertaking the preliminary assessment of the industrial parks are as follows:

- **Walk-through visits:** To determine the current status of performance requirements, a walk-through visit should be conducted at the outset. Preliminary observations of the current status of and existing practices within the park must be compared to the performance requirements (prerequisites) described in the International EIP Framework (See Tool 1.3 for the checklist that can be used during the walk-through visits).
- **Data/information collection:** Available data/information relevant to the performance indicators specified for the four principal areas (park management, and environmental, social, and economic performance) and national regulatory compliance requirements (according to the International EIP Framework) should be collected. Reconnaissance surveys should be conducted to verify the baseline situation and identify missing data/information. If needed, fresh surveys should be conducted to collect additional data/information.
- **Review the performance:** Using the data/information and observations collected from the field visits, the performance of infrastructure and services should be reviewed against the specified performance indicators and their targets. The findings of the analysis should inform the gaps to be bridged to transform the industrial park into an EIP.
- **Identification of potential measures/actions:** Where performance targets cannot be met, the potential measures to be implemented (for example, new infrastructure, services, management structures, and so on) should be identified. The potential investments and sources needed for implementation of the identified measures should be listed, and a preliminary indicative cost-benefit analysis should be undertaken. Suggestions to fulfill the gaps should be realistic in terms of time, budget, and capacity.
- **Stakeholder consultation:** The findings and preliminary measures/actions should be discussed with representatives of the key stakeholder groups. The outcomes of these consultations should be:
  - An agreement among stakeholders to embark on an EIP program, as well as an in-principle commitment by the stakeholders in taking responsibility for their roles in the EIP program.
  - In-principle agreements regarding the identified measures/actions.
  - Providing resources (funds and/or personnel) for the execution of a pre-feasibility assessment

(technical staff from park operators or firms, or funding for commissioning consulting firms) for the identified preliminary measures/actions.

- Agreement of the timeline for the execution of the pre-feasibility assessment of the identified measures/actions.
- Timeline/schedule for the next general assembly to decide on the plans to implement the EIP Framework at the park level, including the need for (re-)organization of the park operating body or the establishment of the EIP management team if needed (see Step 2 of Section 2), and the securing of the stakeholders' final commitment.

## 1.2 Conduct a pre-feasibility assessment and secure the commitment of stakeholders

A pre-feasibility assessment is required to fully investigate the EIP opportunities identified during the pre-assessment stage, and then build on them to fulfill the rest of the EIP performance requirements in a systematic manner. It provides a structured analysis of the four potential intervention areas — park management, and environmental, social, and economic performance — that require a more structured analysis to evaluate the following aspects:

- Stakeholder mapping and assessment
- Forms of collaboration among stakeholders
- Estimation (+/- 30 percent) of the investments (in terms of potential interventions) required to implement an EIP program
- Potential benefits for stakeholders expected from the implementation of the interventions.

A pre-feasibility assessment also helps to identify actions required to implement an EIP program at the park level, focusing on the costs and benefits associated with stakeholder involvement and investment. This kind of Assessment should be conducted by qualified professional services provided by park operators, firms or third parties (consulting firms). The pre-feasibility assessment should identify action

items in a timely way so that the park operator can prioritize actions and earmark the required budget to proceed with a feasibility stage. The park operator will also be responsible for securing the required financing from various sources to realize the EIP interventions.

Park operators empowered by the general assembly of stakeholders should coordinate steps related to the implementation of the pre-feasibility assessment, including:

- Establish a team (personnel from the park operator, resident firms and eventually consultants) to lead the process based on the gap analysis that emerged from the pre-assessment.
- Design various activities to engage all relevant stakeholders. For instance, cooperation of resident firms within the parks is essential to embark on various EIP projects, such as enhancing resource efficiency or creating industrial symbiosis networks within and across the parks.
- Evaluate mid-term progress and final reports prepared by the team performing the pre-feasibility assessment to periodically inform stakeholders about the status of the project.
- Call the general assembly or have workshops with the stakeholders to share findings and secure their final commitment to implementing the EIP program.

The pre-feasibility assessments should primarily include the following four aspects:

- **Assessment of compliance with prerequisites:** The ‘prerequisites’, as defined in the International EIP Framework or the national EIP framework, should be assessed. Any non-compliant aspects should be listed as well. Also, the regulatory compliance aspects with the existing statutory requirements that are applicable to the industrial parks should be assessed. Compliance with regulatory requirements is essential in any case.
- **Performance assessment:** A performance assessment aims to determine compliance with the performance requirements defined in either the International EIP Framework or the national EIP framework/roadmap developed in Section 1. The non-compliant aspects or poor-performing aspects should also be listed. The assessment of performance should include a review the four key components of the performance requirements of the International (or national, if available)

EIP Framework (including park management, and social, environmental, and economic performance). Some assessments are qualitative, whereas outputs related to environmental and economic performance can be quantified and assessed, such as the amount of energy or resource intensity needed to create the unit economic value. However, these combined outputs should be carefully selected reflecting the data availability and the cost of data acquisition (refer to Tool 2.4 for further details).

- **Gap analysis and need assessment:** Based on the assessment of compliance with pre-requisites and performance targets, gap analysis should be undertaken, and corrective measures planned accordingly (see Tool. 2.4).
- **Action plan:** A plan is needed for the implementation of identified measures from the gap analysis and needs assessment (see also Step 2 of Section 1).

Once the pre-feasibility assessment has been concluded, park operators should analyze the findings noted in a pre-feasibility report, and then share them with key stakeholders by arranging a final general assembly. The contents of the pre-feasibility report should include the following:

- **Stakeholder commitment:** Stakeholder commitment to the transformation of the industrial park into an EIP; processes to be followed including the setting up of a steering group, ensuring stakeholder engagement, and so on.
- **Preliminary assessment** that helps apply either the International EIP Framework or the national EIP framework developed in Section 1.
- **Pre-feasibility assessment** that helps to identify actions required to implement an EIP program at the park level, focusing on the costs and benefits associated with stakeholder involvement and investment.
- **Need for additional infrastructures, services, and so on:** List of infrastructure, services and the like to fill the identified gaps in the park for transforming it into an EIP, considering benchmarks from the EIP Framework. For example, include the opportunities for energy/carbon, water, industrial symbiosis, waste, social infrastructure, park management improvement, and collective infrastructure/services options, and so on.

- **General technical descriptions of the infrastructure, services, as well as other measures** needed.
- **Financial aspects:** Estimation (+/- 30 percent) of the costs and investments (in terms of potential interventions) required to implement the identified infrastructure, services, operation and management aspects, cost benefit analysis, and other measures.
- **Service delivery:** Service delivery mechanisms, sources of funding, funds for operations and management aspects, including income from charging for services, and so on.
- **Action plan** with list of actions required, responsible persons/organizations, results/milestones and timelines, including the establishment of a management unit for overseeing the implementation of the Action plan (see Step 1.3 of Section 2).



### 1.3 Develop a park-level action plan

For the transformation of the existing industrial park into an EIP, the next step after the identification of gaps and needs is to develop an action plan for implementation. The park-level action plan should include:

- Actions/measures to meet the EIP pre-requisites
- Actions/measures to meet the EIP performance targets
- Other actions/measures needed
- Milestones/results
- Cost estimates
- Sources of funding
- Stakeholder roles
- Timelines

Based on the findings from the pre-feasibility assessment, park operators should provide an action plan. The plan should be presented at the general assembly for consensus and commitment among shareholders. The action plan should include the list of main activities that the park operator, park tenants and other stakeholders are obliged to implement to ensure that the EIP performance requirements (both the prerequisites and performance targets) are met. The action plan should include the following information (Table 12 to meet EIP performance prerequisites, and Table 13 to meet EIP performance indicators):

**Table 12: Park-level Action Plan Template to Meet EIP Performance Prerequisites**

Topic	Prerequisite requirement	Meets the requirement? (Y/N)	If No, elaborate	Required action	Result/milestone	Cost estimate	Available resources
<b>Park management</b>							
...							
<b>Environmental performance</b>							
...							
<b>Social performance</b>							
...							
<b>Economic performance</b>							

- *Topic* in the table refers to the list of prerequisite indicators from either the International EIP Framework or the national EIP Framework (if available).
- *Requirements* refer to the requirements for meeting the target (yes / no) for each prerequisite and performance target for each indicator, as detailed in either the International EIP Framework or the national EIP Framework, if available.
- *Required action* refers to the list of mandatory activities required to fulfill the performance requirements, including the prerequisites and performance targets.
- *Result/milestone* refers to the final results and/or interim milestones.
- *Cost estimates* refer to investments required to proceed with the action and its potential financial coverage.
- *Available resources* refer to the financial and human resources available for implementation of the required actions.
- *Responsibility* refers to the stakeholders who will implement the measures.
- *Timeline* refers to the estimated start and end dates for a given activity.

**Table 13: Park-level Action Plan to Meet EIP Performance Targets associated with Indicators**

Topic	Performance indicator requirement	Meets the requirement? (Y/N)	If No, elaborate	Target values	Required action	Result/milestone	Cost estimate	Available resources
<b>Park management</b>								
...								
<b>Environmental performance</b>								
...								
<b>Social performance</b>								
...								
<b>Economic performance</b>								

The items for this template are identical to the previous one for prerequisites, except for an additional category on target values.

In the event there is no national EIP framework, target values should be first derived in approximation from the targets available in the International EIP Framework. Specifically, practitioners need to set target values based on consultations with the parties who will be financing the actions (for example, park tenants, local and/or national agencies, and others). When setting the target values, practitioners also need to take into consideration the following information:

- The findings of the prefeasibility assessment, considering:
  - The current national norms and regulations on the related topics;
  - Costs associated with setting target values that are higher or stricter than current norms and national regulations; and

- Costs associated with the implementation of the EIP program based on target values available from the International EIP Framework.
- A sensitivity analysis of:
  - Costs and benefits (that is, uncertainty associated with the range of costs and benefits) of setting the target values higher than national standards (if there are any national standards); and
  - Costs and benefits of setting the target values at the reference values available in the International EIP Framework.

The range of target values for the performance indicators and the related costs and benefits associated with implementing actions to meet these target values must be included in the document and submitted to the general assembly.

In the event there is no national EIP Framework, practitioners need to conduct an internal audit. An internal auditing committee within the park operators would then need to be established. The internal auditing committee helps practitioners periodically monitor the progress of the implementation of steps recommended in this Handbook, thereby creating a continuous improvement cycle (see Step 3 of Section 2).

The park operator should establish a steering group to oversee the pre-feasibility assessment. The group should consist of representatives from various stakeholders, including the following:

- Park operator
- Industries representing large-, medium-, small-scale businesses
- Industrial associations in the industrial area if they exist within the park
- Owner of the industrial park (if different from the operator)
- Existing infrastructure and service companies operating in the park
- Others, as may be relevant

The steering group is required for:

- Process management, including stakeholder engagement;
- Consult with stakeholders and experts undertaking a pre-feasibility assessment and decision making;
- Ensure the efficiency, effectiveness and quality of the pre-feasibility assessment by monitoring progress;
- Catalyze strategic decisions;
- Enhance cooperation among the stakeholders for the successful completion of the pre-feasibility Assessment; and
- Call the general assembly with the main stakeholders to share the findings and obtain final commitment on the EIP program.

Once the pre-feasibility assessment has been concluded, the park operator and the steering group should analyze the findings and share them with the main stakeholders by arranging for a final general assembly. The purpose of the final general assembly is to create consensus among stakeholders and formalize their commitment in the implementation of the EIP program based on the results of the pre-feasibility assessment. The commitment could be in the form of a signed (MoU) between the park operator and the representatives of the stakeholder groups (for example, an industrial or business association representing a group of private sector entities within the park) (see Tool 2.1 for the MoU template). The form should include:

- Implementation details for the action plan
- Investments and fundraising associated with the implementation of the EIP program, taking into account of the benefits in terms of cost savings, marketing and competitiveness.
- Involvement of the stakeholders (including government representatives to create background for the initiation of a national framework piloted by the park initiative).
- Establishment of an EIP management team to implement the EIP Framework (see Step 2 of Section 2)

## Step 2: Establish an EIP management team

As defined and emphasized in the International EIP Framework, each industrial park is required to have a well-defined park operator. The park operator of an industrial park plays a pivotal role in the daily operations of the industrial park property, ensuring the continuous implementation of an EIP framework, and engaging with the park's stakeholders, including resident firms, communities, and regulating bodies. The overarching aim of the performance requirements for park management is to ensure that there is a distinct and empowered park operator. The park operator then manages a range of issues required to develop and operate an industrial park in a sustainable manner, attract investments, and provide socially acceptable and attractive working conditions.

Step 1. Develop stakeholder commitment
Step 2. Establish an EIP management team
Step 3. Performance audits
Step 4. Reporting and marketing

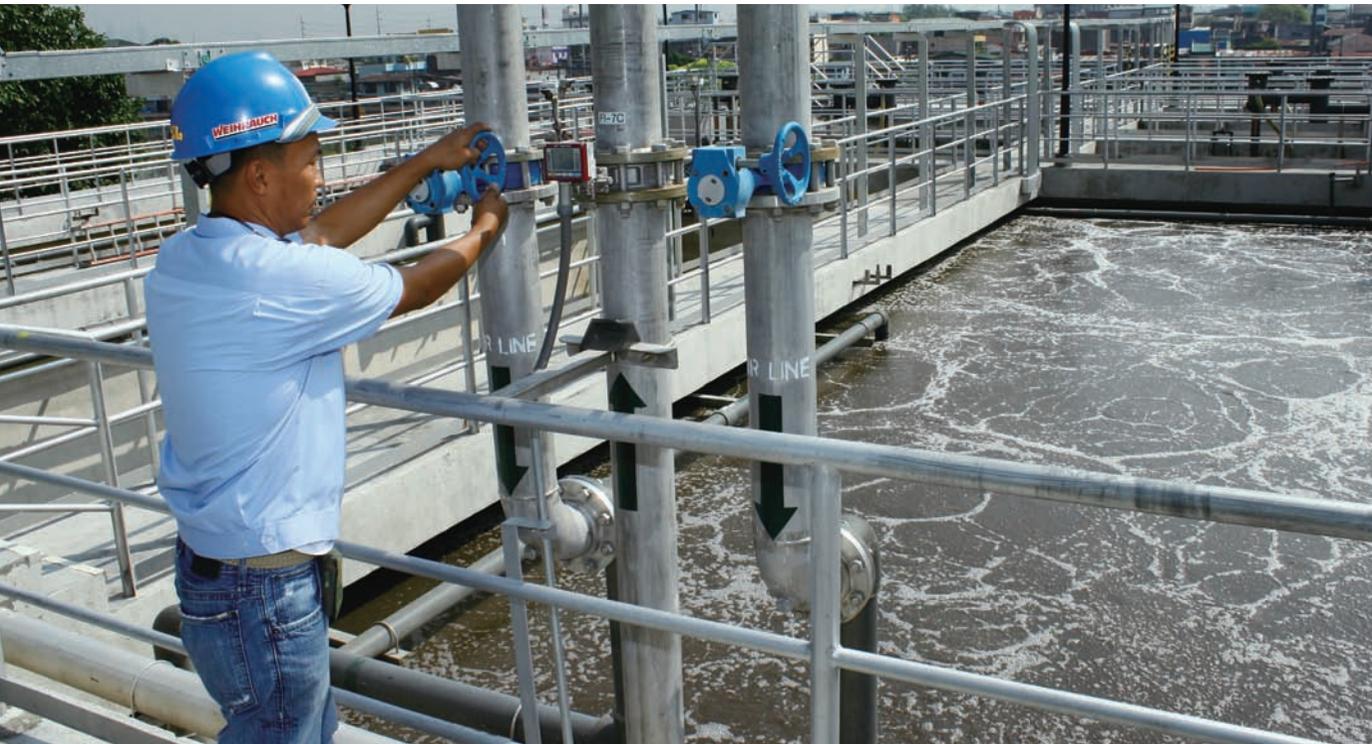
### 2.1 Assess the needs for the EIP management team and human resources

It is recommended that the park operators assign their available technical staff, if they have the required qualifications and are of the requisite number, or hire full-time qualified personnel, to fulfill EIP tasks described in the previous sections. The main work to be done prior to establishing an EIP management team/department within existing park operators is as follows:

- Assessment of specific management needs
- Identification of human resource needs
- Development of a financial concept

### Assess specific management needs

First, the park operator must clarify what kind of new or additional skills, experiences, rules and organizational structures are needed to operationalize the International/ national EIP Framework. It must also identify ways to strengthen its existing functions related to EIP management. If the park operating entity is being established for the first time, it is advisable to identify tasks related to operationalizing the International/ national EIP Framework. According to these identified tasks, the human resource requirements can be defined in terms of qualifications and number of the personnel needed by park operators to oversee the implementation of the EIP Framework within an industrial park. While assessing the specific management needs, the following questions should be posed; answers will then be subject to a detailed analysis.



### Box 14: Sample Questions for Assessing Management Needs

- What are the specific needs and expectations of potential investors and other stakeholders in the industrial park?
- Which services would the tenant firms pay money to the management for and how much?
- What will be the specific added value for companies and communities once the EIP Framework is operationalized?
- Which existing authority / administrative units are responsible for overseeing EIP transformation or implementation of the International/national EIP Framework?
- Which laws and regulations are applicable? These could include local ordinances regarding the four areas of the EIP program (park management, and environmental, social, and economic performance).
- How shall property and possessions — in particular, for real estate, infrastructure and buildings — be organized and what other contractual conditions shall apply?
- Which construction laws have to be applied and what is their content?
- What are the existing decision-making structures and processes for a specific economic zone (SEZ)/area/industrial park?
- Which solutions or methods are used in the waste sector (liquid waste, solid waste, toxic waste, illegal or informal waste disposal)?
- How efficient is environmental and emission surveillance work?
- Which social and work safety standards have to be applied? Are there any participative procedures for any particular aspects? Are the standards respected and controlled?
- What is the economic value proposition of the industrial park to resident firms? Which relevant services are already offered by the park operator and at what price / quality?
- What are the most pressing environmental, social, and economic performance and park management problems to be solved?

## Identify human resource needs

The park operators should explore the needs for human capacity to implement a program to transform an industrial park into an EIP, or to plan a greenfield industrial park with the intention of becoming an EIP. Park operators should understand their existing human resources and skills, as well as those that may be required to fill the gaps identified in the four areas throughout the pre-feasibility assessment. The required numbers, profiles and qualifications of professionals to fulfill these tasks should be analyzed. Although a lot depends on the identified specifications and gaps of the industrial park and the attendant framework, usually a park needs a mix of very different professionals, such as:

- Park executive and deputy(ies) competent in business management, energy and environmental management areas;
- A marketing and communications manager to attract new investors in the park, in case of available capacity or park expansions;
- Engineers and technicians with ample knowledge and experience in maintaining the technical services and infrastructure in the park;
- Dedicated staff to support overseeing the implementation of a program to transform the park into an EIP; operationalize the national EIP framework if available; facilitate public/private/institutional collaboration within and across the park and sectors within and outside the park (for example, for industrial symbiosis networking); facilitate stakeholder engagement; and monitor and report on achievements;
- Finance manager and accountant arranging financing for the required investments.
- Staff to collect and maintain data and records for the reporting period.

According to the specific management needs, different or additional profiles might be relevant. The principle of gender equality — especially during the staff selection process — should be applied to address social performance indicators and targets by creating equal employment and capacity-building opportunities.

## Develop a financial concept

It is advised that the park operator create revenue sources at the outset to meet its financial needs for operationalizing the EIP framework. Three main sources of finance may become available at industrial parks: selling / leasing land and buildings, service fees and fees to retrofit buildings, and facilities to improve resource efficiency.

The financial resources should help to ensure that the park operator will conduct capacity-building activities, remit salary payments to employees, and launch prospective promotional activities.

## 2.2 Roles and responsibilities of the EIP management team

In order to successfully operationalize the EIP framework at the park level, conventional or existing roles of industrial park management should be modified to include the following new roles:

- Roles guided by new management principles
- Promote networking, including stakeholder management
- Act as service provider and advisor on environmental sustainability and social responsibility issues, as empowered by tenants in their residency contract
- Act as a monitoring body
- Facilitate security and disaster preparedness

The EIP management team or department established within the park operating body should ensure that points listed below are integrated into their management system:

- Legally binding arrangements that empower the park operator to perform its responsibilities.
- The EIP management team/ department needs to be endowed with clear mandates and should be in a position to define compulsory by-laws inside the industrial park to implement sustainability measures.

- Clear responsibilities for park management regarding the environmental, social and economic performance of the park should be defined.
- All tenants should sign a residency contract/park charter/code of conduct that also defines additional obligations by tenants that an EIP requires beyond compliance with prevailing rules and regulations.
- Associated governmental authorities and institutions (for example, government departments responsible for environmental and social aspects) should provide a clear mandate to the park operator to establish a well-functioning monitoring system. This mandate will be necessary if there is a national EIP Framework established and operationalized, and the park is to be recognized as an EIP.
- The park operator should ensure the involvement of all actors, including public sector stakeholders, such as governmental entities, and the industrial park association. The association may include a diverse group of resident firms located in industrial parks within the same region. Their involvement is needed to decide on clear responsibilities.

The comparison of conventional roles and the expected new roles of the park operators are summarized below in Table 14.



**Table 14: Differences between the Conventional and New Roles of Park Operators**

<b>Conventional roles of park operators without an EIP management team</b>
<b>Management principles</b>
<ul style="list-style-type: none"> <li>▶ Park operation is guided by national legislation and general planning experience.</li> <li>▶ No focused / comprehensive management systems related to quality are established at the park level, including, environmental energy, and occupational health management, social infrastructure operations, and so on.</li> </ul>
<b>No networking and stakeholder management</b>
<ul style="list-style-type: none"> <li>▶ No networking promoted within the industrial parks.</li> </ul>
<b>The park operator and its management unit does not act as an advisory body</b>
<ul style="list-style-type: none"> <li>▶ Environmental standards are communicated to resident firms in the industrial park.</li> </ul>
<b>Different service providers</b>
<ul style="list-style-type: none"> <li>▶ Basic infrastructure services are rendered by different service providers.</li> </ul>
<b>No monitoring/surveillance system in place</b>
<ul style="list-style-type: none"> <li>▶ Monitoring and surveillance are executed by authorities only.</li> </ul>
<b>No facilitation of security and disaster preparedness</b>
<ul style="list-style-type: none"> <li>▶ Security is enforced only by local authorities and institutions such as the police.</li> </ul>

## New roles of the park operator supported by its in-house EIP management team

### Management principles

- ▶ The park operator, guided and assisted by the EIP management team/department, operates based on the rules, allotment guidelines and standards of sustainable industrial areas or the EIP.
- ▶ The park operator, assisted by its EIP management team/department, adopts the role of service provider to ensure sustainability.
- ▶ The park operator and its EIP management team/department implement a comprehensive management system including the elements of quality, environmental, energy, and occupational health and safety management.

### Promotion of networking and stakeholder management

- ▶ The park operator, with the support from its EIP management team/department, promotes networking and synergies between resident firms within the industrial park and other stakeholder groups.

### The park operator, assisted by the EIP management team/department, acts as an advisory body

- ▶ Environmental standards to be adopted by the resident firms in the industrial parks are defined, communicated and enforced.
- ▶ Advisory services and training activities required to implement the International/ national EIP Framework are offered.

### The park operator, guided and assisted by the EIP management team or department, acts as a service provider

- ▶ The park operator, guided and assisted by the EIP management team or department, offers basic services and organizes additional services through professional service providers.

### Responsible for monitoring/surveillance

- ▶ A monitoring and enforcement system that verifies the compliance of resident firms with the agreed environmental standards is in place.

### Facilitation of security and disaster preparedness

- ▶ The park operator and the EIP management team/department implement a security and disaster risk management system based on an industrial park security concept, and in line with regional disaster response plans.

## 2.3 Functions of EIP management

Practitioners need to consider the following important mandates and functions when establishing the EIP management team or department in a greenfield EIP, or when transforming an existing industrial park into an EIP:

- Building relationships with resident firms to improve an EIP
- Customer and service orientation
- Incorporating sustainability concepts at all levels
- Stakeholder engagement
- Service provision

### Build relationships with resident firms to improve an EIP

The park operator, guided and assisted by the EIP management team or department, should help design and facilitate the launching of EIP projects. In addition, it should build capacity and share best practices to enable peer-to-peer learning. In establishing an EIP, resident firms need to develop good relationships with one other and solve common problems related to economic, environmental and social performance. Awareness, a common understanding, and acceptance of responsibility form the basis for joint activities. In this respect, the EIP management needs to transform its relationship with resident firms into a partnership.

### Customer and service orientation

In transforming an existing industrial park into an EIP, new management skills are required to meet the increasing demands of the resident firms, as well as the standards set by the park operator and EIP management team. The transformation of an industrial park into an EIP, including the introduction of energy and resource efficiency and other related measures, requires a change in the service delivery mode of the industrial park management. The park operator and EIP management team or department must play a new role, assume new responsibilities and become more customer-oriented and proactive.

They must develop mechanisms to organize joint activities within the industrial park, which will encourage resident firms to cooperate with one other and to engage in joint projects. This demands a market orientation and a new type of stakeholder management, as well as a change of the park operator's attitude regarding park management tasks. It also requires an entrepreneurial approach and business-like behavior.

The park operator and the EIP management team or department should leverage the network to commission and mentor technical input for data collection, and advice on execution of activities. They should provide a platform to collaborate with other EIPs working in this area to maximize cross-learning regarding the available financing for such activities.

### **Incorporate sustainability concepts at all levels**

The implementation of sustainability as the guiding management principle can be achieved by establishing a suitable corporate policy and corporate culture in the EIP management and among resident firms. Sustainability should be integrated into procurement, production and service provision, marketing and sales, human resource management — and particularly with respect to organizational and environmental management. The EIP management team should help improve the environmental, social and economic performance of the industrial park as a whole, as well as for resident firms.

### **Engage stakeholders**

As described in Step 1 of Section 1, the creation, planning and operation of an EIP is based on successful stakeholder involvement from the outset. As a first step, developers and managers / operators of the industrial parks need to identify partners who have stakes in key decisions, including the utilization of the industrial park's services. To avoid conflicts, identified stakeholders need to be effectively engaged throughout the whole processes of developing EIPs (see Figure 3 of Section 1).

Regional or national stakeholders, including local communities living adjacent to EIPs, can promote or hinder the development of EIPs. Hence, the main objective of stakeholder engagement is to influence stakeholders by fostering a positive attitude toward the EIP. The park operator and EIP management team or department should facilitate a stakeholder engagement process. Stakeholders should be involved in developing scenarios and action plans, as well as in collaborating with experts regarding technical input and data for keeping the EIP target values dynamic and open to improvement over the years.

A broad list of possible stakeholders would include:

- State- and national-level institutions for industrial development
- Pollution control boards and other statutory organizations
- Workers' representatives
- Planners, architects, and engineers
- Anchor/first companies to invest in the park and in implementing the park-level EIP actions
- Solid waste management firms/entities
- Women entrepreneur representatives
- Waste water management company and other infrastructure/service firms of the industrial area
- Local academic institutions, civil society representatives, and local communities.

The park operators need to build a trusting relationship with the on-site resident companies. Resident firms are customers who receive EIP services. As such, they need to establish formalized cooperation with networks to achieve energy and resource efficiency, as well as industrial symbiosis. The different processes in which the stakeholders should be associated with are presented in Table 15.

**Table 15: Stakeholder and EIP Management Decision-making Processes**

<b>Steering and decision-making processes</b>	Representatives of key stakeholders should be part of the management board, for example, tenants.
<b>Learning processes</b>	Academics, and experts from other successful industrial areas, should be engaged in learning processes. In this way, stakeholders of the industrial park are familiarized with best practices and successful EIP examples. As such, they can identify the improvement needs for their industrial parks. The learning processes can be organized through workshops, conferences, webinars, field visits, and so on.
<b>Participatory processes</b>	To establish an EIP, resident firms must develop good relationships with one other and jointly solve common problems. Joint activities and voluntary actions should be encouraged so that the parties understand each other and know their respective needs relevant to the EIP.
<b>Auxiliary processes</b>	Technical cooperation agencies, such as GIZ, UNIDO, funding agencies, service provider companies, and so on, can play supportive roles. Hence, their engagement in the processes is important.

### Service provision

A well-functioning park operator organizes all management aspects of the industrial parks, including common infrastructure and services, so that the companies in the park can concentrate on their core business (Table 16). The management's tasks and services can range from a rather minimalistic, basic level provision (maintenance and repairs) to an extensive, sophisticated level of provision (a one-stop-shop, and so on). The park operator, with the support of the EIP management team or department, should continuously improve the park's infrastructure, management systems and services provided to resident firms. This will help to ensure that sustainability and competitiveness remain a priority, providing maximum benefits to service beneficiaries.

**Table 16: Common Types of Infrastructure and Services Facilitated by the Park Operator and EIP Management**

Type of Infrastructure and Services	Examples
<p><b>Basic services</b></p>	<ul style="list-style-type: none"> <li>▶ Property/asset/facility management and landscaping.</li> <li>▶ Transport systems such as roads, rail, buses, pathways, pipelines, conveyors, and so on.</li> <li>▶ Utility supply and distribution, such as supply and distribution of water, power, gas, steam, and cooling fluids.</li> <li>▶ Environmental services, such as waste collection, wastewater treatment and discharge, and rainwater collection and drainage.</li> <li>▶ Lighting and traffic control, and a fire protection system.</li> </ul>
<p><b>Common infrastructure and services</b></p>	<ul style="list-style-type: none"> <li>▶ Joint facilities</li> <li>▶ Central workshops</li> <li>▶ Logistical hub, warehouses, refrigeration services</li> <li>▶ Incubation center</li> <li>▶ Laboratories</li> <li>▶ Environmental monitoring system</li> <li>▶ Meeting rooms, and conference centers</li> <li>▶ Support facilities and services for investors</li> <li>▶ Internet marketing and knowledge exchange platforms</li> </ul>

Table 16 (continued)

<b>Type of Infrastructure and Services</b>	<b>Examples</b>
<b>Social infrastructure and service facilities</b>	<ul style="list-style-type: none"> <li>▶ Canteens, restaurants, hotels, supermarkets, and coffee-shops</li> <li>▶ Bank branches, automatic teller machines (ATMs,) and post offices</li> <li>▶ Training facilities, and technical and vocational schools</li> <li>▶ Housing and recreation areas</li> <li>▶ Daycare centers, medical services, and primary health care centers</li> </ul>
<b>Security, emergency services and disaster management</b>	<ul style="list-style-type: none"> <li>▶ Gate service – entry/exit controls</li> <li>▶ Fencing, and flood protection measures</li> <li>▶ Monitoring (closed caption television [CCTV] cameras, and so on)</li> <li>▶ Ambulances, and poly clinics</li> <li>▶ Fire brigade, and emergency planning and response</li> </ul>
<b>Fostering networking among resident firms</b>	<ul style="list-style-type: none"> <li>▶ Promotion of circular economy and resource and energy efficiency</li> <li>▶ Promotion of inter-industry linkages</li> <li>▶ Promotion of networks for industrial symbiosis</li> </ul>

To a large extent, the attractiveness of an EIP is manifested by the services it offers to its tenants. The EIP management should exert direct influence to ensure the availability, reliability and quality of services to the satisfaction of its resident companies.

The industrial parks today have different forms of management structure. Some are tenant-run, whereas others are managed by professional management companies, public entities, or through private-public partnerships. EIPs have similarly diverse structures, as described in Box 15.

### Box 15: Industrial Park Management Models

#### **Associative management model:**

In this model, EIP resident companies organize themselves into an association with the mandate to manage usually one, but sometimes several industrial parks, when companies have operations in several parks. In this model, there is no distinction between park ownership, leadership and management and little or no intervention from government.

#### **Government management model:**

The government ensures the management of the EIP through a dedicated team assigned from a designated national, regional or municipal authority (for example, an industry ministry). This model is often used for special economic zones requiring high government investment. It is possible to have a government-managed EIP model whereby the park operation may be contracted to one or more private operators (see EIP private management model).

#### **Mixed public-private management model:**

This model refers to a government-managed EIP where assistance from a private contractor is required. This partnership can be permanent (for example, a government liaison officer is a permanent staff member, while the private company provides the other park management positions) or temporary (for example, as part of a capacity-building process until the government can perform all park management functions). A non-governmental organization (NGO), association or foundation can also be created by a mix of resident companies and local authorities to manage the EIP by facilitating a cooperative approach to service provision, shared between a city and private sector.

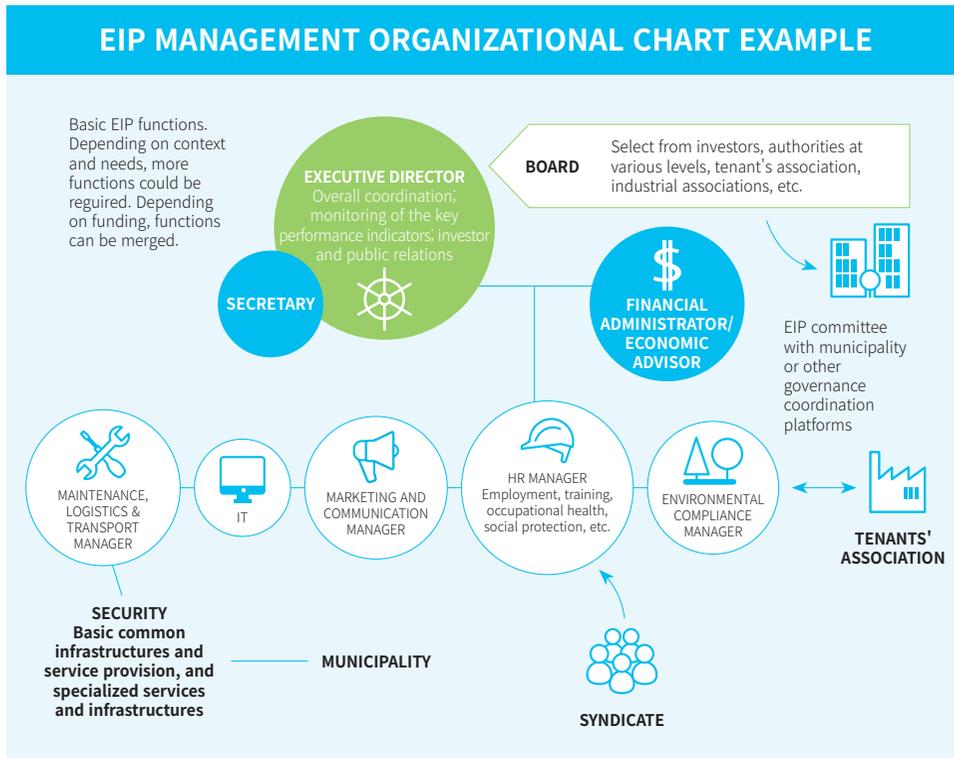
#### **Private company or individual management model:**

In this model, the park management is run by a private operator or real estate agent.

*Source: UNIDO (2017), p. 44*

Choosing an appropriate management system is of particular importance in developing EIPs, given the overall goal of continuous environmental improvement, community connections and business success. Hence, identifying the effective management structure is extremely important. An example of an EIP management organizational chart is provided in Figure 7.

**Figure 7: EIP Management Models**



Source: UNIDO (2017).

If an EIP is to operate in a cost-effective manner, the EIP management team/department established by the park operator also needs to fulfill the following tasks:

- Elaboration of business plans and planning of margins: Formulate annual business plans for sustainable economic development of the EIP, including a budget for investment in common services, the launch of new services, and maintenance.
- Portfolio development: Services can only be profitable if they fulfill what is required and needed by resident companies. Obsolete services should be abandoned, and management should be attuned to new demands for services by resident companies.



## Step 3. Performance audits

Internal auditing is a mandatory activity that needs to be supported by the EIP management team. The board of the EIP or an industrial park transitioning to an EIP, to which the EIP management team reports, needs to ensure that an independent, structured internal audit system with a proven set of rules and auditing methodologies is available for the declaration of conformity of the industrial park to the national or International EIP Framework.

The internal audit committee should be free to work independently and objectively, that is, free from the influence of those being audited. It should have access to information to enable it to fulfill its mandate. In this context, it should be equipped to perform its functions in accordance with appropriate professional standards for internal auditors (see for instance, International Standards for the Professional Practice of Internal Auditing).

To establish an internal audit system, practitioners need to:

- Establish an internal audit system and good reporting relationships.
- Monitor and evaluate the performance of EIP programs taking place within the park.

### 3.1 Establish an internal audit system

#### Establish an internal audit committee

The board of the EIP or an industrial park that is transitioning to an EIP appoints at least three members of the internal audit committee and confirm its authority to conduct:

Step 1. Develop stakeholder commitment
Step 2. Establish an EIP management team
Step 3. Performance audits
Step 4. Reporting and marketing

- Document reviews
- Site visits
- Interviews with park operators, the representatives of resident firms, EIP management team and stakeholders involved in the monitoring of the performance indicators
- All the activities that are necessary to assess how the EIP management team has performed the diagnostic for the performance indicators.

The audit committee shall report the results of its periodic auditing to the EIP management team.

### **Develop an audit plan**

Based on the assessment of prerequisites and performance targets to be achieved, the audit committee develops an audit plan. As the achievement of the annual audit plan depends on resources available, external, independent and qualified auditors may also be commissioned to verify the EIP's performance.

### **Ensure complete cooperation**

Ensure that the EIP management team notifies resident firms in the park about the existence of an internal audit committee, requesting their cooperation.

### **Establish best-practice reporting relationships**

Work with park operators and firms to establish best-practice reporting relationships, ensure that internal audit is promoted throughout the EIP, and develop a methodology for following up on recommendations derived from the auditing process.

Once an internal audit committee and system have been established, the performance of EIP programs within the park need to be periodically monitored and evaluated.

## 3.2 Monitor and evaluate the performance of EIP programs within the park

### Collect and monitor data

The EIP management unit is charged with monitoring and reporting on the park's compliance with the performance indicators and targets provided by the national or International EIP Framework. Different types of methods can be used to collect data from various stakeholders to monitor EIP performance indicators and evaluate the performance of EIP programs. Regarding quantitative indicators of environmental performance, resident firms participating in the EIP program and the park operator should be asked to document and report on their energy, water and resource savings every 3-6 months.

As for qualitative indicators related to park management, surveys and interviews can be used to monitor and evaluate the social and economic performance and impact. In addition, verification methods for collected data should be considered. So too, the costs involved in data collection should be taken into consideration. Park management will need to determine the reasonable cost of obtaining measured, accurate and verified data.

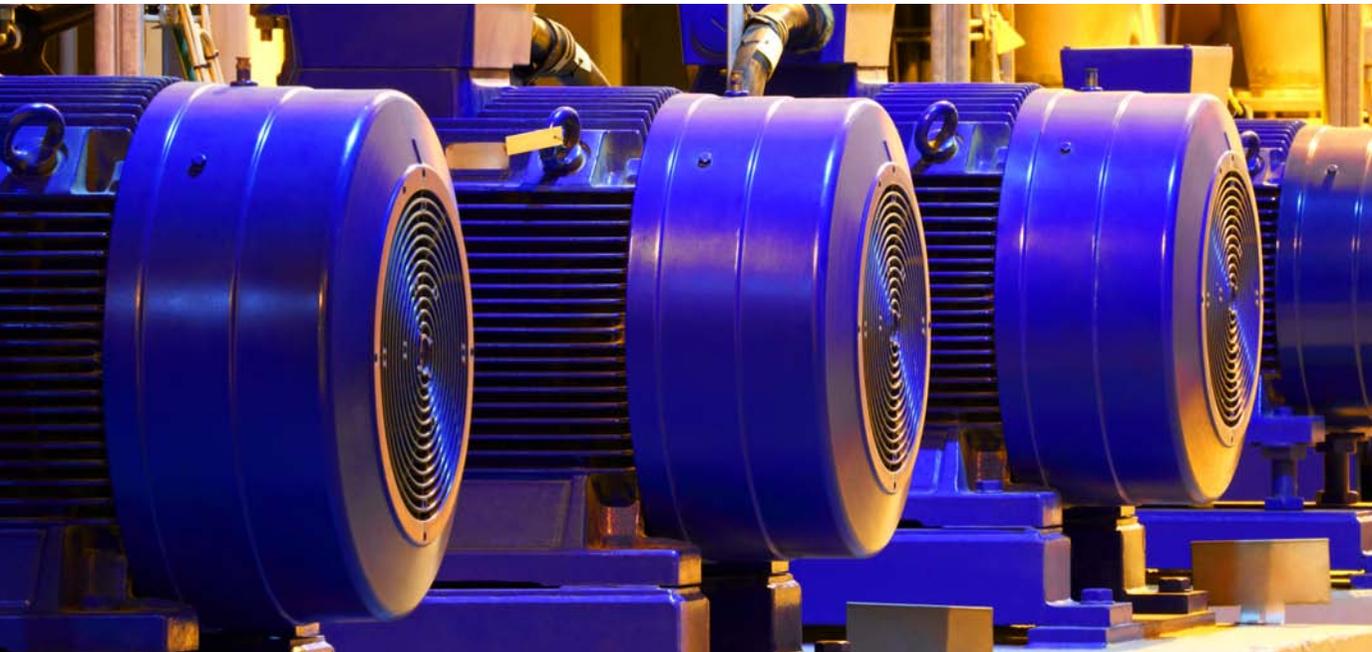
If a national EIP framework is in place, practitioners are advised to collect and monitor performance data every six months in line with the evaluation cycle of the national EIP framework. Practitioners can monitor the performance twice a year, or more frequently, without creating an overwhelming environment for the participating firms. The documentation should be available anytime for auditing purposes, allowing auditors to periodically verify that the applied methodology, the collected data, and the calculation of performance indicators have been performed in conformity with the internal procedures defined by the EIP management unit, or according to the standards set in the Framework.

### Assess the performance of EIP programs within the park

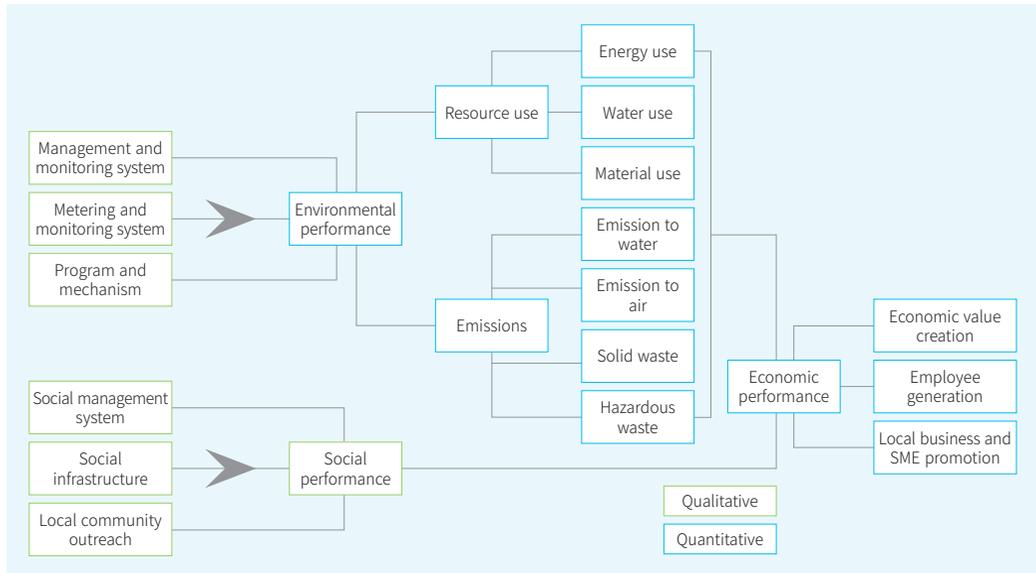
The EIP management team should assess the performance of various EIP programs taking place within the park, such as the modification of the existing management practice or creation of a new one,

changes in metering and monitoring systems, newly added social infrastructure, and local community outreach strategies. These indicators are mostly qualitative in nature, and many are undertaken by the park operator — especially when they are related to the management of common infrastructure, disclosure or information, capacity building, and monitoring of environmental and social performance. Environment and economic performance indicators, such as energy or resource intensity to create a unit of economic value, can also be quantified and assessed.

The interrelationship between environmental, social and economic performance indicators should be carefully selected, reflecting the data availability and the cost of data acquisition. An example of performance assessment indicators at the park and firm levels is illustrated in Figure 8. It should be noted that the performance of EIP initiatives of resident firms and parks needs to be monitored and evaluated against both the EIP performance prerequisites and indicators. The results of this monitoring may be reported on an annual basis so that the park can maintain its EIP status.



**Figure 8: Overview of the Performance Assessment at the Park and Firm Levels**



In parallel to the performance assessments, the audit needs to periodically assess whether the national EIP roadmap or park-level action plans have been successfully implemented and achieved their goals. It also provides recommendations to improve methodologies applied in the development of current or future programs.

### Benchmark performance

The EIP management team should set a baseline or benchmark to compare benefits created by EIP activities. The use a participation indicator is recommended to:

- Create an incentive for maximizing the number of firms in an EIP, providing data against identified indicators and;
- Establish a baseline for the performance of an EIP based on a fixed set of participating firms. The data for the participation indicator should be collected by the park operator. Participation should be established based on a signed MoU with each participating firm.

The participation rating of an industrial park is based on the percentage of firms reporting on the EIP indicators (out of the total number of firms in the industrial park) (Table 17).

**Table 17: Participation Rating of an Industrial Park**

<b>Participation Level Indicators</b>	<b>Type of Information Required</b>
Percentage of firms participating in the EIP program.	Number of firms which agreed to submit data for all indicators.

The data collection and procedure adopted for the calculation of the percentages may be revised based on the results of audits that assess the reliability of the outcomes.

### **Evaluate achievements**

Results and impacts of EIP programs can be evaluated by means of firm level indicators, as shown in the illustration in Table 18. The audits should ensure whether the evaluation methodology has been appropriately applied.

**Table 18: An Example of Monitoring Results Using Firm-level Indicators****Firm Level Quantitative Indicator 1:**

**An X percent (%) Reduction in the ratio of waste disposed to Value Add (VA), compared to baseline year**

**Description and Calculation Formula:**

The purpose of this indicator is to encourage firms within the EIPs to implement initiatives to reduce solid waste generation at the source, and to re-use/recycle any solid waste that is generated. The indicator aims to monitor waste disposed or sent for treatment by the firm and the EIP. This excludes waste which is sent for re-use and/or recycling purposes.

Value added (VA) can be estimated by adding up the monetary value of salaries paid, and profit before tax and depreciation. The data used for calculating the VA will be done according to the audited financial statements of the firm/park developer.

- Calculation of the indicator at the firm level

$$\text{Baseline Year Firm Ratio (A)} = \frac{\text{Tons of waste disposed by firm in baseline year}}{\text{VA by firm in baseline year}}$$

Baseline year can be selected as the first year of monitoring the EIP indicators. All future year data can be then calculated with reference to the data collected during the first year.

$$\text{Current Year Firm Ratio (B)} = \frac{\text{Tons of waste disposed by firm in current year}}{\text{VA by firm in current year}}$$

Indicator calculation for firm is:

$$\text{Indicator 1 for firm} = \frac{A - B}{A} \times 100\%$$

Table 18 (continued)

**Firm Level Quantitative Indicator 1:  
An X percent (%) Reduction in the ratio of waste disposed to Value Add (VA), compared to baseline year**

- ▶ Calculation of the indicator at the industrial park level

$$\text{Baseline Year Ratio (C)} = \frac{\text{Sum of tons of waste disposed by participating firms and the industrial park management entity in baseline year}}{\text{Sum of VA by all firms within the EIP in the baseline year}}$$

$$\text{Current Year Ratio (D)} = \frac{\text{Sum of tons of waste disposed by participating firms and industrial park management entity in current year}}{\text{Sum of VA by participating firms and industrial park management entity in current year}}$$

Indicator calculation for EIP is

$$\text{Current Year Firm Ratio (B)} = \frac{\text{Tons of waste disposed by firm in current year}}{\text{VA by firm in current year}}$$

Indicator calculation for firm is:

$$\text{Indicator 1 for EIP} = \frac{C - D}{C} \times 100\%$$

For the purpose of these calculations “waste disposed” should include solid waste either directly disposed or sent to authorized agencies for treatment (and not reused / recycled). Waste sent to authorized agencies for re-cycling, or supplied to other firms for re-use as a raw material, should be excluded from the calculation.

Source: IFC (2018).

## Step 4. Reporting and marketing

The EIP management team should prepare periodic reports about the park's performance in terms of meeting the EIP performance requirements. This report should be made available at least once a year and be publicly accessible. The reporting should include the economic, environmental and social key performance indicators.

In be successful, EIPs should be managed professionally and run like a business, paying special attention to constant improvement in its operations and services in a sustainable manner. So too, the park operator should prioritize marketing to take advantage of branding opportunities that will improve the competitiveness of the industrial park itself as it becomes more innovation-driven and environmentally-friendly. Therefore, the park operator, assisted by the EIP management team, needs to create effective communication campaigns, while also differentiating itself from competition from conventional industrial parks.

As in any business model, EIPs need to be managed in a cost-effective and efficient manner to assure the return on investment. Well-managed EIPs will bring direct business benefits to the enterprises as they increase savings on utility costs, enhance capital efficiency, and incentivize green innovation. Such tangible business benefits should be used to elaborate the business case for EIPs. As such, they can help strengthen the EIPs' marketing strategy.

Each industrial park often competes with other industrial parks or economic zones. It is therefore obliged to constantly improve its common infrastructure and services to attract new customers, keep them satisfied, and offer a clear added value. It should also respect economic principles, such as the need to assure a return on investment, meaning that the industrial park management has to

Step 1. Develop stakeholder commitment
Step 2. Establish an EIP management team
Step 3. Performance audits
Step 4. Reporting and marketing

be cost-effective and efficiency-driven. However, this is not sufficient. To achieve a higher degree of competitiveness and leverage the sustainable production reached through the implementation of the EIP program, it is advisable for the EIP management team to create a business case about its excellence and invest in marketing to inform resident firms and potential clients of the best practices performed in the EIP — especially compared to other industrial parks that are less “sustainable.”

## 4.1 Build a business case

A business case can be defined as a point of reference, derived from a best practice, that serves as a standard or stimulus for promoting excellence — and from which it is possible to standardize an innovative approach to specific problems. In the context of developing and promoting an EIP, building a business case can be a powerful tool for park operators to remain competitive and differentiated from other conventional industrial parks. By demonstrating the best EIP practices implemented within the park, the park operators can stimulate non-participating resident firms to join park-level EIP activities. It can also attract more national and global buyers who look for suppliers that meet their sustainability standards.

Along with the international cases that can showcase the benefits of EIPs (see Box 4), local business cases can also help practitioners to effectively implement and mainstream the national EIP Framework across different parks (see Step 4.2 of Section 1). These cases will constitute one of the most important means that practitioners can use to provide conventional industrial parks within the country that have not yet implemented an EIP program with proven examples of the benefits associated with joining a national EIP Framework.

Practitioners should recognize that it is essential to develop a clear business case for EIPs using a realistic model of potential revenue gains and cost savings. They should rely on detailed technical and financial analyses, such as the return on investment (ROI) that help build business cases for EIPs. For instance, these analyses can provide evidence of the clear benefits that may result in exceeding the usual way of doing business by investing in a new technology. These analyses may also be conducted by EIP management team staff or external technical experts.

The main steps to build a business case are:

- Identify resident firms that can help build a business case
- Collect data and evidence on the benefits of implemented EIP actions
- Organize and present the collected data

### **Identify and select resident firms that can help build a business case**

Best practices are usually associated with specific outcomes: increased savings and efficiency, and collaboration with a wide range of stakeholders, among other things. For example, business cases showing the advancement of environmental performance, may be drawn from, but not limited to:

- Actions taken by single firms in the park or multiple firms across a sector to address specific issues concerning the improvement of EIP target values;
- Development of new sustainable know-how or technologies that have enhanced resource efficiency within the park; and
- Innovative partnerships among resident firms, implementing the best available technologies with incremental impacts on resource efficiency compared to other industrial parks.

Firms with significant positive impacts on the park's overall achievement of the target values of the EIP performance indicators should be selected.

### **Collect data and evidence about the benefits of EIP actions**

The EIP management team should implement a communications system that allows for the effective collection of data from the resident firms. The team should be informed of the partnerships and projects with impacts on EIP performance indicators. This could include periodic meetings with stakeholders or submitting a questionnaire to the firm requesting updates on project developments.

## Organize and present the collected data

The EIP management team should collect, organize and present the data in a clear way, including the following information:

- Involved stakeholders, resident firms and sub-sectors, if relevant;
- Performance area of best practice (park management, and environmental, social, and economic performance);
- Know how, technology, specific topics addressed with the best practices;
- Description of the initial challenge, adopted methodology, and final outcome; and
- Results and recommendations

Results and recommendations illustrated in the best practices should have detailed information in terms of:

- Specific implications of best practices in supporting the park to meet the target values of the EIP performance indicators;
- Tangible benefits for the participants, such as high return on investment (ROI); and
- Intangible, but important, benefits for the park, such as an increased level of partnership among the resident firms to jointly implement EIP programs.

These results can be shared with line ministries or other entities, who can then help the park operators to differentiate the EIP from the conventional industrial parks. The cases can also be used to update the national EIP framework (if one is in place) and promote EIPs across the country.





Industrial symbiosis refers to the collective collaboration of industry, for example, the sharing of services, utilities, and by-product resources among diverse industrial actors to add value, reduce costs, and improve the environment. Industrial symbiosis aims to develop industrial ecosystems that behave in a similar way to natural ecosystems, wherein everything is recycled. The core component of an EIP consists of utilizing the locational advantage of residing firms in an industrial park engaged in building an industrial symbiosis network that further enables the industrial circularity of by-products and waste.

The industrial symbiosis philosophy is about bringing many cross-sectorial businesses/industries together, generating a high number and variety of industrial material/waste/energy streams with potential to be valorized. This necessitates the assessment of large amounts of information during planning, design, implementation and monitoring of industrial symbiosis networks.

## Creating an industrial symbiosis network

Industrial symbiosis can evolve naturally or through a more proactive approach. First, industrial symbiosis networks may naturally emerge from the existing social interactions among resident firms, gradually evolving into a complex web of symbiotic interactions among facilities. Second, an industrial symbiosis network can be proactively created by bringing firms together around a dedicated project or program executed by governmental agencies or park operators. The former model takes a “laissez faire approach” to establishing an industrial symbiosis network, where the creation of the network does not necessarily require the active involvement of a third party, intermediary organization or government agencies. In this approach, however, it may take a long period of time to initiate and actually realize the network.

In the latter approach, the active involvement of a coordinating agency or government agencies may play a relatively more significant role in establishing the industrial symbiosis network. Moreover, it may require less time and resources to create the network, as demonstrated by the Korean model — especially if projects are well designed and implemented in a way that actively helps identify common interests among resident firms, facilitating their genuine collaboration. For this reason, the Handbook focuses on providing guidelines on the second approach, that is, how to create an industrial symbiosis network.

Unlike energy efficiency programs that often target a single firm, creating the industrial symbiosis network requires the involvement of two or more firms or entities, as well as their cooperation to identify a common interest. Strategies to resolve the intrinsic complexity associated with identifying the common interests of firms involved in the initiation of industrial symbiosis projects require special attention. Based on the extensive experience of the South Korean government's involvement in creating an industrial symbiosis network, this section provides a step-by-step guideline for creating and developing an industrial symbiosis network within and across the parks.

## A Guideline to creating and managing industrial symbiosis networks

### Overview of steps

By-products and energy emitted from the industrial park can take diverse forms depending on the characteristics of the residing firms, product manufacturing practice, and waste treatment process. They could also differ in chemical or other property, even when emitted from the same type of industry. For instance, an appropriate manufacturing process is needed to pursue the recycling and reuse of waste energy emitted from a firm using heat power, since its resulting shape, temperature and pressure are all different.

In general, the most important factor in the recycling of by-products and waste energy is the uniformity of property/structure and the stability of emissions, which helps to build a stable inter-firm network in the demand and supply market. In the case of the by-products discharged, it requires transformation stages into a form/structure requested by the firms through appropriate procedures of separation, purification, concentration, mixing, processing and molding. As such, it is also necessary to conduct sufficient technical studies and review. Regarding waste energy, suitable market demand needs to be identified according to the shape, temperature, and pressure of the collected waste. This also involves technical reviews and studies in the phase of project development to ultimately transform the waste according to enterprise demand.

After the completion of the technical investigation, it is essential that firms reach mutual agreement regarding general procedures, for example, on procurement of investment costs, conditions for installation of equipment, decisions on the unit price for by-products and energy exchange, as well as on the ground rules for operation and management, and so on.

This section will provide practitioners with a general guideline on how to identify and create an industrial symbiosis network, implement projects, and develop a business case. It is organized according to the following three steps:

- Step 1 – Identify potential opportunities to create an industrial symbiosis network
- Step 2 – Implement feasibility assessments, verify EIP opportunities and sign a MoU
- Step 3 – Launch and develop a business case

In Step 1, a pre-feasibility study should be conducted to explore the flow of materials and energy use. During this stage, practitioners should conduct technical studies, as well as data and a literature review on the various methods of collecting, recycling and reusing materials that have high potential for creating an industrial symbiosis network. Practitioners must also review the regulatory and institutional framework that can either constrain or promote the exchange of certain materials, as well as its market creation.

Steps 2 and 3 are required for the implementation of industrial symbiosis network opportunities that have been identified in Step 1. Step 2 mainly involves technical and economic feasibility assessments of the identified opportunities. Following these assessments, participating firms sign a Memorandum of Understanding, and decide on the scope of investment and business development. In Step 3, the project will be completed with the investment of participating companies, to be followed by the construction and operation of the plants and equipment. An evaluation of their performance should also be undertaken. Detailed steps are summarized in Table 19.

**Table 19: Overview of Steps Involved in Creating an Industrial Symbiosis Network**

Steps	Activities	Responsible entities
<b>1. Identify opportunities for an industrial symbiosis network</b>	<ul style="list-style-type: none"> <li>▶ Understand the flow of materials, energy and waste</li> <li>▶ Determine target materials</li> <li>▶ Review the existing regulatory and institutional framework</li> <li>▶ Conduct a pre-feasibility assessment</li> <li>▶ Identify receiving and supplying firms</li> <li>▶ Secure the commitment from participating firms and discuss their roles</li> <li>▶ Shortlist industrial symbiosis opportunities for feasibility assessments</li> </ul>	<ul style="list-style-type: none"> <li>▶ Park operators (and the EIP management team), firms, and banks in partnership with the coordinating agencies</li> </ul>
<b>2. Implement and verify industrial symbiosis opportunities</b>	<ul style="list-style-type: none"> <li>▶ Conduct a feasibility assessment</li> <li>▶ Arrange for financial support</li> <li>▶ Empirical analysis (if necessary)</li> <li>▶ Review the characteristics and economic return of reused materials</li> <li>▶ Participating firms make investment decisions and sign the MOU</li> </ul>	<ul style="list-style-type: none"> <li>▶ Line ministries/government agencies, park operators, firms and banks</li> </ul>
<b>3. Launch and develop the business cases</b>	<ul style="list-style-type: none"> <li>▶ Execute investment</li> <li>▶ Design and construction</li> <li>▶ Commissioning and operation</li> <li>▶ Evaluate and verify performance</li> </ul>	<ul style="list-style-type: none"> <li>▶ Line ministries/government agencies, park operators (assisted by the EIP management team), firms, and banks</li> </ul>

# Step 1. Identify opportunities for an industrial symbiosis network

## 1.1 Understand the flow of materials, energy and waste

Practitioners must first understand the flow of materials, energy and waste produced within the parks. They should then prioritize the target materials based on the quantitative and qualitative characteristics of the materials, energy and waste generated and treated within the industrial parks. They will also need to schematize the flow of by-product, energy and waste by reviewing relevant international and national literature on industrial symbiosis, as well as operational documents. This activity covers the industrial symbiosis networks and practices within similar industrial parks from around the world in terms of scale, sectorial distribution, provided infrastructure services, and so on. Material/waste/energy exchange opportunities and case studies reported in the literature and other sources are studied and reported as best practice examples to help motivate the firms to be included in the industrial symbiosis network. In addition to material/waste /energy exchange opportunities, other dimensions of industrial symbiosis approaches should also be evaluated.

Practitioners need to engage and conduct interviews with industrial park representatives and some key selected stakeholders in the region. They should utilize checklists of the data to be collected during this stage (see Tool 3.2). Industrial park operator partners can distribute data collection forms to all of their resident firms, requesting that they complete and return the forms prior to site visits. The interview or data collection processes may be implemented with confidentiality agreements if necessary.

Step 1.  
Identify opportunities for an industrial symbiosis network

Step 2.  
Implement and verify industrial symbiosis opportunities

Step 3.  
Launch and develop the business cases

During the data collection phase, data regarding a variety of factors is gathered, including firm inputs and outputs; firm processes and operational attributes; firm needs and capacities in terms of production, utilities and logistics infrastructure; and human and information resources. Data collection can be facilitated by using a specially designed information database that will enable information to be shared by the other partner industrial parks. This data will facilitate the identification of industrial symbiosis opportunities both within and between the partner industrial parks. In this context, it is also important that the quantity and components of the emitted materials be considered. For example, Material Flow Analysis (MFA) is a typical tool used to create the database (see Tool 3.1).

## 1.2 Determine target materials

Preliminary site visits are important in determining the target material. Interviews should be conducted with the person in charge of the firm, and essential documents acquired. The purposes of these preliminary site visits are to:

- Inform the firms about the EIP program and activities that are specifically relevant to industrial symbiosis;
- Obtain the support of the firms and involve them in the EIP program and activities that are relevant to creating an industrial symbiosis network;
- Determine whether the firms already conduct any industrial symbiosis applications (for example, waste exchange); and
- Investigate the production process and the amount/type of any by-product generation, treatment process, and so on.

Accordingly, the selection of the firms to be visited will be based on several parameters, such as:

- The potential of acting as an exemplar/pioneer and convincing other firms to join;
- Playing an active role in creating a network;
- Possessing industrial symbiosis potential; and
- Demonstrating an interest in industrial symbiosis activities from information submitted in the data collection forms.

The data provided by the firms during the data collection step is reviewed before the on-site visits are conducted. The visits are also an opportunity to discuss possible industrial symbiosis opportunities applicable to the firms. In this context, it is important to provide the firms with concrete examples of industrial symbiosis applications in their sectors (based on the literature review and compilation of case studies). The firms are then asked to complete and return the data collection forms (if not previously provided). The data will be used during the industrial symbiosis opportunity identification step. After the site visits are completed, follow-up contacts (telephone, e-mail, further visits) may be required to clarify any points and obtain additional data.

Based on the results of the visit, an investigation of the production process will be undertaken, including details about the amount and type of generation of by-products of production. In addition, the basic property of the target material for use will be determined, and a firm that can utilize it as a source material will be identified.

Similarly, practitioners need to conduct site visits and audits, identifying firms that are willing to receive the by-products. Firms should be informed of the results and the EIP program, specifically the industrial symbiosis-oriented activities. Efforts should be made to obtain their support and involve them in the EIP program in general, and the industrial symbiosis-oriented activities and networks in particular. Firms to be visited may be selected based on their potential as a creator and proponent of a network, having industrial symbiosis potential, or having shown an interest in industrial symbiosis activities in the data collection forms.

The main points of discussion may be developed based on the characteristics of the target materials as suggested below:

- The value of use as source materials
- Potential impact associated with the use of the product
- The pre-treatment technology of the source material based on the content of impurities
- The quantity of the collected source material and its types
- The safety of the supplied source material, and so on.

Apart from these elements, characteristics based on the conditions of the receiving firm should be discussed. In this context, the types of source material and applicable technology can be categorized as shown in Box 16. While reviewing the related technologies, firms should also consider the best technologies that are most appropriate to them. Example technologies are also provided in Box 16.

**Box 16: Examples of Technologies Implemented in South Korea to Establish an Industrial Symbiosis Network**

Category		Description
<b>Material recovery</b>	Categorize according to the material collected	Wet screening, sieve screening, self-selection, optical separation, electrostatic separation, overcurrent separation, wind power screening, and so on.
	Collection of precious metals from spent/waste catalysts	Dry smelting, wet smelting, and so on.
	Collection of normal spent/waste catalysts	Enrichment, smelting, solvent extraction, and ion-exchange
<b>Material conversion</b>	Recycling of waste fiber	Synthetic leather manufacturing technology
	Recycling of acidic and alkaline wastes	
	Recycling of incineration ash and waste refractories	
<b>Energy transformation</b>	Energy recovery from waste	Gasification, pyrolysis, organic sludge biomass gasification, and so on.
	Solid fuel (Refuse-Derived Fuel (RDF)) from waste	
	Waste heat recovery	
<b>Industrial water reuse</b>	Water Pinch Technology, installment of greywater recycling system	

Source: MOTIE (2011).

### 1.3 Review the existing regulatory and institutional framework

As the regulatory and institutional framework that governs the reuse or circulation of materials can shape the feasibility assessment and scope of the industrial symbiosis network, practitioners will need to map and review the existing frameworks and analyze gaps. For example, in South Korea, there is no need to declare the waste recycling business if the material is produced and recycled within the same company. However, if the material exchange takes place between two different companies, the waste recycling business must be declared. Detailed step-by-step guidelines on how to conduct regulatory and institutional analyses are provided in Step 2.3 and Step 2.4 of Section 1.

### 1.4 Conduct a pre-feasibility assessment

After determining target materials, practitioners should conduct a pre-feasibility assessment based on the information obtained during the preliminary analysis of the material flow. A pre-feasibility assessment is an analysis that allows practitioners to shortlist projects eligible for a feasibility assessment. The following issues or items are considered in the pre-feasibility assessment: waste and energy generation; processing and unit sales price; economic profit that can be generated from positive environmental effects; the profit structure shared among the participating companies; and so on. For an accurate estimation, practitioners need to secure data on the internal rate of return and net present value and ensure that related information is accessible. If collecting this kind of information becomes challenging, practitioners are encouraged to estimate the average collection period. In general, a project's profitability is assumed if the average collection period is less than 3 years, albeit to varying degrees.

The profitability of an EIP project for the average collection period can be evaluated by calculating the investment cost for infrastructure development and maintenance, and total revenues that the investment can eventually generate.

- The investment cost for infrastructure can be deducted through a quotation or other related documents provided by technology holders. To improve its accuracy, the quotation should include detailed information, such as on the project scope, geographic conditions, and so on.
- When calculating the maintenance cost, all possible expenses expected during the operation of facilities should be taken into consideration. Specifically, these costs should cover electricity, labor, medicine, as well as expenses for other related supplies.
- The revenues can be calculated by considering the margin of recycled target material and the profit from carbon credit sales generated from the reduction of waste treatment cost, as well as other revenues from the emission trading scheme. In case of self-developed technology, royalties on technology can also be included.

At this stage, practitioners also need to conduct preliminary site visits to evaluate whether participating firms have the potential to develop business cases. They also need to examine where to locate equipment or plants necessary to operationalize the network. Questionnaires that can be used in the preliminary site visits are detailed in Table 20.



**Table 20: Questionnaires for Pre-feasibility Assessment<sup>19</sup>**

Procedure	Questions	Note
<b>Emission characteristics of the target material</b>	<ul style="list-style-type: none"> <li>▶ Is the emitted amount of the target materials sufficient for the supplying quantity?</li> <li>▶ Are the target materials steadily emitted?</li> <li>▶ Is the content of target materials stable?</li> <li>▶ Are the purity, properties, and so on, of target materials appropriate to the demand-supply conditions?</li> </ul>	Consider the safety of supply and demand quantity
<b>Company conditions</b>	<ul style="list-style-type: none"> <li>▶ Is there any investment intention in relation to network building?</li> <li>▶ Is there enough demand-supply capital capacity to secure infrastructure investment?</li> <li>▶ Is the company management and operation stable?</li> <li>▶ Is the propriety of the company size secured?</li> </ul>	Consider the cash flow, and so on, in accordance with investment decision making
<b>Installation site</b>	<ul style="list-style-type: none"> <li>▶ Is the site for plant installment secured?</li> </ul>	-
<b>Operation plan</b>	<ul style="list-style-type: none"> <li>▶ Have the labor, facilities, and so on, for the operation been prepared?</li> </ul>	-

<sup>19</sup> Some of these questions may be asked again during the feasibility assessment. We provide a more extensive list of questionnaires in Step 2.1 of this Section.

## 1.5 Identify receiving and supplying firms

Firms participating in the industrial symbiosis network can be divided into the following three categories, depending on their roles within the network:

- Supplying firms that generate profit by cutting the waste treatment costs due to the reduction of waste generation
- Receiving firms that can create profit by reducing the production costs as they can obtain source materials at a cheaper price
- Intermediary firms that can create added value by recycling materials

The industrial symbiosis network can be initiated when an appropriate agreement is reached among these companies.

When identifying receiving and supplying firms, practitioners need to review the entire area of the industrial park. If there are no related companies identified within one industrial park, it may be necessary to identify the receiving firm in a neighboring industrial park or even in other regions. This identification process may also help facilitate the development and scaling-up of the industrial symbiosis network development within and throughout the country.

Receiving firms can be identified with the support from the local government and public organizations. To help identify and build business cases on site, it is recommended that coordinating agencies visit each company to identify potential receiving companies. Practitioners can leverage the economic benefits that firms can achieve by participating in the creation of the industrial symbiosis network, highlighting the importance of the environmental impact, as well as the improvement in their corporate image.

## 1.6 Secure commitment from participating firms and discuss their roles

The primary purpose of creating the industrial symbiosis network is to minimize environmental emissions through the maximization of recycling. In this context, the economic and social effects are additional benefits. Therefore, the coordinating agency<sup>20</sup> can attract firms and secure their commitment by highlighting the economic benefits at the early stage. It should also induce companies to engage in improving their corporate image and environmental profile.

Practitioners must ensure that firms participating in the creation of the industrial symbiosis network can generate additional values and share in the mutual economic benefits. Participating firms need to discuss and work sufficiently among themselves to achieve this goal. Workshops and round tables may be organized in the partner industrial parks to introduce and discuss the industrial symbiosis opportunities identified during the literature review and site visits (see also Step 1.3 in Section 1). If they are well structured and facilitated, extensive discussions and negotiations among the participating firms can generate new proposals for developing an industrial symbiosis network.

Workshops that are organized by clustering firms and bilateral matchmaking meetings can be a particularly useful format if they are designed according to the industrial symbiosis opportunities identified, sectors considered, and priorities of the partner industrial park. Discussions can further enhance the awareness of the on-going activities of industrial symbiosis network, thereby motivating the firms and other stakeholders to create new network opportunities.

Each participating firm should also adhere to the accurate agreement and contract relationship with regard to the sales allocation of the emission trading scheme of the newly developed technologies. A distinct role distribution regarding the additional expenses, such as on the secondary by-product treatment cost and so on, must be also taken into consideration. In accordance with this content, the coordinating agency, a unit or an organization responsible for identifying business opportunities needs to draft a proposal.

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20 Regarding the establishment of a coordinating agency or EIP management team: see Step 3.2 in Section 1. For a similar guideline that can be applied at the park level, see Step 2 in Section 2.

## 1.7 Shortlist industrial symbiosis opportunities for feasibility assessments

Practitioners need to conduct detailed feasibility studies for the selected industrial symbiosis opportunities in the partner industrial park. Industrial symbiosis opportunities identified in the previous step should be evaluated and shortlisted. A set of evaluation criteria can be used in determining which industrial symbiosis network would require feasibility assessments. Examples of the criteria are suggested in Table 21.

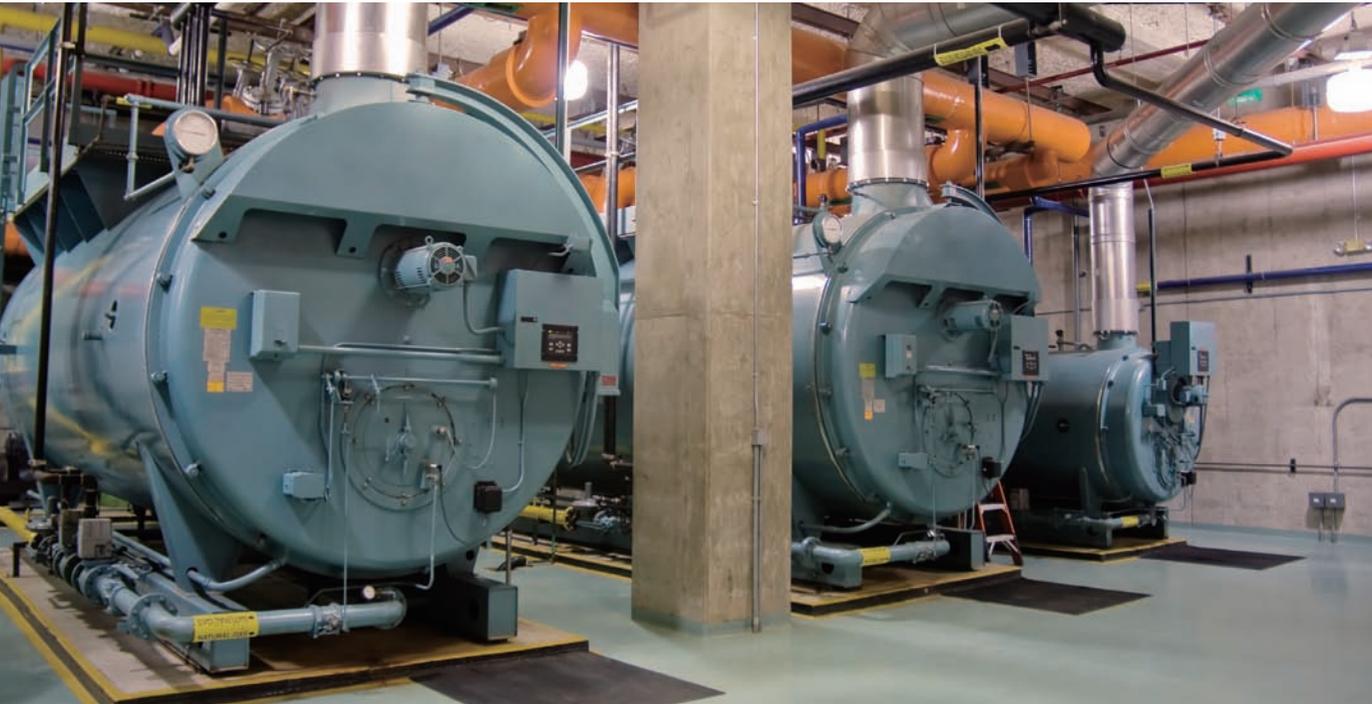
**Table 21: Evaluation Criteria for Shortlisting Industrial Symbiosis Network Opportunities**

Evaluation Category	Examples of Evaluation Criteria
<b>Financial Considerations</b>	Substantial economic gains and viability
<b>Legal Considerations</b>	Absence of legal barriers regarding the waste exchange
<b>Environmental Impact</b>	Potential for raw material saving, and GHG emission reduction
<b>Technical Capacity/ Requirements</b>	Technical capacity to create a synergistic impact
<b>Impact Area</b>	Importance of the relevant sectors within industrial parks
<b>Regional Criteria</b>	Proximity of firms
<b>Project-based Criteria</b>	Appropriateness of project objectives Effectiveness of project promotion strategy Appropriateness of the cost breakdown of the project Implementation progress of project, and probability of project success Appropriateness of project implementation method and performance progress Appropriateness of project execution costs

Source: Examples are drawn from the World Bank Group's EIP projects.

When evaluating industrial symbiosis opportunities, practitioners may give more weight to industrial symbiosis projects or opportunities that have following aspects:

- A project has already established a network and secured purchasing companies
- After having reviewed the applicability of the item with high economic feasibility, the project has the potential to build a network.
- A project has high potential for business opportunity due to the involvement of a business or participation of the company as the key operator.
- Core companies with by-products, waste, and so on, as the source of occurrence are participating in the project.



## Step 2. Implement and verify industrial symbiosis opportunities

In Step 2, which is part of the implementation process, practitioners need to ensure that the following sub-steps are implemented and completed: feasibility assessment and verification; decision-making; a detailed review of the technologies used to establish the network; an empirical analysis; a review of the yield of materials and economic performance; and the signing of the MoU.

### 2.1 Conduct a feasibility assessment

A feasibility assessment is conducted to examine whether the shortlisted industrial symbiosis network opportunities or proposals have investment value. Practitioners must review the shortlisted industrial symbiosis opportunities created in the previous step in accordance with the outcomes of the workshops, and prepare the final list of selected industrial symbiosis opportunities. A working group or technical committee that consists of partner industrial park experts, consultants, and firm representatives may be established for each selected industrial symbiosis opportunity. The working group carries out the necessary data collection, input-output analyses and other technical studies, including tests, measurements and analyses, as required. If needed, additional short-term consultants may be hired to address the specific technical issues. The group may conduct several rounds of site visits to acquire a deeper understanding of the feasibility in the following four areas: technical, economic, environmental and regulatory performance. Sample questions that can be used during the feasibility assessments are suggested in Table 22.

Step 1.  
Identify  
opportunities for an  
industrial symbiosis  
network

Step 2.  
Implement and  
verify industrial  
symbiosis  
opportunities

Step 3.  
Launch and develop  
the business cases

**Table 22: Sample Questions for an Industrial Symbiosis Feasibility Assessment**

Category of feasibility assessments	Sample questions
<b>Technical</b>	<ul style="list-style-type: none"> <li>▶ Determine whether the composition of exchange material is suitable for the industry.</li> <li>▶ Does the vendor provide and guarantee a sufficient amount of exchanged material to the industry?</li> <li>▶ Will the product quality change?</li> <li>▶ Will production be adversely affected adversely in any way (for example, by time, staff, generation of toxicity, and so on)?</li> <li>▶ Determine whether the intended exchange will require more staff and an additional set of processes and technologies.</li> <li>▶ Are the required technology and supervisors available?</li> <li>▶ Is extra training of the workers required?</li> <li>▶ How does the industrial symbiosis affect the health and safety of workers?</li> <li>▶ Will the intended exchange reduce the amount of waste generation?</li> <li>▶ Is the plant layout, design, area and location suitable for the symbiotic relationship?</li> <li>▶ Do stakeholders use exchange material for a new product or a current product?</li> <li>▶ Ease of application of the intended exchange (location, accessibility, and so on).</li> </ul>

Table 22 (continued)

Category of feasibility assessments	Sample questions
<p><b>Economic</b></p>	<ul style="list-style-type: none"> <li>▶ Does the symbiotic relationship decrease raw material costs?</li> <li>▶ Does the symbiotic relationship help to reduce material and material waste storage costs?</li> <li>▶ Does the industrial symbiosis help to reduce regulatory costs?</li> <li>▶ How does the industrial symbiosis affect the health and safety of workers?</li> <li>▶ How does the industrial symbiosis influence insurance premiums?</li> <li>▶ Will the symbiotic relationship reduce waste disposal and transportation costs?</li> <li>▶ Is the payback period acceptable?</li> <li>▶ Is the investment cost of the industrial symbiosis (or the cost of implementation (CAPEX) of the industrial symbiosis technologies/ techniques) acceptable to stakeholders?</li> <li>▶ How can the investment costs of industrial symbiosis be funded?</li> <li>▶ Does the industrial symbiosis reduce operational costs? (for example, energy / manpower)?</li> <li>▶ Determine whether EIP members have an economic risk.</li> <li>▶ How does industrial symbiosis affect the production phase duration?</li> <li>▶ Quantify the economic benefits of an EIP for its members.</li> <li>▶ Reducing infrastructure requirements (How do infrastructure requirements change, and how can costs associated with developing additional infrastructure be reduced?)</li> <li>▶ How does market demand change when production is carried out with exchange material?</li> <li>▶ Does the industrial symbiosis require any testing procedures, if necessary, and what does it cost?</li> </ul>

Table 22 (continued)

Category of feasibility assessments	Sample questions
<b>Environmental</b>	<ul style="list-style-type: none"> <li>▶ Quantify the environmental impact of the industrial symbiosis relationship.</li> <li>▶ Does the industrial symbiosis reduce the amount of carbon released?</li> <li>▶ Does the industrial symbiosis relationship reduce raw material and fuel/energy usage per product?</li> <li>▶ Indicate whether the intended exchange will enable an increase in energy efficiency.</li> <li>▶ Does the industrial symbiosis create new environmental impact?</li> <li>▶ Does the industrial symbiosis generate new hazardous waste?</li> <li>▶ Does the industrial symbiosis help minimize waste generation?</li> <li>▶ Does the symbiotic relationship change the forms of waste generation?</li> <li>▶ Does the industrial symbiosis increase the possibilities of recycling the waste streams?</li> </ul>
<b>Regulatory</b>	<ul style="list-style-type: none"> <li>▶ What are the regulatory uncertainties or barriers that participating firms might confront?</li> </ul>

Regarding industrial symbiosis technologies and business cases whose feasibility assessments have been completed and verified, practitioners can collect detailed information on the size of the facility or equipment, and the costs of equipment, and so on, to decide whether their installation is appropriate for the selected proposals.

## 2.2 Arrange financial support

Financial arrangements should be carefully developed in consultation with stakeholders because industrial symbiosis projects are not only capital intensive, but also require the active involvement of many different resident firms and supporting entities to create the network. Decisions about financial arrangements can be effectively made by forming the consortium of park operators and resident firms that will apply for financing. The key stakeholders potentially involved in a financial arrangement for industrial symbiosis projects include:

- Ministries or public entities
- Industrial park operators
- Firms
- Banks/funds

Ministries and public entities provide fiscal incentives such as tax exemptions, accelerated depreciation for certain goods, equipment, or machinery, or performance-based fiscal incentives (feed-in tariffs). They also assist firms in making R&D investments through grants or low interest loans. Industrial park operators can be involved in the business consortium as part of the investing firms or as a vendor (service management associated with the industrial symbiosis infrastructure: logistics, operations and maintenance, and so on). Firms sponsor industrial symbiosis projects based on the technical and economic analysis of potential partnerships. Banks/funds can provide financing for specific industrial symbiosis projects if the governance of the business consortium guarantees a clear understanding of responsibilities of the firms in case of default.

Practitioners should provide financial support to firms for the following three actions:

### Financial support for initiating the creation of an industrial symbiosis network

Park operators need to stimulate opportunities and dialogue among the firms in the industrial parks by arranging for cross-sectoral seminars to identify potential opportunities. Financing arrangements can be used to support such activities.

Stakeholders: Firms, park operators and Ministries/public entities

Potential financing schemes:

- Self-financed initiatives: Park operators could offer seminars on the best industrial symbiosis practices for tenants, requesting a participation fee.
- Subsidized initiatives: Ministries/public entities have programs in place to incentivize cross-sectoral dialogue among firms, providing financial support to cover the expenses of arranging seminars on industrial symbiosis topics as part of the broader national goal to increase sustainability.

### **Financial support for feasibility assessments**

Practitioners can also help to arrange financing tools for the technical and economic feasibility assessments used to identify and develop effective solutions in reusing waste or by-products, and optimizing productions of power, water and steam.

Stakeholders: Firms, park operators and Ministries/public entities, banks/funds

Potential financing schemes:

- Self-financed initiatives: Firms, using their credit lines, could invest directly in technical and economic studies to confirm their preliminary valuation of the benefits related to project implementation.
- Subsidized initiatives: Firms require grants or subsidies from Ministries/public entities to support industrial partnerships. This is similar to subsidized schemes for R&D and innovation (see the South Korean example in Box 8, or the Horizon 2020 Initiative developed by the European Union).

### **Financial support for business consortia or industrial partnerships**

Stakeholders: Firms, park operators and Ministries/public entities, banks/funds

Potential financing schemes:

- Self-financed initiatives: Firms, using their credit lines, could invest directly in the project, requesting commercial loans from banks. Ministries/public entities could support SMEs by providing financial guarantees to banks to facilitate SME access to financing tools, such as buyer or supplier credits.
- Subsidized initiatives: Ministries/public entities can facilitate access to financing tools by providing the industrial partnerships with the following support:
  - Fiscal subsidies (grants, loans with low interest, customs duty exemption, value-added tax (VAT) remission, accelerated depreciation, or performance-based fiscal incentives on reducing emissions and waste production).
  - PPPs in cases of infrastructure related to the industrial symbiosis project. For example, South Korea invested US\$22 million in pipelines to connect firms in industrial parks, with a 25 percent contribution in capital by interested firms.

### 2.3. Empirical analysis (if necessary)

The objective of the empirical study is to evaluate the cost-efficiency aspects by operating the actual experimental equipment. This study is frequently conducted in the laboratory or at testbeds, depending on the size of participating firms. However, if the evaluation can only take place with the laboratory scale test due to the company's size, it is possible to omit the pilot scale test. By contrast, if the investigation is carried out based on a laboratory scale test, it is possible to analyze it by selectively considering among the business characteristics, the site conditions, and so on. During this empirical analysis stage, it is important not to target a single company, if possible. Rather, it is necessary to assess targeting raw material discharged from diverse companies in the same industry. Furthermore, performance should be analyzed according to condition changes.

## 2.4 Review the characteristics and economic return of reused materials

The characteristics and economic return of materials required to evaluate economic performance. Practitioners need to ensure stable data management for a minimum of 3 months to assess the economic return of materials. This will be calculated as a percentage of the collected amount based on data, including the actual treatment capacity, content, and collection quantity. To evaluate the economic performance, the operating costs are averaged during the stable operation period and used as basic information. The evaluation methods can involve the cost-benefit analysis method, internal rate of return (IRR) analysis method, net present value (NPV) analysis method, and so on, that are applicable. It should be noted, though, that the decision made by the company considering the present conditions is important, as the decision criteria on the results can be different.

## 2.5 Participating firms make investment decisions and sign the MoU

Once the investment decision is made and financing strategies are arranged, the MoU will be signed to promote cooperation between technology holders, investment firms and management agencies. The MoU mainly consists of the roles and responsibilities of the agencies. More specific matters can be replaced with necessary documents (for example, contracts) when promoting business development.

## Step 3. Launch and develop the business cases

### 3.1 Execute investment

As a first step in business development, it is preferable to self-fund, as it does not incur additional financial costs, and it can improve profitability. Yet, it can also lead to a loss of opportunity cost due to the funding operation. This can be determined based on the decision of the investment company. The profitability from the government funding program can be low, but these programs can be practically utilized because they can be easily financed at a low interest rate. For instance, it may be necessary to use such diverse programs for by-product recycling, the energy sector (for example, the ESCO fund), and the environmental facility improvement fund, and so on. Regarding the use of private capital, loans from financial institutions, pre-investment in technology holders or construction companies, and Built-to-Order (BTO) deductions through operating profit are potential alternatives that can be considered. However, there is also a concern of deteriorating the profitability margin due to high financial costs.

### 3.2 Design and construction

Technology vendors should play a key role in the preliminary design stage, and may be mainly responsible for the processing field, and guarantee of the post-commissioning and performance result. The investment firm should provide suggestions and basic information about the site conditions, factors affecting existing production facilities, conditions for post-operation, and so on, at each design stage. After the acquisition of the facility, the operator will need to acquire

Step 1. Identify opportunities for an industrial symbiosis network
Step 2. Implement and verify industrial symbiosis opportunities
Step 3. Launch and develop the business cases

an understanding of the technology to prevent problems that can arise. If the technology owner cannot demonstrate its ability to design, it will be necessary to consider another method, requesting help from a specialized design firm. This can be decided after discussion between the investment firm and the technology vendor firm. The construction can be fulfilled either by supplying the equipment from the technology vendor, or by requesting a special contractor to install the plant.

### 3.3 Commissioning and operation

After the completion of the plant construction, the technology vendor should be responsible for the operation of the plant. Through this commissioning process, the optimization of the plant operation should be completed as well. After commissioning, after-sales operators must participate and cultivate knowledge about plant operations and management, and they should be able to develop the capacity to cope with any recurring problems.

After commissioning, the management firm designates a person(s) to be responsible for the operations and management of the plant. In this way, results from continuous data operation will be documented and utilized as a basic database for future performance evaluation and economic evaluation. The operation results — including the treatment volume, collected quantity, properties of raw materials, energy consumed, operation time, and so on — are recorded to make accurate decisions and judgments in the post-evaluation stage.

### 3.4 Evaluate and verify performance

In order to make an evidence-based decision, the operation period should be at least 3 months, and at least one year of data accumulation is required if biological treatment methods are introduced. Nevertheless, in order to enhance the participation of similar firms in line with the closing of the business, an organizational body can be established (including related firms and institutions) to enhance mutual cooperation and participation. By expanding it further, it is possible to create effects,

such as promoting technologies and related business, providing information on related firms, and identifying similar business cases by creating a homepage, and so on.

Finally, as in other EIP projects, it is important that practitioners engage stakeholders and conduct awareness raising throughout the entire process of establishing the industrial symbiosis network. For example, during the initial phase, resident firms, service providers, consultants, suppliers, R&D institutions, and other local and sectorial associations must be convened. The call to invite institutions into the network is made through various means, such as the web site of the industrial park, resident firm and stakeholder visits, industrial symbiosis networking events, workshops, some umbrella organizations such as chambers of industry, as well as fax and e-mail messages.

The goal is to demonstrate the possible synergies between the members of the network and the advantages to be gained. The network will be made functional in all relevant industrial symbiosis activities, such as studies of industrial symbiosis opportunity working groups; the meeting needs of the service, consultancy and R&D firms; the development and extension of industrial symbiosis opportunities; the organization of matchmaking events, dissemination, and so on. The industrial park operator can also identify the pioneering firms whose involvement in the industrial symbiosis activities are desirable. The identified firms are then introduced to the industrial symbiosis activities and its objectives, potential benefits, and practical implications using different means of communication.

It is also desirable to engage resident firms in identifying the potential benefits that an industrial symbiosis network can provide both to the industrial park as a whole and to individual firms. To secure commitment from the firms, it may be useful to present details about the economic benefits, positive environmental impact, and improvement in their corporate image. When done effectively, stakeholder engagement and awareness raising can initiate a communications platform, which has proven to be one of the backbones of the industrial symbiosis network. In addition, it may lead to the establishment of an industrial symbiosis working group (or a committee) of firms.

## ● Concluding remarks

## Concluding remarks

EIPs have been acknowledged in the literature for some time as an effective way to achieve sustainable design, management and operation of industrial parks. They reduce resource intensity, improve productivity, minimize environmental impact, and improve the well-being of workers. However, the concept had lacked a solid footing in the understanding of what constitutes an EIP. In December 2017, UNIDO, the World Bank Group and GIZ jointly developed “An International Framework for EIPs” to adopt a holistic approach to promoting EIPs and the sustainability of the industrial park, as well as to assist stakeholders in building provide a common understanding of EIPs. This Handbook focused on helping practitioners operationalize the recently released International EIP Framework, assisting them in successfully developing EIPs in practice.

EIPs are an important policy tool that help to improve productivity and competitiveness of industrial sectors while helping governments to meet their international climate pledges and other national priorities, such as economic growth and social inclusiveness. In addition, EIPs offer both soft and hard infrastructure that can help resident firms satisfy the demands of global buyers who pay close attention to firms' adherence to international labor rights, as well as compliance with strict emissions and effluent controls. As a result, there is a growing interest in adopting an EIP concept as a tool through which resident firms and park operators can differentiate themselves from those operating in conventional industrial parks. Such EIPs can also facilitate exports and attract FDI. The Handbook was written to meet this growing interest, helping practitioners operationalize the International EIP Framework at both the national and park levels.

The Handbook emphasizes that the successful development of EIPs depends on a thorough diagnostic, an effective and realistic national EIP framework, and guidelines and park-level actions that are developed, improved and monitored continuously through an active public-private dialogue platform. Practitioners are advised to achieve the International EIP performance requirements across all four core categories (park management, environmental, social and economic performance) by adopting

an indicator-by-indicator approach, while considering the specific local context. This context includes the institutional capacity to enforce regulations and monitor compliance of the parks and resident firms. The Handbook suggests that practitioners design the national EIP framework, various supporting programs and park level action plans based on the thorough assessment of existing technologies, policies, regulatory framework, institutional structures and financial needs for the development of an EIP program. Practitioners can follow the steps described in Section 2 to implement the national EIP framework if one is available, or apply the International EIP Framework at the park level if one is not. In addition, the Handbook provides detailed guidelines on how to achieve EIP performance requirements by implementing guidelines to create industrial symbiosis networks, as suggested in Section 3.

International development banks and development agencies have a very instrumental role to play because they can catalyze investment and knowledge exchange in EIP development. UNIDO, the World Bank Group, and GIZ have been working to fulfill this role. Thus, they have the expertise and experience to provide technical support for practitioners interested in promoting EIPs.

The Handbook is written based on this collective expertise and experience. With funding available from the public, donors, and private sector sources, EIPs must continue to evolve to address global climate change, resource and energy scarcity challenges, and the dynamic global market trends that shape international trade. We welcome the opportunity to discuss with client governments and their respective park operators the options to operationalize the International EIP Framework at the national and park levels.



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