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LE THI TO NGA

SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

DOCTORAL DISSERTATION ABSTRACT

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INTRODUCTION

1. Rationale for selecting the topic

In the context of escalating global challenges such as climate change, environmental degradation, and resource depletion, the traditional industrial development model—characterized by resource-intensive practices and high emissions - has revealed significant limitations. The transition toward green growth, circular economy, and sustainable development has become a strategic orientation for many countries. Eco-industrial parks (EIPs) are regarded as a key solution to harmonize industrial development, environmental protection, and sustainability by optimizing resource use, promoting waste recycling, and enhancing industrial symbiosis among enterprises. In Viet Nam, EIP development has been institutionalized in the green growth and sustainable development strategies, as well as in the legal framework on industrial parks and economic zones. By 2030, the country targets that 40–50% of localities will develop plans to convert existing industrial parks into EIPs, and 8–10% will develop new EIPs. However, implementation remains challenging due to the involvement of multiple stakeholders and governance levels, requiring coordinated institutional, policy, and capacity reforms. In this context, provincial governments play a central role in policy implementation, support mechanisms, resource coordination, and enabling enterprises to transition toward eco-friendly practices.

Da Nang is a leading locality in pursuing sustainable development and the vision of an "environmental city," supported by a relatively well-developed industrial park system that contributes to economic growth. However, industrialization has also increased environmental pressures, making the transition to EIP essential for improving growth quality and aligning with green and smart development strategies. While the role of provincial governments in supporting EIPs is widely acknowledged, existing studies mainly focus on technical aspects, with limited analysis from a public administration perspective. Most research concentrates on the national level or individual industrial parks, leaving provincial governments - key actors in policy implementation and coordination - underexplored. In Da Nang, in-depth studies on EIPs from a public management perspective, particularly regarding government support in their development and operation, remain limited.

Against this backdrop, the author has selected the topic "Local Government Support for the Development of Eco-Industrial Parks in Da Nang City" as the subject of this doctoral dissertation in Economic Management. Based on empirical investigation and analysis of the achievements, limitations, and underlying causes of limitations in supporting EIPs development in Da Nang, this study not only contributes to the theoretical foundation concerning provincial government support in promoting sustainable industrial models, but also provides scientific evidence for improving policy mechanisms, enhancing the effectiveness of public administration, and advancing green transformation in the industrial sector in Da Nang in particular and other localities in general.

From an academic perspective, the study expands the research approach to eco-industrial parks from the standpoint of economic management, highlighting the role of local government as a developmental actor in fostering sustainable development. From a practical perspective, the findings may serve as a useful reference for public authorities in Da Nang in designing support measures, while also offering insights for other localities implementing the EIPs model in Viet Nam.

2. Research purpose and tasks

2.1. Research purpose

From a theoretical perspective, the study aims to develop and enrich an analytical framework for supporting EIPs development at the provincial level, clarifying the content and modalities of support, evaluation criteria, and the factors influencing such support.

From a practical perspective, the study examines the implementation of EIPs development support in Da Nang City and proposes solutions and policy recommendations to improve support mechanisms at the local level.

2.2. Research tasks

To review the literature and clarify the theoretical foundations of provincial support for EIPs; analyze international and domestic experiences to draw lessons for Da Nang; assess the current state of EIP support, including achievements, limitations, and causes; identify influencing factors; and propose solutions and policy recommendations to enhance EIP support in Da Nang City.

3. Research object and scope

The supporting actors are provincial-level authorities; examining support from the perspective of activities undertaken by provincial governments to promote the development of EIPs, and does not cover general state management activities related to EIP development; analyzing the current state of EIP development support in Da Nang City (prior to its merger with Quang Nam Province under Resolution No. 60-NQ/TW), and proposes solutions for the newly reorganized Da Nang City following the merger; the study examines the current state of EIP development support in Da Nang City during the period 2014-2025 (with a particular focus on the period from 2020 to before June 2025). Proposed solutions and recommendations are oriented toward 2030, with a vision to 2045.

4. Theoretical foundation and research methods

4.1. Theoretical Foundation

The dissertation is grounded in the methodological foundations of dialectical materialism and historical materialism, while also incorporating and building upon contemporary research approaches in the field of economic management.

The study primarily adopts a management science perspective, combined with theories of industrial ecology, industrial symbiosis, and sustainable development, to examine provincial-level government support for EIP development within the broader framework of national policies.

4.2. Research Methods

The study employs a combination of commonly used methods in economic research, including analytical-synthetic methods, descriptive statistics, and comparative analysis. Delphi method and Analytic Hierarchy Process (AHP) medthod to determine the relative weights and priority of factors influencing support for EIP development in Da Nang City, based on expert evaluations.

Secondary data are collected from databases such as Web of Science, Scopus, and Vista.gov.vn, as well as from academic publications, legal databases of Viet Nam, international organizations, and provincial-level authorities. Primary data are collected through expert interviews following a standardized procedure.

5. Novel contributions of the dissertation

5.1. Theoretical contributions

First, the dissertation contributes to broadening and clarifying the research approach to EIPs from the perspectives of local governance and public administration. Second, developing an analytical framework for supporting EIPs development at the provincial level, clarifying the structure of support activities, evaluation criteria, and influencing factors; third, identifying and measuring the factors influencing support for EIPs development at the provincial level, thereby contributing to the research stream on determinants of governance effectiveness in promoting environmentally sustainable industrial development.

5.2. Practical contributions

First, the dissertation provides a systematic analytical overview of government support for EIPs development in Da Nang City, clarifying the current situation, achieved results, and emerging issues specific to the locality.

Second, the study identifies key influencing factors and their relative impacts on EIPs development support, thereby providing a scientific basis for determining priority areas in supporting EIPs development in Da Nang City.

Third, the findings and analytical framework of the dissertation can serve as a reference for other localities in designing support mechanisms for EIPs development, contributing to the promotion of environmentally sustainable industrial transformation in Viet Nam.

6. Theoretical and Practical Significance of the Research Topic

6.1. Theoretical Significance of the Dissertation

The findings of this dissertation provide a stronger scientific basis for a more comprehensive understanding of the role of provincial governments in supporting EIPs development. At the same time, the study clarifies several theoretical and practical issues related to the role of provincial authorities in promoting environmentally sustainable industrial development. The research also reinforces an interdisciplinary approach that integrates economic management, environmental governance, and sustainable development, thereby contributing valuable references for studies on policy implementation and local development governance.

6.2. Practical Significance of the Dissertation

The findings of this dissertation can serve as a reference for public authorities in Da Nang City in improving support mechanisms for EIPs development. They may also be useful for other localities in promoting the EIPs model in alignment with green growth and sustainable development objectives. In addition, the results can be utilized as reference materials for teaching, learning, and research on topics related to local governance, sustainable industrial development, and environmental policy in academic and research institutions.

Chapter 1
LITERATURE REVIEW

1.1. RESEARCH DIRECTIONS RELATED TO THE DISSERTATION TOPIC

1.1.1. Studies on eco-industrial park development worldwide and in Viet Nam

Research on EIPs worldwide has its roots in industrial ecology, emerging from the 1960s and gradually evolving in both theoretical and practical dimensions. Scholars such as Perrucci, Chertow, and Schlüter have outlined the stages, models, and development pathways of EIPs, emphasizing the transition from traditional production systems toward

industrial symbiosis and circular economy models. Empirical studies conducted in countries such as South Korea (Park, Cheol), China (Huang, Yuan), and Japan (Srinivas) demonstrate that EIP development is a policy-driven process characterized by a combination of top-down and bottom-up approaches, supported by established criteria, certification mechanisms, and multi-stakeholder participation. In this process, public actors play a crucial role in facilitating inter-firm linkages and improving resource efficiency. In Viet Nam, studies by Huynh Phuc Nguyen Thinh, Tran Duy Dong, Guillaume et al., Vuong Thi Minh Hieu, Nguyen Tram Anh, and Nguyen Duc Long have focused on analyzing international experiences, clarifying the theoretical foundations of EIPs, and evaluating pilot EIP transformation models in Da Nang, Ninh Binh, and Can Tho. These studies have also identified key barriers - social, technical, and particularly governance-related—in the development of EIPs in Viet Nam. Overall, the research findings suggest that while Viet Nam has considerable potential for EIP development, the effectiveness of the transition largely depends on the institutional framework, policy instruments, and the coordination capacity of local governments.

1.1.2. Studies on government support for eco-industrial park development

International studies consistently highlight the central role of the state in supporting the development of EIPs. Regarding supporting actors, scholars such as Uusikartano, Mirata, Chertow, Costa, Wouter, and T-Seng emphasize the role of the state in institutional design, coordination, and providing incentives for EIP development. In terms of support mechanisms, the state facilitates EIP development through two main forms: direct support (e.g., regulations and financial incentives) and indirect support (e.g., environmental standards and compliance pressures). Some studies by authors such as Chertow, Mellisa, Costa & Ferrão, and Park identify three models of EIP development: top-down, bottom-up, and hybrid (middle-out). Empirical evidence suggests that the hybrid model tends to be more effective in practice. Regarding policy instruments, research findings indicate that the state influences EIPs development through two main groups of tools. The first group consists of economic instruments, such as financial subsidies and tax incentives; the second group includes regulatory instruments, particularly the establishment of legal frameworks for EIPs development. From an environmental governance perspective, some scholars categorize policy tools into two groups: command-and-control regulations combined with economic instruments, and voluntary instruments. Experiences from countries such as South Korea, China, Denmark, the United Kingdom, and Brazil show variations in policy mixes, but consistently confirm the strong impact of government intervention. In terms of support content, Uusikartano, Boons, Hong, Yu, and Cheol identify key roles of the state, including policy formulation, financial support, technical assistance, information provision, coordination of industrial symbiosis networks, and diffusion of EIP models. However, as noted by Veleva, there is no one-size-fits-all model applicable to all contexts. In Viet Nam, Vu Thi Hong Tham emphasizes that improving institutional frameworks, piloting and scaling up initiatives, strengthening monitoring, and enhancing multi-stakeholder coordination are essential conditions for effective state support in EIPs development. These studies provide valuable references for the researcher in addressing the objectives and tasks of this dissertation.

1.1.3. Studies on local-level support for eco-industrial park development

Existing studies highlight the central role of local governments in supporting EIP development, as reflected in frameworks such as New Public Management (NPM), multi-

level governance (MLG), network governance, and the collaborative governance model of Ansell and Gash. Scholars including Vesela et al., Kohoren et al., Deutz and Gibbs, Chertow, and Heeres et al. emphasize that local authorities act as network brokers by providing institutional frameworks, financial resources, infrastructure, and knowledge to enterprises. They may also function as "knowledge brokers" (Von), facilitating coordination and industrial symbiosis. Karolina et al. identify key barriers—economic, technical, regulatory, social, and informational—and propose corresponding strategies. Empirical studies by Yu et al. and Shi et al. (Tianjin), Tiberio et al. (Tuscany), Costa and Ferrão (Portugal), and Desrochers (Kalundborg) show that local governments use a mix of economic, regulatory, and voluntary instruments to support EIP transformation. In Viet Nam, Pham Hong Diep et al., Mai Van Sy et al., and Nguyen Thi Hai highlight the role of local authorities and propose evaluation criteria, although studies directly assessing provincial-level support remain limited, with most relying on general frameworks such as those by Le Van Hoa, Le Chi Mai, OECD, PAPI, and RBM.

Regarding influencing factors, existing studies mainly address general policy implementation and governance effectiveness rather than specific support for EIPs. Research by Nguyen Huu Hai, Le Thi Ly, and Bui Thi Phuong Lan indicates that support is shaped by institutional, socio-economic, and governance factors, while international studies by Mirata, Heeres et al., Taddeo, and Vesela et al. identify key barriers such as regulatory constraints, financial limitations, and institutional rigidity. These findings provide a foundation for developing the analytical framework of this dissertation.

1.1.4. Studies on sustainable industrial park development in Da Nang City

Studies on sustainable industrial park development in Da Nang show that the city has established an early policy foundation for ecological transformation. Under the "Da Nang Environmental City" Project, the city aims to have at least one EIP by 2025 and two to three by 2030. Le Thi To Nga highlights the integration of circular economy principles and government support for enterprise transition. Research by Doan Thi Ngoc Thuy on Hoa Khanh Industrial Park indicates that, despite implemented measures, key barriers remain-particularly limited access to preferential financing and weak mechanisms for industrial symbiosis. From a broader perspective, Nguyen Cao Luan identifies multiple management measures supporting sustainable industrial development. Meanwhile, studies by the Da Nang Biotechnology Center propose an EIP model and develop evaluation criteria applied at Hoa Khanh Industrial Park in line with Decree No. 35/2022/ND-CP. Overall, there is still a lack of research examining EIP development in Da Nang from a state management perspective.

1.1.5. Studies on the application of the AHP method in identifying and evaluating impacts

Numerous studies have applied the Analytic Hierarchy Process (AHP) to identify and quantify the relative importance of factors across different fields. For instance, Afroj used AHP to determine the weights of criteria for evaluating urban service quality in Bangladesh based on expert pairwise comparisons, while Marzouk applied Fuzzy AHP to rank the impacts of COVID-19 on Sustainable Development Goal (SDG) indicators in Egypt. In Viet Nam, studies by Dao Van Khanh; Do Son Tung et al.; and Le Tan Loi et al. have employed AHP to determine the weights of factor groups based on expert assessments, supporting analyses of economic efficiency, technology valuation, and the selection of agricultural models. In the fields of education and environmental studies,

Pham Ngoc Son et al. applied AHP to rank the importance of digital competencies for secondary school teachers, while Nguyen Thi Thanh Nga et al. used AHP to calculate climate vulnerability indices based on multidimensional criteria systems.

These studies demonstrate that AHP-particularly when combined with expert judgment through the Delphi process-is an effective tool for standardizing qualitative assessments, determining factor weights, and supporting decision-making in complex, multi-criteria problems. It also provides an important methodological foundation for the application of AHP in this dissertation.

1.2. SYNTHESIS OF RESEARCH FINDINGS AND ISSUES REQUIRING FURTHER INVESTIGATION

1.2.1. Research findings

Previous studies have clarified the theoretical foundations of EIPs development as well as the role of state support in promoting EIPs development. First, earlier studies have progressively identified key theoretical aspects of EIPs development. Second, these studies have analyzed various roles of the state in supporting EIPs development from different perspectives. Some have developed general theoretical frameworks regarding public sector support, particularly state support, for EIP development. At the same time, they consistently affirm the indispensable role of the state in the organization and operation of EIPs. Third, prior research has reached a consensus on the essential role of local governments in EIPs development, positioning them as intermediary actors bridging national governments and enterprises, and coordinating policies in accordance with local contexts and conditions. Fourth, existing studies have identified key factors influencing local governance, public policy implementation, and local support policies across various sectors. From a practical perspective, both international and domestic studies have examined a wide range of policy instruments and support mechanisms for EIPs and their relationships with development outcomes. Many studies have also highlighted the potential and current state of EIP transformation in Da Nang. In addition, the application of the Analytic Hierarchy Process (AHP) has enabled the quantification of the relative importance of criteria, thereby supporting evaluation and prioritization of solutions in sustainable development contexts.

1.2.2. Research gaps

The literature review reveals several gaps that require further investigation. There remains a lack of studies that systematically examine provincial governments as the primary supporting actors, grounded in state intervention theories. Moreover, a comprehensive theoretical framework for provincial-level support for EIPs development has yet to be fully developed. Notably, none of the reviewed studies directly examine the factors influencing provincial government support for EIPs development.

The review of existing studies provides a foundation for the dissertation to build upon and extend prior research, thereby addressing these gaps and identifying solutions for supporting EIPs development in Da Nang City. Specifically, the dissertation focuses on the following issues: First, to systematize existing literature and further clarify the concepts, scope, development models, and approaches to EIPs development. Second, to develop a theoretical framework for provincial-level support for EIPs development that is appropriate to the Vietnamese context. Third, to identify the factors influencing provincial government support for EIPs development at the local level. Fourth, to analyze the practice of provincial government support for EIPs development in Da Nang City from an economic management perspective; to assess the extent and direction of its impacts; to

examine achievements, limitations, and their underlying causes; and to propose feasible and context-appropriate solutions. These contributions aim to improve policies for EIPs development at both local and national levels toward 2030, with a vision to 2045.

Chapter 2
SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

2.1. ECO-INDUSTRIAL PARKS AND EIP DEVELOPMENT

2.1.1. Eco-industrial parks

2.1.1.1. Definition

An eco-industrial park (EIP) is an industrial park that implements integrated solutions in design, management, and production—at both the park level and the enterprise level - aimed at achieving sustainable development in economic, social, and environmental dimensions.

2.1.1.2. Benefits of eco-industrial park

From a societal perspective, EIPs generate value beyond conventional business benefits by simultaneously contributing to economic efficiency (cost reduction and improved resource efficiency), environmental protection (reduced pollution, energy savings, and waste reuse), and social development (job creation and enhanced local welfare). For industrial parks and enterprises, this model improves technical efficiency, fosters industrial symbiosis, enhances competitiveness, reduces regulatory risks, and strengthens corporate image. Therefore, EIPs should be considered an inevitable development pathway for industrial parks in order to meet the requirements of sustainable growth and the circular economy.

2.1.1.3. Components of eco-industrial parks

The dissertation proposes a framework of key components of eco-industrial parks (EIPs) tailored to the Vietnamese context, including: industrial park management services; resource efficiency and cleaner production; industrial symbiosis; spatial planning and industrial park infrastructure; and EIP databases.

2.1.1.4. Criteria for identifying eco-industrial parks

At present, there is no universally standardized set of criteria for assessing the level of development or identifying EIPs globally. In Viet Nam, a national set of criteria for EIPs has been established. According to the perspective of this dissertation, an industrial park can be identified as an EIP if, at a general level, it satisfies all five core components of an EIP. For each component, the level of attainment can be measured based on national EIP criteria.

2.1.2. Eco-industrial park development

2.1.2.1. Definition

EIP development is understood as a process involving both the increase in the number of EIPs within a given area and the qualitative improvement of industrial parks in meeting EIP criteria over specific stages.

2.1.2.2. Models of eco-industrial park development

International research identifies three models of EIP development: a bottom-up model driven by enterprises through resource exchange (e.g., Kalundborg); a top-down model guided by the state through planning and sectoral allocation; and a hybrid "middle-out" model combining both approaches. In practice, the integration of top-down policy

instruments with bottom-up market dynamics has proven to be an effective approach for initiating and sustaining EIPs.

2.1.2.3. Approaches to eco-industrial park development

EIP development is implemented through two main approaches: developing new EIPs from the outset with integrated planning for industrial symbiosis, infrastructure, and the 3R principles; or transforming existing industrial parks through infrastructure upgrades, improved management, and the establishment of symbiotic linkages among enterprises.

Developing new EIPs offers advantages in terms of integrated implementation, ease of designing industrial symbiosis networks, and higher success rates, but requires substantial resources and faces dual pressures related to ecological design and economic performance. In contrast, the transformation of existing industrial parks is more common and leverages existing foundations; however, it often faces challenges due to established enterprise structures-particularly in fully occupied parks-making the formation of new symbiotic networks more complex.

2.1.2.4. Outcomes of eco-industrial park development

The outcomes of EIP development can be assessed through several indicators, including: the number of industrial parks converted to or newly developed as EIPs; the growth rate of EIPs over time; the scale of EIPs measured by total planned or developed land area; the proportion of EIP land relative to total industrial land within a province or city; the degree of compliance with national EIP criteria; the level of achievement across EIP components; the gap between current conditions and development targets; and the potential for scaling up from pilot EIPs to other industrial parks.

2.1.2.5. Barriers to eco-industrial park development

Global experience shows that the implementation of EIPs often encounters several barriers, including limited awareness and understanding of the EIP concept; technical constraints; financial barriers; institutional and regulatory challenges; and the lack of sufficiently strong economic incentives.

2.2. PROVINCIAL-LEVEL SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT

2.2.1. Concept of provincial-level support for eco-industrial park development

2.2.1.1. Concept of state support

State support refers to a set of forms and measures implemented by the state to provide direct or indirect assistance to entities within the national territory, with the aim of ensuring benefits both for the recipients and for the broader public interest.

2.2.1.2. Concept of provincial-level support for eco-industrial park development

Provincial-level support for EIP development refers to a set of direct and indirect forms and measures implemented by provincial authorities to assist infrastructure investors undertaking industrial park construction and infrastructure business projects, enterprises, and other relevant stakeholders. The objective is to encourage and promote the establishment and development of EIPs within the provincial jurisdiction.

2.2.2. Objectives of supporting eco-industrial park development

First, to address and overcome barriers to the development of eco-industrial parks. Second, to create incentives for industrial parks and enterprises to actively and proactively participate in EIP development.

2.2.3. Contents of support for eco-industrial park development

2.2.3.1. Enhancing awareness and capacity on eco-industrial parks

Provincial authorities should take the lead in enhancing awareness and capacity on EIPs through capacity-building programs for public officials, communication activities, and technical support for enterprises and industrial parks. In addition, they should develop technical guidelines and establish expert networks in collaboration with research institutes, universities, and international organizations. These efforts contribute to strengthening both institutional capacity and stakeholder engagement in a coordinated and sustainable manner.

2.2.3.2. Creating an enabling environment for eco-industrial park development

First, establishing an enabling institutional environment; Second, creating a supportive policy environment; Third, facilitating administrative procedures; Fourth, aligning national policies with local conditions through effective policy coordination.

2.2.3.3. Technical support for eco-industrial park development

Provision of EIP management services; Spatial planning and infrastructure development for eco-industrial parks; Promotion of resource efficiency and cleaner production; Implementation of industrial symbiosis; Development of EIP databases.

2.2.3.4. Financial support and access to finance for eco-industrial park development

The development of eco-industrial parks faces significant barriers related to high investment and operational costs, as well as challenges in mobilizing financial resources. This requires enterprises and infrastructure investors to access diverse financing sources. Provincial governments play a key role in providing budgetary support, facilitating access to green finance, investment funds, and international financial institutions, as well as promoting investment and expanding international cooperation to mobilize funding for EIPs.

2.2.3.5. Support for research and development (R&D) on eco-industrial parks adapted to local contexts

Provincial authorities play a central role in researching and designing EIP models tailored to local conditions, based on assessments of industrial park conditions, enterprise readiness, and context-specific challenges. On this basis, local governments collaborate with research institutes, universities, and consulting organizations to implement research activities, allocate funding for R&D, and develop context-specific EIP evaluation criteria, thereby providing a foundation for proposing locally appropriate development models.

2.2.3.6. International cooperation for eco-industrial park development

International cooperation is an important channel through which provinces support EIP development. It focuses on technology transfer, adoption of cleaner production and recycling technologies, and the exchange of management experience, while also attracting investment from high-tech and sustainability-oriented enterprises. Provincial authorities may collaborate with international organizations to implement pilot projects and capacity-building programs; participate in international networks; sign memoranda of understanding (MoUs); and engage in bilateral and multilateral projects and forums. These activities enhance access to knowledge, finance, and technology, thereby promoting the ecological transformation and international integration of industrial parks.

2.2.4. Modes of support for eco-industrial park development at the provincial level

Provincial authorities support the development of eco-industrial parks (EIPs) through two main modes: direct support and indirect support.

2.2.5. Criteria for evaluating support for eco-industrial park development at the provincial level

The evaluation of support content is based on the following criteria: comprehensiveness and coverage of support; effectiveness of support; efficiency of support; and sustainability of support.The evaluation of support modes is based on the following criteria: diversity of support modes; balance between direct and indirect support; and the appropriateness of support modes.

2.2.6. Factors influencing provincial-level support for eco-industrial park development

2.2.6.1. State institutions and policies for eco-industrial park development

State institutions and policies play a foundational role in EIP development in three main aspects: providing a stable legal environment, setting development directions, and offering necessary support mechanisms. Institutional stability is associated with higher levels of investment and growth. A clear and coherent policy system enables local authorities to effectively implement EIP support, while regulatory gaps create barriers. Moreover, trends toward decentralization and modern governance expand the proactive role of local governments in EIP development.

2.2.6.2. Local socio-economic conditions

Localities with stable economic growth, well-developed infrastructure, and a high level of human capital are better positioned to attract investment, adopt new technologies, and implement EIP development policies. Higher living standards and environmental awareness within the community also facilitate policy implementation, communication efforts, and the organization of EIP models more efficiently and at lower cost.

2.2.6.3. Capacity of local governments

The capacity of local governments in EIP development is reflected in: the effectiveness of organizational structures and coordination mechanisms; the quality of civil servants involved in policy advisory; and the level of priority and proactiveness in governance. A clearly structured system ensures smooth coordination; a competent workforce enhances policy feasibility; and proactive, flexible leadership, along with effective inter-agency coordination, directly drives EIP development at the local level.

2.2.6.4. Level of industrial park development in the locality

In localities where industrial parks are well-developed, with strong infrastructure and management systems, and where enterprises are familiar with environmental standards, government support tends to focus on advanced aspects such as improving resource efficiency, promoting cleaner technologies, and fostering industrial symbiosis. As a result, the transition to EIPs is more feasible. Conversely, in areas where industrial parks are still at an early stage, policies tend to prioritize industrial expansion, investment attraction, and infrastructure occupancy; EIP development is not yet a primary focus and requires further accumulation of scale, capacity, and infrastructure foundations.

2.2.6.5. Capacity of enterprises within industrial parks

The capacity of enterprises within industrial parks determines their ability to participate in and sustain the EIP model, as reflected in their technological level, management capacity, financial resources, and environmental compliance. Enterprises with strong capabilities are more proactive in technological innovation, industrial symbiosis, and effectively utilizing support policies, thereby facilitating the transition of industrial parks toward an ecological model.

2.3. EXPERIENCE IN SUPPORTING ECO-INDUSTRIAL PARK DEVELOPMENT AT THE PROVINCIAL LEVEL IN SELECTED COUNTRIES AND IN VIET NAM, AND LESSONS LEARNED

2.3.1. Experiences in supporting eco-industrial park development worldwide and in Viet Nam

2.3.1.1. Tianjin Eco-Industrial Park, China

The Tianjin Economic-Technological Development Area (TEDA), established in 1984, is one of the 14 successful eco-industrial parks in China. Support for EIP transformation in Tianjin is implemented by the TEDA Administrative Committee through several key measures, including: promoting the establishment of environmental institutional frameworks; implementing solutions to foster industrial symbiosis and develop industrial park infrastructure; and adopting a "planning and support" model for EIP development.

2.3.1.2. Devens Eco-Industrial Park, Massachusetts, United States

The Devens Eco-Industrial Park was established in 1993. Support for its development is provided by the Devens Enterprise Commission and MassDevelopment. The development of the Devens EIP is supported through several key approaches, including: promoting local support policies; establishing dedicated institutions to provide opportunities, knowledge, and educational guidance, as well as to facilitate enterprise networking; and developing performance indicators to measure achievements and identify gaps.

2.3.1.3. Nam Cau Kien Eco-Industrial Park, Viet Nam

Nam Cau Kien Industrial Park is located in Thuy Nguyen District, Hai Phong City. Developed by Shinec Joint Stock Company, it is a pioneering model in Hai Phong in registering for transformation into an eco-industrial park. The Hai Phong city government has incorporated EIP development and transformation into its resolutions and action plans, setting targets to convert 2–3 industrial parks by 2025. At the same time, it has introduced support mechanisms, invested in infrastructure, promoted industrial symbiosis, strengthened international cooperation, and integrated digital transformation and smart industrial park development. Nam Cau Kien serves as a representative pilot model, benefiting from international technical support, resource efficiency and cleaner production (RECP) assessments, and initiatives to promote industrial symbiosis. It has also attracted high-tech investment projects and demonstrated the proactive role of the infrastructure developer in building a green business community, gradually meeting EIP criteria.

2.3.2. Lessons learned for provincial-level support for eco-industrial park development

First, enhancing awareness and building capacity is a necessary starting condition. Second, establishing an enabling institutional environment serves as a fundamental foundation. Third, technical support for EIP development should be systematic and comprehensive. Fourth, promoting research and technological innovation must be closely aligned with practical conditions. Fifth, financial mechanisms and economic incentives play a crucial role in stimulating the transition. Sixth, it is essential to mobilize international cooperation and engage non-state actors. Seventh, support should combine both direct and indirect approaches. Finally, attention should be paid to institutional differences and context-specific conditions between the studied cases and Da Nang in order to design appropriate support solutions.

Chapter 3
RESEARCH DESIGN AND METHODOLOGY

3.1. RESEARCH DESIGN

The research process consists of three main stages:

Stage 1: A theoretical review is conducted to propose a research model of factors influencing support for eco-industrial park (EIP) development in Da Nang City, based on the literature review.

Stage 2: A preliminary study is carried out using the Delphi method (two rounds) with 15 experts to determine the level of consensus, screen relevant factors, and finalize the list of factors for inclusion in the formal model.

Stage 3: The main study is conducted using the Analytic Hierarchy Process (AHP) to determine the relative importance of factors influencing support for EIP development in Da Nang City.

3.2. RESEARCH MODEL AND HYPOTHESES

3.2.1. Final research model

The research model of factors influencing support for eco-industrial park development in Da Nang City comprises five groups of factors, along with their corresponding criteria as follows: state institutions and policies for EIP development (6 criteria); local socio-economic conditions (4 criteria); capacity of local government (6 criteria); level of industrial park development in the locality (4 criteria); and capacity of enterprises within industrial parks (6 criteria).

3.2.2. Research Hypotheses

H1: The factor groups (TC, ĐP, CQ, KCN, DN) differ in their levels of influence on support for EIP development in Da Nang City.

H2: The individual criteria within each factor group differ in their levels of influence on support for EIP development in Da Nang City.

3.3. RESEARCH METHODS

3.3.1. Data Collection Methods

3.3.1.1. Secondary data collection

The dissertation draws on international literature from databases such as Web of Science and Scopus, as well as domestic sources from the database of the Ministry of Science and Technology, using keywords related to eco-industrial park (EIP) development and management. All materials are manually screened for relevance. The study also compiles legal documents, programs, and projects from Viet Nam, international organizations, and local authorities such as Da Nang, related to sustainable development and EIPs. After collection, the data are classified, analyzed, and compared across time and content in order to systematize the theoretical and practical foundations of provincial government support for EIP development.

3.3.1.2. Primary data collection

The Delphi method is conducted in two rounds with 15 experts. In the first round, a focus group discussion is organized with all 15 experts. In the second round, a structured questionnaire is administered, asking the same experts to evaluate the importance of each factor using a 5-point Likert scale. The Analytic Hierarchy Process (AHP) is applied to determine the relative weights and priority of factor groups based on expert evaluations. The number of experts involved in the AHP analysis is eight.

3.3.2. Data Processing Methods

The study employs the Content Validity Ratio (CVR) to assess the relevance of factors; examines the percentage of consensus, mean values, and interquartile range (IQR); and determines the priority levels and weights of factors and their associated criteria.

Chapter 4
CURRENT STATUS OF SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

4.1. OVERVIEW OF ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

4.1.1. Current status of industrial park operations

As of June 2025, Da Nang has six industrial parks and one high-tech park in operation. The city is currently pursuing a strategy to expand and develop additional industrial parks, with a target of having 2–3 industrial parks meeting EIP standards by 2030.

4.1.2. Current status of eco-industrial park development

4.1.2.1. Development process of eco-industrial parks

Da Nang began its transition toward the EIP model in 2015 under the project "Implementation of Eco-Industrial Park Initiatives towards Sustainable Industrial Zones in Viet Nam" (2014–2019), with Hoa Khanh Industrial Park as a participant. Since 2020, Hoa Khanh Industrial Park has continued to participate in Phase II of the project "Implementation of Eco-Industrial Parks in Viet Nam under the Global Eco-Industrial Parks Programme." After nearly a decade of implementation, Hoa Khanh Industrial Park has achieved positive outcomes in economic, social, and especially environmental performance. Building on these initial achievements, Da Nang has set a direction to scale up and continue the transition in two additional industrial parks: Hoa Khanh Expansion Industrial Park and Hoa Cam Industrial Park (Phase 1).

4.1.2.2. Model of eco-industrial park development

The transition to the EIP model at Hoa Khanh Industrial Park has been implemented following a planning-based (top-down) approach.

4.1.2.3. Approach to eco-industrial park development

The development of the EIP model at Hoa Khanh Industrial Park follows a transformation approach, involving upgrading and restructuring based on existing infrastructure and conditions.

4.1.3. Outcomes of eco-industrial park development

In terms of quantity, as of early 2025, only one industrial park—Hoa Khanh Industrial Park—has undergone transformation into an EIP. In the cases of Hoa Cam Industrial Park (Phase 1) and Hoa Khanh Expansion Industrial Park, the transformation process has not yet been implemented in practice.

In terms of scale, there has been a noticeable increase in the proportion of land allocated to EIP development relative to the total industrial land area of the city by 2025.

Regarding compliance with EIP criteria, based on the standards stipulated in Decree No. 35/2022/ND-CP, Hoa Khanh Industrial Park has met 6 out of 9 criteria. In terms of EIP components, Hoa Khanh Industrial Park has not yet developed an EIP database. While investments have been made to upgrade other components, significant limitations remain. According to Report No. 431/BC-UBND (2025) of the Da Nang People's Committee on the implementation of the "Da Nang Environmental City" Project for the period 2021–2030, achieving the target of having one industrial park meeting national EIP standards by 2025 is considered unlikely due to various challenges in the transition process.

4.2. CURRENT STATUS OF SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY FROM 2014 TO THE PRESENT

4.2.1. Support content

4.2.1.1. Awareness raising and capacity building for eco-industrial park

The Da Nang authorities have actively participated in and coordinated the implementation of the UNIDO eco-industrial park (EIP) project during the 2014–2024 period, promoting training activities, domestic workshops, and participation in international programs to enhance awareness and management capacity among state agencies, enterprises, and stakeholders within the industrial ecosystem.

The Da Nang Hi-Tech Park and Industrial Zones Authority has gradually shifted from a participatory role to a coordinating role, expanding its activities from communication and awareness-raising to specialized technical training, including resource efficient and cleaner production (RECP), industrial symbiosis, energy auditing, chemical safety, and environmental compliance.

Numerous specific programs have been implemented with the participation of hundreds of enterprises, contributing to the formation of both domestic and international cooperation networks, and strengthening institutional capacity and human resources for the transition to EIPs. As a result, awareness and practical capacity have initially improved, with enterprises becoming more proactive in adopting eco-industrial and circular economy models.

4.2.1.2. Creating an enabling environment for eco-industrial park development

Da Nang has gradually established an institutional environment for EIP development through three phases: prior to 2015, focusing on building environmental foundations; from 2015 to 2020, strengthening the legal framework and waste treatment infrastructure; and since 2020, clearly defining a development orientation toward a green and circular economy, with targets of having at least one EIP meeting national standards by 2025 and 2–3 EIPs by 2030.

The city has implemented various industrial promotion policies, supporting industries programs, technological innovation initiatives, and interest rate subsidies, thereby providing financial and technical incentives for enterprises to upgrade technologies, improve energy efficiency, and reduce emissions. Administrative reforms have also been accelerated: the appraisal time for environmental impact assessment (EIA) reports has been reduced to 40 days (27 days for key projects), 99% of environmental dossiers are submitted online, and decentralization has been strengthened for the industrial zone management authority. In addition, Da Nang has actively coordinated national policies, supported enterprises in adopting cleaner production practices, and facilitated access to green finance. However, support measures remain largely integrated into broader policies, lacking dedicated programs specifically targeting EIPs, which limits policy coherence and reduces the overall effectiveness of the transition process.

4.2.1.3. Technical support for eco-industrial park development

Da Nang has improved coordination mechanisms for environmental management in industrial zones and, by 2025, has consolidated institutional arrangements and established a dedicated focal point for EIP development. Infrastructure and services at Hoa Khanh Industrial Park have been ensured, with stable security and order.

The Resource Efficient and Cleaner Production (RECP) program has been implemented for 29 enterprises, proposing 334 solutions and implementing 228 of them. These efforts have resulted in annual savings of over VND 14 trillion, reductions of approximately 50,000 m^3 of wastewater, 7,000 tons of CO_2 emissions, and 2,700 tons of solid waste.

Industrial symbiosis activities have identified 22 opportunities, conducted feasibility studies for six, and implemented three projects in practice. Typical models demonstrate short payback periods (0.1–1.2 years) and significant CO_2 emission reductions. Industrial park infrastructure has been comprehensively upgraded (100% occupancy rate, a wastewater treatment plant with a capacity of 5,000 m^3/day, and automated monitoring systems).

However, Hoa Khanh Industrial Park has not yet developed an EIP database. Only an initial digital foundation, market assessments, and basic data tools have been established.

4.2.1.4. Financial support and access to finance for eco-industrial park development

Da Nang ensures that at least 1% of its budget expenditure is allocated to environmental activities, operationalized through the "Environmental City" Project with an estimated total budget of VND 2,818 billion. The city mobilizes diverse funding sources (state budget, ODA, and socialized capital) to provide "seed funding" for the transition of industrial parks toward eco-industrial models.

The expenditure structure is organized into three levels: (i) enterprise level, supporting cleaner production, equipment upgrades, and waste treatment technologies; (ii) industrial park level, focusing on infrastructure investment and environmental monitoring systems; and (iii) institutional level, including ISO 14000 certification, training, and communication to enhance environmental management capacity.

Industrial promotion programs and interest rate support schemes have facilitated enterprises' access to preferential financing, with increasing coverage and investment levels, shifting from equipment modernization toward environmental performance and cleaner production. Enterprises also have access to local funds (Environmental Protection Fund, Science and Technology Fund, Da Nang Investment Development Fund – DDIF), international green finance, and strong incentives such as tax reductions, land rental incentives, and one-stop administrative procedures, thereby attracting investment aligned with ecological orientation.

Nevertheless, financial resources remain integrated within broader environmental objectives, and no dedicated financial mechanism or fund specifically for EIP development has yet been established, limiting the stability and focus of investment for the transition process.

4.2.1.5. Research and development (R&D) support for eco-industrial parks adapted to local conditions

During 2023–2024, Da Nang assigned the Biotechnology Center to implement two science and technology projects on EIPs, with budgets of VND 250 million and VND 156 million, respectively, under the "Environmental City" Project.

A key outcome is the development of an EIP criteria framework consisting of 35 criteria and 57 indicators for three groups of stakeholders (infrastructure investors, industrial parks, and enterprises), covering four dimensions: management, economic, environmental, and social aspects. Field surveys conducted at Hoa Khanh Industrial Park were used to assess compliance levels and propose models and solutions for transition.

This criteria framework has the potential to become an official assessment tool for the city, serving as a basis for industrial park classification, support policy design, and measurement of progress toward EIP transformation. The continuous implementation over

two years, from criteria development to practical application, reflects a clear commitment and long-term orientation of the Da Nang government toward EIP development.

4.2.1.6. International cooperation in eco-industrial park development

Da Nang has actively promoted international cooperation to advance EIP development in alignment with environmental urban development, circular economy, and sustainable energy. A notable example is the UNIDO EIP project, which has supported the transition of Hoa Khanh Industrial Park, involving dozens of enterprises, generating cost savings, and establishing a pilot model.

In parallel, the city has implemented various related initiatives, such as City Lab, the Circular Economy Hub, solar energy projects, urban energy security, waste management, and environmental protection programs, with support from organizations such as UNDP, the EU, and USAID. These initiatives provide important financial, technical, and knowledge resources, contributing to the institutional foundation for EIP transition.

However, international support remains largely project-based, short-term, and fragmented, and has not yet formed a stable, long-term mechanism specifically dedicated to EIP development.

4.2.2. Support approaches

4.2.2.1. Direct support

Da Nang provides direct support for the transition to eco-industrial parks through training and capacity-building programs for enterprises, the industrial zone management authority, and relevant officials, particularly at Hoa Khanh Industrial Park. At the same time, the city has strengthened its management apparatus, upgraded key EIP components, and provided technical, technological, and financial support, as well as facilitating access to funding sources for enterprises.

4.2.2.2. Indirect support

Indirect support for EIP development in Da Nang is reflected in the government's role in creating an enabling environment. This includes integrating green and circular economy principles into industrial, land-use, and urban planning, as well as prioritizing the attraction of high-tech and environmentally friendly industries.

Administrative reforms, one-stop mechanisms, and digital transformation have helped reduce costs and risks for enterprises. In addition, the city coordinates national programs and develops green urban infrastructure and logistics systems, thereby providing a foundation for the transition toward eco-industrial parks.

4.3. EVALUATION OF SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY BASED ON ESTABLISHED CRITERIA

Table 4.1. Evaluation of support for EIP development in Da Nang

No.	Evaluation Criteria	Actual Results
1. Support content		
1.1. Comprehensiveness and scope of support		
1	Coverage of core EIP components	No support for EIP database component
2	Coverage across EIP development stages	All stages in Hoa Khanh have been supported
3	Spatial coverage	Only 1 pilot EIP (Hoa Khanh)
1.2. Effectiveness of support measure		
4	Legality	Aligned with national policy (Decree 35/2022/ND-CP)
5	Institutionalization	Integrated into programs, plans and projects

No.	Evaluation Criteria	Actual Results
6	Policy consistency	No unified and dedicated EIP policy in Da Nang
7	Behavioral impact	Firms are more proactive in adopting eco-solutions
1.3. Efficiency of support		
8	EIP development results	Hoa Khanh meets 6/9 national criteria
9	Replication	Planned but not yet implemented
10	Cost-effectiveness	No sufficient data to evaluate
1.4. Sustainability of support		
11	Financial sustainability	Dependent on short-term funding; no dedicated fund
12	Institutional sustainability	No stable local legal framework yet
13	Capacity sustainability	Limited human resources; no on-site experts
14	Environmental/social sustainability	Initial benefits observed
2. Support approaches		
15	*Diversity of support methods*	Relatively diverse (direct & indirect tools)
16	*Balance of methods*	Indirect support dominates
17	*Appropriateness of support mechanisms*	Appropriateness Generally suitable for SMEs but not large firms.

4.4. AHP ANALYSIS OF FACTORS INFLUENCING SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

The study employs the Delphi method in combination with the Analytic Hierarchy Process (AHP) to identify and assess factors influencing support for eco-industrial park (EIP) development in Da Nang. The results indicate that all five groups of factors have an impact, among which the institutional and policy framework exerts the strongest influence. Within this group, criteria TC6 and TC5 have the highest weights. This is followed by local socio-economic conditions, with criterion ĐP4 having the greatest influence (weight = 0.0583). The capacity of local government ranks third in terms of influence, with an overall weight of 0.100, and within this group, criterion CQ has the highest weight. The detailed results are presented as follows:

Table 4.1. Summary of global influence weights of factors

Factor group weight	Criteria weight		Global weight
0,389	TC1	0,222	0,0864
	TC2	0,202	0,0786
	TC3	0,186	0,0591
	TC4	0,152	0,0591
	TC5	0,265	0,1031
	TC6	0,345	**0,1342**
0,130	ĐP1	0,287	0,0373
	ĐP2	0,180	0,0234
	ĐP3	0,149	0,0194
	ĐP4	0,351	**0,0456**
0,100	CQ1	0,145	0,0145
	CQ2	0,168	0,0168
	CQ3	0,176	0,0176

	CQ4	0,240	**0,0240**
	CQ5	0,203	0,0203
	CQ6	0,218	0,0218
0,077	KCN1	0,194	0,0149
	KCN2	0,310	**0,0239**
	KCN3	0,179	0,0138
	KCN4	0,237	0,0182
0,075	DN1	0,224	0,0168
	DN2	0,283	**0,0212**
	DN3	0,095	0,0071
	DN4	0,108	0,0081
	DN5	0,282	0,0211
	DN6	0,267	0,0200

4.5. OVERALL ASSESSMENT

4.5.1. Achievements

Da Nang has established a relatively solid foundation of awareness and capacity for eco-industrial park development across both the public and enterprise sectors, transitioning from conceptual understanding to practical implementation, as evidenced by cleaner production models and industrial symbiosis initiatives at Hoa Khanh Industrial Park.

At the same time, the city has created a favorable institutional "framework" by integrating green economy principles, supporting technological innovation, implementing administrative reforms, and coordinating national policies. Technical, financial, and R&D support have begun to generate tangible results, forming a scientific basis, infrastructure, and resource foundation for EIP transition. International cooperation has played a crucial leveraging role in providing financial resources, knowledge, and pilot models, thereby enhancing institutional capacity and expanding the city's green transition ecosystem.

4.5.2. Limitations

Support for EIP development in Da Nang still lacks a dedicated policy framework and a clear roadmap, resulting in fragmented orientation, difficulties in resource coordination, and challenges in scaling up successful models. Technical support remains largely confined to pilot implementation at Hoa Khanh Industrial Park, with a lack of on-site advisory services, EIP databases, industrial symbiosis coordination mechanisms, and specialized management tools. In terms of finance and R&D, resources remain limited and fragmented, access to funding is constrained, and research activities tend to focus more on surveys and criteria development rather than technological solutions and practical applications. International cooperation is mainly project-based, short-term, and fragmented, lacking a stable mechanism and a long-term strategic program specifically dedicated to EIP development.

4.5.3. Causes of limitations

In practice, one of the major obstacles to EIP development in Viet Nam lies in the lack of coherence and clarity in the legal framework. Existing regulations remain fragmented, with insufficient technical guidance, criteria, and specific incentives for EIP development. Many regulations related to waste management, resource reuse, and EIP

certification procedures are not yet fully aligned with practical conditions and the requirements of industrial symbiosis implementation. Regarding local socio-economic conditions, the relatively small industrial scale, limited budget, and technological capacity have led the city to prioritize short-term economic growth, resulting in a cautious and incremental approach to EIP transition. In terms of local government capacity, certain limitations persist, including the absence of a dedicated focal unit, the prevalence of part-time staff, and limited specialized training in EIP-related fields. At the industrial park level, infrastructure developers remain cautious due to high investment costs, while many industrial parks have already reached full occupancy, making it difficult to adjust planning and establish industrial symbiosis networks. At the enterprise level, most firms are small and medium-sized enterprises with limited financial resources, technological capabilities, and managerial capacity. Their focus on short-term profitability reduces incentives to engage in industrial symbiosis and green innovation.

Chapter 5
SOLUTIONS AND POLICY RECOMMENDATIONS TO ENHANCE SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

5.1. INTERNATIONAL AND DOMESTIC CONTEXTS AFFECTING SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

5.1.1. International context

The global trend toward green growth, Net Zero commitments, and increasingly stringent ESG standards presents opportunities for Da Nang to attract investment, advanced technologies, and international support for eco-industrial park (EIP) development, while enhancing its investment competitiveness.

The Fourth Industrial Revolution and digital transformation also provide a technological foundation for smart industrial park management and industrial symbiosis. However, rising global environmental standards, climate risks, limitations in local governance capacity, and the difficulties faced by small and medium-sized enterprises (SMEs) in adapting to these changes pose significant challenges.

In addition, increasing competition among localities in attracting green investment, along with the need for cross-sectoral coordination and more effective mobilization of international resources, places considerable pressure on the city government.

5.1.2. Domestic context

Domestically, policy orientations toward green growth, circular economy, Net Zero, and digital transformation, as reflected in Party guidelines and state policies and laws, provide a favorable political and legal foundation for Da Nang to promote EIP transformation and improve investment selection standards. Public awareness of environmental issues and the city's long-standing identity as an "environmental city" constitute important advantages. However, disparities in capacity and resources among enterprises - particularly SMEs - remain a major constraint.From an economic perspective, the need for recovery and enhanced industrial competitiveness creates momentum for EIP development, but limited financial resources for green infrastructure, waste treatment, and renewable energy remain significant challenges. The planned merger of Da Nang and Quang Nam under Resolution No. 60-NQ/TW opens up a larger industrial development space, greater integration capacity, and the potential to shape a sustainable development model, thereby contributing to green growth, circular economy objectives, and improved

resource efficiency and regional competitiveness. However, this process also requires adjustments in institutional frameworks, planning, human resources, and coordination mechanisms to ensure coherent and effective transition.

5.1.3. Scientific basis for proposing orientations and solutions to enhance EIP development support in Da Nang city

The proposed orientations and solutions for enhancing EIP development support in Da Nang are designed for the period up to 2030, with a vision to 2045, and apply to the newly merged Da Nang administrative unit, including industrial parks previously located in Quang Nam Province. These proposals are grounded in several key considerations. First, the former Da Nang serves as the regional core, and its existing EIP support mechanisms reflect governance capacity, policy approaches, and multi-stakeholder coordination models. Second, while the merger expands the scale and diversity of the industrial landscape, it does not alter the fundamental objective of transitioning toward the EIP model. Third, from a methodological perspective, the proposed solutions are not mechanically replicated but are adapted to the new context, characterized by larger scale, more diverse industrial structures, and stronger requirements for regional linkage. Fourth, prior to the merger, no industrial park in Quang Nam had formally implemented or operated under the EIP model, resulting in limited empirical data to fully assess the effectiveness of provincial-level support. Nevertheless, Quang Nam has shown initial orientations toward EIP development, particularly in industrial zones located along the eastern corridor of the Da Nang–Quang Ngai expressway.

5.2. ORIENTATIONS FOR ENHANCING SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

Following the merger, the new Da Nang will have 20 industrial parks, of which one has been transformed into an EIP and two others have identified transition orientations. In addition, industrial parks located east of the Da Nang–Quang Ngai expressway are being planned according to the EIP model.

Based on current conditions, the development orientation for EIPs in Da Nang up to 2030 should aim to increase the number of industrial parks meeting national EIP standards from the pre-merger target of 2–3 parks to 5–6 parks by 2030. Enhancing support for EIP development in Da Nang should follow these key directions: (i) unlocking resources through institutional and policy reforms for EIP development; (ii) creating an enabling environment and improving local policy absorption capacity;
(iii) strengthening governance capacity and the network coordination role of local government; (iv) activating the role of industrial parks and enterprises as key actors and promoting green transition incentives.

5.3. SOLUTIONS TO ENHANCE SUPPORT FOR ECO-INDUSTRIAL PARK DEVELOPMENT IN DA NANG CITY

5.3.1. Enhancing awareness and capacity for eco-industrial park development

First, shift the focus from general awareness-raising to specialized, practice-oriented capacity building. Second, develop a core team of EIP professionals within the Da Nang Hi-Tech Park and Industrial Zones Authority. Third, establish on-site learning mechanisms using the “Hoa Khanh Industrial Park as a pilot model.” Fourth, leverage digital transformation by developing online training platforms, data libraries, and shared toolkits on cleaner production and industrial symbiosis for enterprises. Fifth, link capacity-building activities with concrete incentives (financial and technical support, recognition schemes for green enterprises, and preferential access to land or infrastructure services).

5.3.2. Creating an enabling environment for eco-industrial park development

First, develop a dedicated local policy framework for EIPs. Da Nang should formulate a specific program or action plan for EIP development instead of integrating it into fragmented environmental or circular economy initiatives. Second, design strong economic incentive packages to offset transition costs for enterprises. Third, continue administrative reform toward "green governance" through a "green one-stop mechanism" tailored to EIP-related projects. Fourth, establish an inter-sectoral coordination mechanism for EIP development. Fifth, develop external markets and supporting ecosystems beyond industrial parks. Sixth, introduce mechanisms encouraging voluntary commitments from enterprises toward green production, positioning environmental protection as a core business value.

5.3.3. Technical support for eco-industrial park development

Technical support should focus on five key areas: (i) EIP management services; (ii) spatial planning and infrastructure; (iii) industrial symbiosis; (iv) resource efficiency and cleaner production; (v) EIP database.

5.3.4. Financial support and access to finance

Establish and operate a dedicated EIP transition fund using local budget resources while mobilizing international financing. Increase funding for R&D in key technologies and strengthen partnerships with external technical organizations. Utilize industrial park revenues to reinvest in shared ecological infrastructure. Enhance the government's intermediary role in connecting enterprises with green finance. Introduce local financial incentives, expand public–private partnerships (PPP), and encourage leading firms to drive industrial symbiosis and resource sharing within industrial parks.

5.3.5. Research and development (R&D) support

Prioritize applied research addressing practical transformation needs, particularly at Hoa Khanh Industrial Park. Promote innovation in cleaner production, circular economy, and low-carbon technologies. Strengthen linkages among universities, research institutes, management authorities, and enterprises to form interdisciplinary research groups. Develop data platforms to support EIP research and encourage commercialization of research outcomes through pilot testing, incubation, and integration with innovation funding programs.

5.3.6. International cooperation for eco-industrial park development

Strengthen cooperation with international organizations experienced in EIP development. Promote joint research and technology transfer with universities and innovation centers. Mobilize international financial resources, particularly climate funds and green finance programs. Enhance local government capacity to manage and coordinate international cooperation, ensuring alignment with local development strategies and reducing dependency on short-term project-based support.

5.4. POLICY RECOMMENDATIONS

5.4.1. For the National Assembly

5.4.2. For the Government

5.4.3. For the Ministry of Finance

5.4.4. For the Ministry of Agriculture and Environment

5.4.5. For the Ministry of Industry and Trade

CONCLUSION

The development of eco-industrial parks (EIPs) represents an inevitable trend toward achieving green growth, sustainable development, and the transformation of the growth model in Da Nang City. This dissertation has systematized the theoretical foundations of provincial-level support for EIP development, while clarifying the content, instruments, and approaches of such support within the local institutional and socio-economic context.

The research findings indicate that the role of the Da Nang city government in promoting EIP development is reflected in five key areas and implemented through two main approaches: direct and indirect support. These support mechanisms have initially generated positive economic, social, and environmental outcomes at the pilot site of Hoa Khanh Industrial Park. However, several limitations remain, most notably the fact that, as of 2025, Da Nang has acknowledged its inability to achieve the target of upgrading Hoa Khanh Industrial Park to meet national EIP standards.

By applying the Delphi method and the Analytic Hierarchy Process (AHP), the study identifies five key factors influencing support for EIP development in Da Nang and determines their relative levels of impact. These findings provide a basis for analyzing the causes of existing limitations and serve as a foundation for proposing orientations, solutions, and policy recommendations presented in Chapter 5.

Despite efforts to provide a comprehensive and systematic analysis, the study has several limitations. First, due to time and resource constraints, the research mainly focuses on support activities during the recent period (2020–2025), without fully capturing long-term dynamics or interactions across different governance levels (central–local–enterprise). Second, the empirical analysis is largely limited to Hoa Khanh Industrial Park and does not include comparative assessments with other EIPs or similar industrial zones in comparable localities. Third, data collection relies primarily on secondary sources and administrative reports, which may limit the timeliness and comprehensiveness of the findings. Furthermore, the quantitative analysis focuses on identifying the magnitude of influence of factors rather than their directional effects.

Future research could be extended in two main directions. First, more in-depth quantitative studies are needed to measure the impact of specific support mechanisms on EIP transformation outcomes. Second, comparative analyses between Da Nang and other localities—both domestically and internationally (e.g., Ho Chi Minh City, Binh Duong, Tianjin (China), or Kalundborg (Denmark))—would provide valuable practical insights and opportunities for policy learning and replication. Additionally, further research should explore multi-level coordination mechanisms and governance models linking government, enterprises, and communities in EIP development, aiming to achieve substantive and context-appropriate sustainable development.

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