buildings

MDPI

Article

Energy Management and Environmental Protection in Industrial Parks: A Comparative Study of Central Taiwan Science Park and Silicon Glen

Fu-Hsuan Chen [1] and Hao-Ren Liu [2,*]

[1] Department of Science Education and Application, National Taichung University of Education, No. 140, S Minsheng Rd., West Dist., Taichung City 403514, Taiwan; fhchen@mail.ntcu.edu.tw
[2] Department of Graduate Institute of Building and Planning, National Taiwan University, No. 1, Sec. 4, Roosevelt Rd., Taipei 10617, Taiwan
* Correspondence: d01544007@ntu.edu.tw; Tel.: +886-2-3366-3366; Fax: +886-2-2362-7651

Abstract: This manuscript focuses on analyzing the growth dynamics of the Central Taiwan Science Park (CTSP) and Silicon Glen in Scotland with a specific emphasis on their approaches to energy, environmental conservation, and economic management. The objective is to provide insights into their sustainable development strategies. In terms of energy, CTSP addresses Taiwan's energy security and green transformation challenges, while Silicon Glen concentrates on Scotland's wind energy generation technologies. Both regions prioritize the advancement of renewable energy sources and smart grid technologies. In the realm of environmental conservation, both CTSP and Silicon Glen prioritize environmental protection and sustainability by implementing rigorous environmental monitoring measures. Regarding economic management, CTSP and Silicon Glen serve as vital technology industry hubs in Taiwan and Scotland, respectively, attracting a multitude of high-tech and startup enterprises. This growth is facilitated through various means, including policy support, access to research resources, and robust infrastructure. This manuscript presents a comparative analysis of these two industrial parks, focusing on their environmental and economic management strategies. It aims to elucidate the principles underpinning the sustainable development and economic growth of industrial parks, offering valuable insights to decision-makers and stakeholders involved in the planning of sustainable industrial parks.

Keywords: sustainable development; energy management; environmental protection; economic management

Citation: Chen, F.-H.; Liu, H.-R. Energy Management and Environmental Protection in Industrial Parks: A Comparative Study of Central Taiwan Science Park and Silicon Glen. *Buildings* **2023**, *13*, 2299. https://doi.org/10.3390/buildings13092299

Academic Editor: Chiara Bedon

Received: 9 August 2023
Revised: 4 September 2023
Accepted: 7 September 2023
Published: 9 September 2023

1. Introduction

This research paper aims to conduct a comparative assessment of the environmental, energy, and economic management aspects of the Central Taiwan Science Park (CTSP) and Silicon Glen in Scotland. Both industrial parks were established and developed under distinct geographical, political, and economic conditions. They have emerged as notable examples of successful high-tech clusters, employing various policies and management tools to ensure their prosperity.

Silicon Glen, one of the earliest industrial parks globally, has earned a well-established reputation in the electronics field, boasting highly developed infrastructure over the past 70 years. Effective management policies have also contributed to the park's prosperity [1,2]. CTSP, which is approximately 20 years younger [3], learned from the development of Silicon Glen. CTSP encompasses various industries, including optoelectronics, integrated circuits, precision machinery, and computer peripherals [4]. The historical trajectory of CTSP bears a resemblance to that of Silicon Glen. In the 1950s, Silicon Glen hosted only a few foreign companies, such as IBM, which established factories in the region [5]. However, in the 1990s, the number of companies underwent rapid growth. Initially, these companies

relied heavily on low-cost labor for assembly and production, resulting in relatively low-value-added products that were mostly exported to neighboring European countries [6]. This situation mirrors Taiwan's scenario in the early 1950s when foreign companies like RCA and Philips established assembly plants in Taiwan [7].

CTSP, located in the central region of Taiwan, was established in the 1970s and has emerged as one of the most significant technology industry clusters for Taiwanese companies [8]. It leverages its advantageous geographical location and well-developed infrastructure to attract numerous domestic and international high-tech enterprises, which establish research and development centers and production bases in the park. CTSP focuses on information and communication technology, semiconductors, optoelectronics, bio-medicine, and green energy as its primary development directions, fostering the growth of numerous innovative companies and nurturing technological talents. The park places strong emphasis on sustainable development, advocating for energy conservation, emission reduction, and environmental protection to enhance both economic and environmental sustainability.

Silicon Glen serves as the hub for the electronics and semiconductor industries in Scotland. It rose to prominence from the 1990s to the early 2000s due to its significant presence in these sectors. However, the region encountered an economic downturn in the early 2000s, primarily attributed to the collapse of the global high-tech economy. Nonetheless, the Scottish government and relevant stakeholders endeavored to revive Silicon Glen and attain sustainable development through a series of policies and measures [9].

In summary, both CTSP in Taiwan and Silicon Glen in Scotland serve as significant high-tech clusters. They have achieved notable success within their respective contexts but have also faced challenges and issues during their development. Therefore, conducting a comprehensive assessment of their sustainable development and providing targeted policy insights holds great significance. The purpose of this research is to examine the recent development characteristics of CTSP and Silicon Glen in Scotland, with a specific focus on energy, environmental, and economic management. By comparing the performance of CTSP and Silicon Glen, this study aims to provide valuable insights for decision-makers and stakeholders in the areas of sustainable development and economic growth. Based on the research objective, the following research questions were formulated:

- What are the key areas of focus in energy management for CTSP and Silicon Glen?
- What are the priorities in environmental management for CTSP and Silicon Glen?
- What roles do CTSP and Silicon Glen play in economic management?

In response to the challenges of ensuring supply security and promoting a green transformation, this research seeks to obtain valuable insights through a performance comparison of CTSP and Silicon Glen in terms of energy, environmental, and economic management. These insights can guide decision-makers and stakeholders in achieving sustainable development and economic growth. Specifically, the research questions of this study are centered around energy, environmental, and economic aspects.

2. Materials and Methods

This study adopted a comparative research approach, focusing on CTSP in Taiwan and Silicon Glen in Scotland, to conduct a comprehensive evaluation. The research paper comprises several sections, including a thorough examination of the key factors contributing to the financial success of CTSP and a comparative analysis of the similarities and differences between Silicon Glen and CTSP. Three data collection and analysis strategies were utilized in this study: a literature review, comparative analysis, and data analysis.

- Literature review: A variety of academic reports, research papers, policies, and case studies were reviewed in the process of reconstructing the parks' historical background, their implemented strategies, and the unique features of each industrial hub.
- Comparative analysis: Relevant data on energy consumption, the implementation of green technologies, economic metrics, and the state of the environment around the parks' areas were collected and processed to conduct a comparative analysis of Silicon Glen and CTSP.

- Utilizing official government data for analysis: To carry out an objective analysis, researchers employed quantitative data from the reports of both parks, with a primary focus on energy, environmental, and economic management aspects. The data assessment encompassed a thorough analysis of energy, environmental, and economic management data on CTSP and Scotland's Silicon Glen through the use of the decision tree algorithm. This signifies that the analysis examined how these industrial parks tackle energy consumption, environmental impacts (such as waste management and emissions), and economic factors (including costs, revenues, and profitability). This process entailed collecting data from diverse sources, considering multiple variables, and scrutinizing various operational facets of the parks. Additionally, the analysis framework was built upon six theoretical perspectives. In order to identify crucial comparative factors, the study incorporated the innovation systems approach, the triple helix model, the sustainable development framework, policy mix and governance analysis, comparative analysis, and regional development theory for a comprehensive analysis. This data-driven approach, coupled with theoretical frameworks, contributed to a more holistic comprehension of the distinct characteristics and commonalities in sustainable development practices within these regions.

The novelty of this paper lies in its comprehensive exploration of the CTSP and its comparison with Silicon Glen. While there are existing studies that have touched on related topics, no studies have precisely delved into the specific comparison and analysis of these two regions in terms of their development paths, policy approaches, and outcomes. The purpose of this study is to provide policymakers and decision-makers with relevant and contemporary information on modern industrial clusters that can assist authorities in gaining a deeper understanding of these two management styles while highlighting their unique features.

To sum up, this research paper is unique, as it is the first attempt to conduct a comparative study of Scottish and Taiwanese industrial hubs, and it examines two styles of management and problem-solving present in these parks. Through the combination of various methods, a profound understanding of the similarities and differences in sustainable development between the two regions is achieved, thus offering valuable policy implications and references.

3. Comprehensive Comparative Analysis: CTSP vs. Scotland's Silicon Glen

These comparisons highlight the similarities and differences between Taiwan's CTSP and Scotland's Silicon Glen in terms of their geographic location, their industrial structure, their government support, education and research, and the entrepreneurship environment (Table 1). The success of these regions can be attributed to government support, excellent talent and research environments, and long-term investments in technological innovation.

Table 1. Comparisons between CTSP and Scotland's Silicon Glen.

Comparison Topics	CTSP	Scotland's Silicon Glen
Geographic Location	Located in the central region of Taiwan, including Taichung Science Park, Huwei Science Park, Houli Science Park, Earlin Science Park, and Chung Hsing Science Park [4].	Situated in the Scottish Highlands, serves as a hub for technological innovation.
Industrial Structure	Emphasizes high-tech industries, such as semiconductors, optoelectronics, and biotechnology, attracting renowned international companies.	Focuses on technological innovation and the digital economy, including software development, AI, and data science.

Table 1. *Cont.*

Comparison Topics	CTSP	Scotland's Silicon Glen
Government Support	Receives strong support from the Taiwanese government with policies, measures, and funding to promote the development and innovation of the technology industry.	Also receives support from the Scottish government, which provides innovation research funds, tax incentives, and other measures to encourage the growth and innovation of tech enterprises.
Education and Research	Surrounded by prestigious universities and research institutions, providing an excellent talent pool and research resources.	Boasts several higher education institutions, such as the University of Edinburgh and the University of Glasgow, offering abundant research and educational resources [10].
Entrepreneurship Environment	Offers a well-developed entrepreneurial ecosystem, including accelerators, investment funds, and incubators, supporting and nurturing startups.	Similarly, has a thriving entrepreneurship environment, attracting numerous startups and venture capital investments.

4. Research Theory Review

In the existing literature, numerous studies have investigated various aspects of technology clusters and innovation ecosystems. Clustering theory, as summarized in this paper, explores the spatial concentration of high-tech industries and the benefits of agglomeration [11–20]. Studies on innovation ecosystems analyze interactions among firms, universities, research institutions, and government agencies with a focus on knowledge exchange and technology transfer [21–26]. Policymakers need to comprehend the specific challenges within developing entrepreneurial ecosystems and formulate policies adapted to the local context [27]. The triple helix model explores the collaboration among academia, industry, and government [28–34]. Sustainable development frameworks evaluate the environmental, social, and economic aspects of clusters [35–44]. Policy mix and governance analyses assess the policy measures supporting technology clusters [45–47].

While these existing studies have provided valuable insights into different dimensions of technology clusters, none of them have comparatively analyzed CTSP and Silicon Glen in terms of their geographic location and industrial structure, government support, education and research, and the entrepreneurship environment (see Table 1). This paper's unique contribution lies in its specific focus on the comparison between these two regions, identifying the best practices, lessons to be learned, and transferable policy implications. This offers insights into the unique dynamics of these regions and contributes to the broader discourse on technology clusters, innovation ecosystems, and regional development. This comparative approach adds a new layer of understanding to the field by examining how different regional contexts, policies, and strategies impact the development and success of technology clusters.

In light of the following research theories, the factors and criteria needed for a comprehensive assessment of the CTSP and Scotland's Silicon Glen were drawn, and their policy implications were studied, as outlined in Table 2.

By employing these research theories or concepts, policymakers and researchers can undertake a comprehensive evaluation of CTSP and Silicon Glen, analyzing their strengths, weaknesses, opportunities, and challenges. Comparative analysis was selected as the methodology for this study. The findings obtained from this analysis can offer valuable insights for policymaking and contribute to the formulation of strategies aimed at promoting sustainable development, fostering innovation, and driving economic growth within these technology clusters.

Table 2. Research Theories or Concepts for Assessing CTSP and Silicon Glen.

Research Theory	Content Summary
Clustering Theory	Examines the spatial concentration of high-tech industries and the benefits of agglomeration in terms of knowledge spillovers, networking opportunities, and economies of scale [11,12,48–53].
Innovation Ecosystems	Focuses on the interactions and relationships among firms, universities, research institutions, and government agencies in the innovation ecosystem [50]. Analyzes how these systems facilitate knowledge exchange, technology transfer, and innovation-driven growth [54,55].
Triple Helix Model	Explores the collaboration between academia, industry, and government in fostering innovation and regional development [56,57]. Assesses the coordination and collaborative dynamics among these sectors in CTSP and Silicon Glen.
Sustainable Development Framework	Provides a lens to assess the environmental, social, and economic aspects of the clusters [37]. Evaluates efforts and outcomes in terms of environmental management, resource efficiency, social inclusiveness, and economic prosperity [58]
Policy Mix and Governance	Analyzes the design and implementation of policy measures to support technology clusters [59]. Evaluates the effectiveness and coherence of policy interventions, including government policies, incentives, regulations, and institutions [60].
Comparative Analysis	Compares and contrasts the development paths, policy approaches, and outcomes of CTSP and Silicon Glen. Identifies best practices, lessons learned, and transferable policy implications between the two regions.
Regional Development Theory [61,62]	Analyzes the regional development models and success factors of CTSP and Silicon Glen. Provides relevant regional development strategies [20] and policy recommendations.

5. Examining Government Policies and Initiatives That Have Facilitated Advancement

An examination of government policies and initiatives that facilitated the growth of Silicon Glen and Taiwan's electronics industry yields several notable observations:

(1) State-led science parks: Both Scotland and Taiwan have established state-led science parks with the aim of attracting and nurturing high-tech industries. In Scotland, collaboration among entities such as the Scottish Chamber of Commerce and Industry, the Scottish Government, and three official organizations enables nationwide marketing efforts. In Taiwan, the Science Park Agency, which operates under National Science and Technology, is responsible for overseeing the science parks. These park management agencies demonstrate a strong drive and administrative effectiveness, playing a vital role in attracting investments and providing business support.

(2) High-quality workforce: Both regions successfully attracted international manufacturers due to their high-quality workforces. Scotland is home to numerous universities and higher education institutions, with more than 700 professionals engaged in the field of electronics. A significant number of these individuals are researchers specializing in areas such as artificial intelligence, optoelectronics, and research on very large-scale integrated systems (VLIS). Universities including Dundee, Edinburgh, Glasgow, Heriot-Watt, and St. Andrews conduct research in the field of semiconductors. Collaboration among colleges, universities, manufacturers, and governments promotes the development of the local semiconductor industry. Institutions such as the Microelectronics Imaging and Analysis Center, Wolfson Microelectronics, and National Microelectronics have been established to support these initiatives.

(3) Industrial upgrading and transformation: Scotland has implemented initiatives to promote the upgrading and transformation of its industries. "Global Connection Strategies," launched in 2001, focuses on areas including digital connectivity, entering global product markets, attracting investments, and making Scotland an attractive place for both working and living. By integrating talent, information, and technology, these strategies attract additional funding and contribute to the development of the

region. CTSP has also attracted a highly educated workforce, contributing to its growth. The educational level of CTSP employees reflects the quality of the workforce. Various industries, including the photoelectric sector, precision machinery, computer peripherals, communications, biotechnology, integrated circuits, and digital content, employ skilled personnel.

(4) Focus on next-generation semiconductor design: Unlike Taiwan, which has developed a significant number of local information and electronics industries, Silicon Glen has primarily relied on foreign investments. The "Alba Semiconductor Design Center Complex" project aims to position Scotland as an international player in next-generation semiconductor design with a particular focus on system-on-chip development.

These government policies and initiatives have played a crucial role in supporting the development and growth of Silicon Glen in Scotland and Taiwan's electronics industry. They have included measures to attract investments, promote research and development, enhance workforce quality, and facilitate industrial upgrading and transformation.

6. Assessment of Energy Management: Comparing the Performance of the Two Regions in Terms of Energy Security and Green Transitions

Energy consumption in Taiwan and the United Kingdom falls within the range of 2500–5000 TWN (Terawatt-hours), indicating a significant amount of primary energy required for various end-uses, including electricity generation and transportation. Primary energy refers to the initial energy input before it undergoes transformation into different forms for specific applications. This includes energy sources such as fossil fuels, nuclear power, and renewable energy sources [63]. The data provided were sourced from Our World in Data, which relies on information from BP and the Shift Data Portal (see Figure 1). These figures highlight the substantial energy demands in both countries and emphasize the importance of efficient energy management and the development of sustainable energy sources to meet present and future needs.

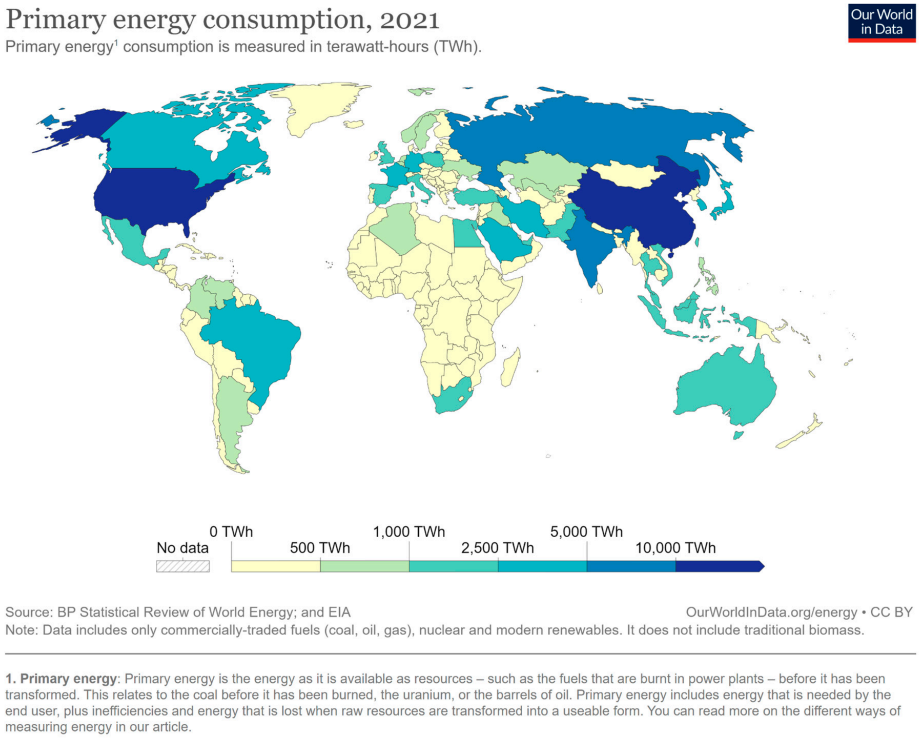

Figure 1. Energy consumption worldwide.

There are some differences in the performance of energy security and green transitions between Central Taiwan and Central Scotland:

6.1. Energy Security: Energy Security in Central Taiwan and Central Scotland

(1) Central Taiwan's energy security:

Central Taiwan heavily relies on imported petroleum fuels and natural gas for its energy supply. To ensure energy security and mitigate supply risks, the Taiwanese government is committed to diversifying energy sources, establishing energy reserves, and implementing relevant policies and regulations [64]. Furthermore, Taiwan is actively promoting the development of renewable energy to reduce its dependence on imported fuels [65–74].

However, Taiwan faces several challenges regarding its current energy and electricity mix. One major concern is the country's excessive dependence on a limited number of oil and coal suppliers, making its energy supply chain vulnerable and fragile. The energy security of Taiwan faces long-term threats due to potential conflicts in the Middle East involving major oil-producing nations such as Iran or Saudi Arabia. Additionally, Taiwan's economy heavily relies on the power-intensive electronics industry, presenting another challenge. The electronics sector, responsible for a significant portion of electricity consumption, relies on coal (45%) and liquefied natural gas (LNG) (36%) for power generation, thereby contributing significantly to carbon dioxide emissions in Taiwan. Notably, the Semiconductor Manufacturing Company (TSMC) of Taiwan alone consumes approximately 4.8% of the nation's total power [75], surpassing even the capital city, Taipei. Consequently, the projected increase in electricity demand not only has detrimental environmental consequences but also poses challenges for companies themselves, as customers such as Apple require their suppliers to transition to renewable energy sources. In response to these challenges, Taiwan is actively pursuing substantial changes to its electricity mix, as depicted in Figure 2. As an interim measure, Taiwan has chosen to employ LNG due to its lower carbon emission factor compared to coal or oil.

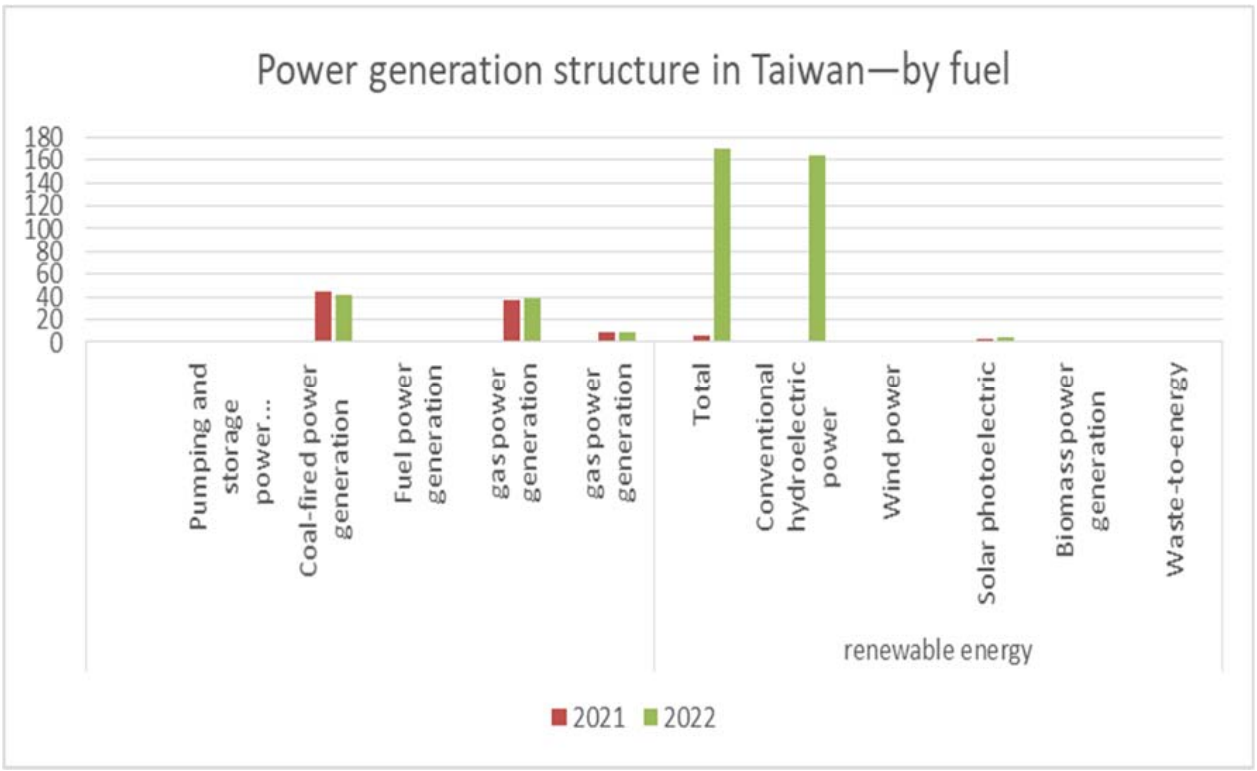

Figure 2. Power generation structure in Taiwan by fuel [76].

Central Taiwan has made significant advancements in its transition towards a greener future. The government of Taiwan has devised a comprehensive strategy for the development of renewable energy [74], outlining targets for renewable energy generation and

encouraging the establishment of solar and wind power projects. Moreover, Taiwan has implemented a range of initiatives aimed at enhancing energy efficiency and curbing energy consumption, fostering the adoption of sustainable energy sources, and diminishing the reliance on fossil fuels.

(2) Central Scotland's energy security:

Central Scotland has made remarkable strides in its transition to a greener energy landscape. The region benefits from a diverse array of energy sources, including oil, natural gas, nuclear energy, and renewable energy, owing to its abundant natural resources, such as wind, hydropower, and biomass [77]. The Scottish government has proactively implemented policies and measures to foster the growth and integration of renewable energy with a focus on ensuring long-term sustainability and energy security. Consequently, the majority of electricity generated in the region, amounting to 87.8% in 2021 (see Figure 3), is sourced from low-carbon alternatives, while fossil fuels contribute a mere 10.9%. This signifies a substantial departure from the generation composition observed in 2010, where an equal share of the generation originated from low-carbon and fossil fuel sources.

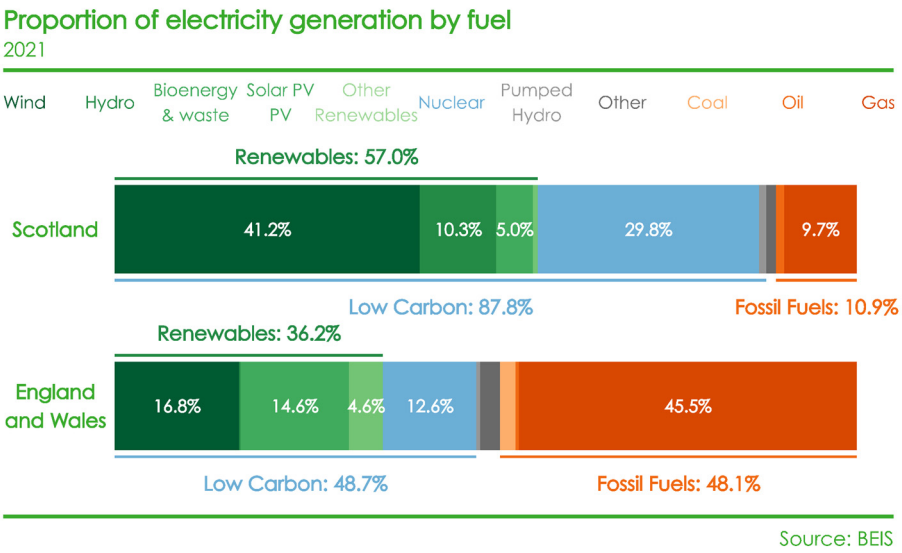

Figure 3. Proportion of electricity generation by fuel in Scotland in 2021. Source: Scottish Energy Statistics Hub (https://scotland.shinyapps.io/Energy/?Section=RenLowCarbon&Subsection=RenElec&Chart=ElecGen), accessed on 26 June 2023.

The growth of renewable energy has played a pivotal role in propelling the surge in low-carbon generation, with its proportion soaring from 19.0% in 2010 to 57.0% in 2021. National and international incentives, such as the Renewables Obligation and the EU Renewable Energy Directive [78–80], have played significant roles in facilitating this transition.

These developments highlight the positive impact of government initiatives and supportive policies in promoting a sustainable and diversified energy landscape in Central Scotland. The significant increase in renewable capacity not only signifies Scotland's commitment to cleaner energy sources but also underscores the region's efforts to enhance energy security and reduce carbon emissions.

Central Scotland has made remarkable strides in transitioning towards a greener energy system. The region possesses abundant wind energy resources and has emerged as a key player in the European wind energy industry through the development of wind power projects. Additionally, the Scottish government actively encourages the development of other renewable energy sources, including tidal energy, solar energy, and biomass.

In summary, both Central Taiwan and Central Scotland have implemented various measures to address energy security and promote green transitions. While Central Taiwan

heavily relies on imported energy, it seeks to enhance its energy supply security through the diversification of energy sources and the development of renewable energy. On the other hand, Central Scotland boasts a more diversified energy supply and actively promotes the growth of renewable energy. Both regions have achieved varying degrees of success in their green transition efforts, but Central Scotland exhibits greater potential in the field of renewable energy, particularly in the domain of wind energy.

6.2. Assessment of Environmental Protection: Evaluating Measures in Waste Management, Water Resource Management, and Environmental Monitoring

Regarding the measures taken by Central Taiwan and Central Scotland in environmental protection, we can assess their actions in waste management, water resource management, and environmental monitoring.

6.2.1. Waste Management

Central Taiwan: Central Taiwan has taken proactive measures in waste management. The Taiwanese government has implemented policies for waste classification and recycling, encouraging residents to sort and recycle their waste. Additionally, modern waste treatment facilities, including incinerators and landfills, have been established in Central Taiwan to effectively process waste and reduce environmental impacts [81].

Central Scotland: Central Scotland has adopted proactive waste management strategies to foster resource circularity and waste reduction, in line with the Scottish government's objective of achieving a zero-waste society and promoting a circular economy [82–85]. The area has implemented state-of-the-art waste treatment facilities, such as incinerators and biomass utilization plants, to facilitate both waste minimization and energy recovery. The overarching goal is to minimize reliance on virgin resources and maximize the reuse, recycling, and recovery of resources, rather than treating them as disposable waste [86].

In order to accomplish these objectives, Central Scotland has established ambitious targets for waste reduction and recycling by 2025. These targets include a 15% reduction in total waste generation in Scotland compared to the 2011 levels, a 33% reduction in food waste compared to the 2013 levels, a 70% recycling rate for the remaining waste, and a maximum landfill disposal rate of 5% for the remaining waste [87]. Furthermore, Central Scotland aims to align with the EU objective of ensuring that all plastic packaging is economically recyclable or reusable by 2030.

To effectively manage and reduce waste, several actions have been undertaken in Central Scotland. These include promoting resource efficiency by discouraging the use of single-use materials, implementing measures to reduce and recycle food waste, introducing a deposit return scheme for drink containers, supporting efforts to tackle litter and fly tipping through collaboration with delivery partners, seeking advice from the Expert Panel on Environmental Charging, providing funding to Zero Waste Scotland for waste-reducing initiatives, and supporting the Scottish Environment Protection Agency (SEPA) in regulating waste treatment and disposal.

In sum, Central Scotland has demonstrated a proactive management style and achieved excellent results in waste management, particularly in recycling and waste reduction. Through the implementation of innovative waste treatment facilities and the pursuit of ambitious targets, the region aims to create a zero-waste society, maximize resource recovery, and contribute to the transition towards a circular economy.

6.2.2. Water Resource Management

Central Taiwan: Central Taiwan faces water scarcity issues, making water resource management crucial. The Taiwanese government has implemented a series of measures, including improving water resource utilization efficiency, enhancing water resource allocation, and constructing reservoirs. Additionally, the Central Taiwan Science Park (CTSP) has implemented measures such as improving water resource utilization efficiency, enhancing water resource allocation, and constructing detention ponds.

Central Scotland: The geographical profile of this region differs significantly from Taiwan's, particularly in terms of climate and water resources. Central Scotland, despite its abundant water resources, faces unique challenges due to its terrain. Over the years, the region has developed an effective pattern of water utilization and conservation. Water conservation initiatives, including water quality monitoring and governance, play a significant role in the region's water resource management. Some notable management strategies in Scotland involve including stakeholders in decision-making processes, establishing uniform principles for manufacturers and consumers, striving for continuous improvement in water supply services, and implementing the Hydro Nation strategy to optimize the economic benefits derived from water resources [88].

Efforts to reduce flood risk in Central Scotland involve collaborative work with partners to manage flood risk, enhance flood resilience, and raise awareness among communities. These actions contribute to the overall objective of protecting and improving Scotland's water environment, which is considered a crucial natural asset supporting public health, well-being, wildlife, and sustainable economic growth.

Legislation plays a crucial role in shaping the management of water resources in Central Scotland. Acts such as Sewerage (Scotland) Act 1968, Water (Scotland) Act 1980, Water Services etc. (Scotland) Act 2005, and Water Resources (Scotland) Act 2013 delineate the powers and responsibilities pertaining to the regulation and development of the water industry. Furthermore, specific regulations such as Private Water Supplies (Scotland) Regulations 2006, Water Environment (Controlled Activities) (Scotland) Regulations 2011, and Reservoirs (Scotland) Act 2011 provide guidance and stipulations to ensure the provision of safe drinking water, safeguard and enhance the water environment, and mitigate the risks of flooding [89].

In brief, Central Scotland places significant emphasis on the management and protection of its water resources. The region implements various measures, including water resource management plans, monitoring systems, and legislative frameworks, to ensure the sustainable utilization of water, preserve water quality, and mitigate flood risks. These endeavors align with the Scottish government's vision of fostering a resilient and well-governed water sector, which contributes to the overall well-being and prosperity of Central Scotland.

6.2.3. Environmental Monitoring

Central Taiwan: Central Taiwan has an Environmental Protection Agency responsible for monitoring and managing the environment. The agency conducts regular surveillance of environmental indicators, such as air quality, water quality, soil pollution, and noise, and undertakes appropriate actions to enhance environmental quality. Central Taiwan also encourages public engagement in environmental monitoring and reporting instances of environmental violations [90].

Central Scotland: Central Scotland has established an Environmental Protection Agency, along with several environmental monitoring institutions, to effectively monitor and manage the environmental quality within the region. These entities engage in the regular monitoring of crucial environmental indicators such as air quality, water quality, soil pollution, and noise levels. Their primary goal is to safeguard the environment and proactively enhance air quality.

The Environmental Protection Agency in Central Scotland holds the responsibility for regulating, controlling, and monitoring activities that might impact air quality in Scotland. This authority is derived from the Pollution Prevention and Control (Scotland) Regulations of 2012. According to these regulations, the agency oversees and monitors specific industrial activities in Scotland that could potentially generate airborne pollution. Additionally, under the Environment (Scotland) Act of 1995, the agency collaborates with local authorities to monitor, manage, and improve air quality across the region.

In addition to its regulatory and policy roles, the agency offers guidance and consultation to the government, industry stakeholders, and the general public regarding pollution

control and various environmental concerns. It actively endeavors to synchronize its efforts with the goals and targets established by Scottish, UK, and EU authorities to combat global climate change and address the cross-border transportation of pollutants. Moreover, the agency administers the Airborne Hazards Emergency Response Service (AHERS) on behalf of the Scottish Government. This service plays a crucial role in responding to emergencies and hazards related to airborne pollutants.

Overall, the Environmental Protection Agency in Central Scotland serves as a dedicated entity for monitoring, regulating, and managing environmental quality [91]. It actively encourages public participation in environmental protection initiatives and provides information and channels for the public to engage in environmental monitoring and decision-making processes.

6.3. Assessment of Economic Growth

The assessment of the characteristics and success factors of the two regions, CTSP and Silicon Glen in Scotland, as technology industry hubs reveals distinctive traits that contribute to economic growth. Here is a comprehensive evaluation of the two regions:

1. Technological innovation and industry diversity: Both CTSP and Silicon Glen prioritize technological innovation, attracting numerous high-tech companies and innovative startups. These regions exhibit diverse industrial structures, encompassing sectors such as semiconductors, software development, biotechnology, and more. This diversity fosters stable and sustainable economic growth.
2. Industry–academia collaboration and knowledge transfer: Both regions place great value on collaboration between industry and academia, establishing close partnerships to facilitate the transfer of knowledge and technology. This collaboration accelerates the commercialization and market application of technological advancements, driving rapid industry development and economic growth. It enables the vibrant growth of the technology industry and contributes to overall economic progress.
3. International collaboration and market expansion: Both CTSP and Silicon Glen prioritize international collaboration and market expansion, actively engaging with international companies and markets to promote the internationalization of local technology enterprises. This emphasis on international collaboration stimulates the export of technology products and services, thereby driving economic growth.

In conclusion, CTSP and Silicon Glen, as technology industry hubs, demonstrate characteristics and success factors such as technological innovation, industry–academia collaboration, a strong talent pool, government support and favorable policy environments, and international collaboration. These attributes provide valuable insights and inspiration for other regions aiming to develop their technology industries and promote economic growth.

7. Policy Insights for Sustainable Energy Development

Both CTSP and Silicon Glen in Scotland are renowned technology industry hubs, and they can draw policy insights from each other regarding sustainable energy development. The following are policy measures from both regions that can provide insights for sustainable energy development:

- Government support and incentives: Both the CTSP and Silicon Glen receive active support from local governments, which offer various measures to incentivize investments and research and development in the field of sustainable energy. These policy measures can serve as references for other regions in formulating corresponding sustainable energy policies.

7.1. Policy Insights for Environmental Protection and Resource Management

When it comes to environmental protection and resource management, the following policy insights can be derived from the experiences of the CTSP and Silicon Glen:

- Development of environmental laws and regulatory mechanisms: Governments should develop corresponding environmental laws and regulatory mechanisms, requiring businesses to implement environmental protection measures and reduce adverse impacts on the environment.
- Resource conservation and recycling: Both the CTSP and Silicon Glen emphasize resource conservation and recycling. Governments can encourage businesses to implement energy-saving and emission reduction measures and promote resource recovery and reuse. Additionally, governments can support the research and development of environmentally friendly technologies and products to facilitate efficient resource utilization.
- Promotion of green transportation and sustainable mobility: Both the CTSP and Silicon Glen are dedicated to reducing the environmental impact of transportation. Governments can encourage businesses to adopt green transportation policies, promote public transportation and ride-sharing models, and provide supporting infrastructure, such as bicycle lanes and electric vehicle charging facilities, to reduce car usage and carbon emissions.
- Emphasis on ecological conservation and green space development: Both the CTSP and Silicon Glen value ecological conservation and green space development. Governments can require businesses to protect and restore ecosystems during construction processes and encourage the establishment of green spaces and landscape facilities within industrial parks. Additionally, governments can formulate corresponding ecological protection policies to safeguard natural resources and biodiversity.
- Environmental education and public participation: Both the CTSP and Silicon Glen conduct environmental education and public participation activities to raise the public awareness and understanding of environmental protection. Governments can collaborate with businesses, schools, and communities to organize environmental education initiatives and encourage public participation in environmental conservation actions.

In conclusion, policy insights for environmental protection and resource management can be drawn from the experiences of the CTSP and Silicon Glen. These insights include the development of environmental regulations and governance, resource conservation and recycling, the promotion of green transportation and sustainable mobility, and an emphasis on ecological conservation and green space development, as well as environmental education and public participation. Other regions can consider these policy measures when formulating their own environmental protection and resource management policies.

7.2. Policy Insights for Promoting Technological Industry Development

The CTSP and Silicon Glen in Scotland are both successful clusters in the technological industry. Here are policy insights into how they promote technological industry development:

- Establishing a supportive environment for innovation: Both the CTSP and Silicon Glen are committed to establishing an environment that supports innovation. This includes providing excellent infrastructure, research centers, and scientific institutions, as well as fostering an open atmosphere for innovation. Governments can offer corresponding financial support and tax incentives to attract businesses and talent to engage in research and innovation in the technology field.
- Facilitating international scientific and technological cooperation: Governments can play a vital role in facilitating international scientific and technological cooperation. This can be achieved by initiating technology exchanges, fostering market collaborations, and promoting the internationalization of local technology enterprises. Additionally, governments can provide support measures, such as international market research and business promotion, to assist businesses in entering international markets.
- Talent cultivation and attraction: Both the CTSP and Silicon Glen place a strong emphasis on talent cultivation and attraction. Governments can collaborate with educational institutions to cultivate technological talents and provide relevant education and

training programs. Simultaneously, governments can offer measures, such as visa facilitation and favorable treatment, to attract outstanding talent from both domestic and international sources to develop the technological industry locally.

In summary, policy insights for promoting technological industry development from the CTSP and Silicon Glen include establishing a supportive environment for innovation, promoting industry–academia collaboration, providing investment and entrepreneurship support, engaging in international cooperation and market expansion, and cultivating and attracting talent. These policy measures can serve as references for other regions in formulating corresponding policies to foster technological industry development.

8. Conclusions

In this study, we have conducted a comprehensive analysis of energy, environmental, and economic management in the CTSP and Silicon Glen regions. By examining the strategies, practices, and policies employed in these technology hubs, we have gained valuable insights that can inform decision-making and shape future initiatives in similar contexts.

Energy management: The focal points of energy management in CTSP and Silicon Glen revolve around supply security, green transformations, and sustainable development. Both regions prioritize the diversification of their energy sources, reducing the reliance on fossil fuels, and promoting renewable energy technologies. They also emphasize energy conservation and efficiency measures to ensure a reliable and uninterrupted energy supply for the industries located within these technology hubs.

Environmental management: In terms of environmental management, both CTSP and Silicon Glen implement rigorous environmental monitoring measures to comply with regulations and standards. They regularly monitor air quality, water quality, and noise levels to proactively prevent pollution and mitigate environmental impacts. The regions are committed to promoting sustainable resource management, waste reduction, recycling initiatives, and water conservation practices. Their primary objective is to safeguard the environment, reduce carbon emissions, and contribute to the overall sustainability of their respective areas.

Economic management: Regarding economic management, both CTSP and Silicon Glen play vital roles as technology industry hubs, attracting high-tech enterprises and startups through the provision of supportive infrastructure, research resources, and policy support. These regions offer state-of-the-art facilities, such as research and development centers, technology parks, and incubators, tailored to the specific needs of technology-driven industries. Moreover, they foster collaborations with universities, research institutions, and industry stakeholders to drive innovation, facilitate knowledge transfer, and promote the commercialization of technology.

The substantial success of CTSP and Silicon Glen can be attributed to significant government intervention and support. Both regions' governments have implemented favorable policies, incentives, and investments to nurture the growth of these technology hubs. They provide tax incentives, grants, subsidies, and funding programs to attract and retain high-tech companies. Additionally, their governments support infrastructure development, enhance connectivity, and establish collaborative frameworks with universities and research institutions to stimulate industry growth, innovation, and technology transfer.

Recommendations for future work: However, it is important to acknowledge the limitations of this research. The scope of this study focused on CTSP and Silicon Glen, and while these regions provide valuable insights, the applicability of the findings to other contexts might vary. Further research could explore a broader range of technology hubs in different geographical and socio-economic settings to enhance the generalizability of the conclusions drawn from this study.

In light of the findings and limitations of this research, we recommend several directions for future work. Researchers could delve deeper into the specific policy instruments and incentive structures that have been most effective in driving sustainable energy, environmental, and economic development in these regions. Additionally, a longitudinal

analysis could provide insights into the long-term impacts of these strategies and policies. Furthermore, comparative studies involving more regions could offer a richer understanding of the factors that contribute to successful technology hubs and inform more tailored strategies for others aspiring to achieve similar outcomes.

In summary, the analysis of CTSP and Silicon Glen's experiences offers valuable lessons for regions aiming to develop sustainable technology hubs. By combining diversified energy strategies, rigorous environmental monitoring, and supportive economic policies, these regions have created models that can guide the transformation of energy sectors, the protection of the environment, and the fostering of economic growth through innovation and collaboration.

Author Contributions: Writing—original draft, F.-H.C.; Writing—review and editing, F.-H.C. and H.-R.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Adams, S.B. Stanford and Silicon Valley: Lessons on Becoming a High-Tech Region. *Calif. Manag. Rev.* **2005**, *48*, 29–51. [CrossRef]
2. Muldoon, J.; Liguori, E.W.; Solomon, S.; Bendickson, J. Technological Innovation and the Expansion of Entrepreneurship Ecosystems. *Rev. Manag. Sci.* **2023**, *17*, 1789–1808. [CrossRef]
3. Yan, M.-R.; Chien, K.-M.; Hong, L.-Y.; Yang, T.-N. Evaluating the Collaborative Ecosystem for an Innovation-Driven Economy: A Systems Analysis and Case Study of Science Parks. *Sustainability* **2018**, *10*, 887. [CrossRef]
4. Chen, F.-H. Assessing Sustainable Development Initiatives in Central Taiwan Science Park: A Study of Residents' Opinions and the Impact on the Urban Ecosystem. *Buildings* **2023**, *13*, 1202. [CrossRef]
5. Dimitratos, P.; Liouka, I.; Ross, D.; Young, S. The Multinational Enterprise and Subsidiary Evolution: Scotland since 1945. *Bus. Hist.* **2009**, *51*, 401–425. [CrossRef]
6. Glasmeier, A. Factors Governing the Development of High Tech Industry Agglomerations: A Tale of Three Cities. *Reg. Stud.* **1988**, *22*, 287–301. [CrossRef]
7. Todd, D. *Routledge Revivals: The World Electronics Industry (1990)*; Routledge: Abingdon-on-Thames, UK, 2018.
8. Chen, F.-H.; Liu, H.-R. Evaluation of Sustainable Development in Six Transformation Fields of the Central Taiwan Science Park. *Sustainability* **2021**, *13*, 4336. [CrossRef]
9. Castells, M. *Technopoles of the World: The Making of 21st Century Industrial Complexes*; Routledge: Abingdon-on-Thames, UK, 2014.
10. Ahmed, S.; Davidson, P.; Durkacz, K.; Macdonald, C.; Richard, M.; Walker, A. The Provision of Mathematics and Statistics Support in Scottish Higher Education Institutions (2017): A Comparative Study by the Scottish Mathematics Support Network. *MSOR Connect.* **2018**, *16*, 5–19. [CrossRef]
11. Döring, T.; Schnellenbach, J. What Do We Know about Geographical Knowledge Spillovers and Regional Growth?: A Survey of the Literature. *Reg. Stud.* **2006**, *40*, 375–395. [CrossRef]
12. Iammarino, S.; McCann, P. The Structure and Evolution of Industrial Clusters: Transactions, Technology and Knowledge Spillovers. *Res. Policy* **2006**, *35*, 1018–1036. [CrossRef]
13. Alecke, B.; Alsleben, C.; Scharr, F.; Untiedt, G. Are There Really High-Tech Clusters? The Geographic Concentration of German Manufacturing Industries and Its Determinants. *Ann. Reg. Sci.* **2006**, *40*, 19–42. [CrossRef]
14. Feldman, M.P. The New Economics of Innovation, Spillovers and Agglomeration: Areview of Empirical Studies. *Econ. Innov. New Technol.* **1999**, *8*, 5–25. [CrossRef]
15. Henderson, J.V. Understanding Knowledge Spillovers. *Reg. Sci. Urban Econ.* **2007**, *37*, 497–508. [CrossRef]
16. Bekele, G.W.; Jackson, R. *Theoretical Perspectives on Industry Clusters*; West Virginia University: Morgantown, WV, USA, 2006.
17. Rosenthal, S.S.; Strange, W.C. Evidence on the Nature and Sources of Agglomeration Economies. In *Handbook of Regional and Urban Economics*; Elsevier: Amsterdam, The Netherlands, 2004; Volume 4, pp. 2119–2171.
18. Capello, R. Entrepreneurship and Spatial Externalities: Theory and Measurement. *Ann. Reg. Sci.* **2002**, *36*, 387–402. [CrossRef]
19. Boshuizen, J.; Geurts, P.; Van der Veen, A. Regional Social Networks as Conduits for Knowledge Spillovers: Explaining Performance of High-Tech Firms. *Tijdschr. Voor Econ. En Soc. Geogr.* **2009**, *100*, 183–197. [CrossRef]
20. Yan, D. Measurement and Comparison of the Innovation Spatial Spillover Effect: A Study Based on the Yangtze River Delta and the Pearl River Delta, China. *Systems* **2023**, *11*, 90. [CrossRef]

21. Asheim, B.T.; Smith, H.L.; Oughton, C. Regional Innovation Systems: Theory, Empirics and Policy. *Reg. Stud.* **2011**, *45*, 875–891. [CrossRef]
22. Papaioannou, T.; Wield, D.; Chataway, J. Knowledge Ecologies and Ecosystems? An Empirically Grounded Reflection on Recent Developments in Innovation Systems Theory. *Environ. Plan. C Gov. Policy* **2009**, *27*, 319–339. [CrossRef]
23. Radosevic, S.; Yoruk, E. Entrepreneurial Propensity of Innovation Systems: Theory, Methodology and Evidence. *Res. Policy* **2013**, *42*, 1015–1038. [CrossRef]
24. Li, X. Exploring the Spatial Heterogeneity of Entrepreneurship in Chinese Manufacturing Industries. *J. Technol. Transf.* **2017**, *42*, 1077–1099. [CrossRef]
25. Lassen, A.H.; McKelvey, M.; Ljungberg, D. Knowledge-intensive Entrepreneurship in Manufacturing and Creative Industries: Same, Same, but Different. *Creat. Innov. Manag.* **2018**, *27*, 284–294. [CrossRef]
26. Sousa, C.; Silva, L.S. Knowledge-Intensive Entrepreneurship: A Systematic Review and Future Directions. *Manag. Res. J. Iberoam. Acad. Manag.* **2019**, *17*, 50–67. [CrossRef]
27. Brown, R. Mission-Oriented or Mission Adrift? A Critical Examination of Mission-Oriented Innovation Policies. *Eur. Plan. Stud.* **2020**, *29*, 739–761. [CrossRef]
28. Leydesdorff, L. The Knowledge-Based Economy and the Triple Helix Model. *arXiv* **2012**, arXiv:1201.4553.
29. Cai, Y.; Etzkowitz, H. Theorizing the Triple Helix Model: Past, Present, and Future. *Triple Helix* **2020**, *7*, 189–226. [CrossRef]
30. Saad, M.; Zawdie, G. *Theory and Practice of Triple Helix Model in Developing Countries: Issues and Challenges*; Routledge: Abingdon-on-Thames, UK, 2011.
31. Cai, Y.; Amaral, M. The Triple Helix Model and the Future of Innovation: A Reflection on the Triple Helix Research Agenda. *Triple Helix* **2021**, *8*, 217–229. [CrossRef]
32. Liu, Y.; Huang, Q. University Capability as a Micro-Foundation for the Triple Helix Model: The Case of China. *Technovation* **2018**, *76*, 40–50. [CrossRef]
33. Scalia, M.; Barile, S.; Saviano, M.; Farioli, F. Governance for Sustainability: A Triple-Helix Model. *Sustain. Sci.* **2018**, *13*, 1235–1244. [CrossRef]
34. Ng, W.K.B.; Appel-Meulenbroek, R.; Cloodt, M.; Arentze, T. Towards a Segmentation of Science Parks: A Typology Study on Science Parks in Europe. *Res. Policy* **2019**, *48*, 719–732. [CrossRef]
35. Bossel, H. *Indicators for Sustainable Development: Theory, Method, Applications*; International Institute for Sustainable Development: Winnipeg, MB, Canada, 1999.
36. Shi, L.; Han, L.; Yang, F.; Gao, L. The Evolution of Sustainable Development Theory: Types, Goals, and Research Prospects. *Sustainability* **2019**, *11*, 7158. [CrossRef]
37. Baker, S.; Kousis, M.; Young, S.; Richardson, D. *The Politics of Sustainable Development: Theory, Policy and Practice within the European Union*; Psychology Press: London, UK, 1997.
38. Dasgupta, P. Measuring Sustainable Development: Theory and Application. *Asian Dev. Rev.* **2007**, *24*, 1–10. [CrossRef]
39. Van den Bergh, J.C. *Ecological Economics and Sustainable Development. Theory, Methods and Applications*; Edward Elgar Publishing Ltd.: Cheltenham, UK, 1996.
40. Simon, D. Sustainable Development: Theoretical Construct or Attainable Goal? *Environ. Conserv.* **1989**, *16*, 41–48. [CrossRef]
41. Sneddon, C.; Howarth, R.B.; Norgaard, R.B. Sustainable Development in a Post-Brundtland World. *Ecol. Econ.* **2006**, *57*, 253–268. [CrossRef]
42. Jabareen, Y. A New Conceptual Framework for Sustainable Development. *Environ. Dev. Sustain.* **2008**, *10*, 179–192. [CrossRef]
43. Pisano, U. Resilience and Sustainable Development: Theory of Resilience, Systems Thinking. *Eur. Sustain. Dev. Netw. (ESDN)* **2012**, *26*, 50.
44. Baker, S.; Kousis, M.; Richardson, D.; Young, S. The Theory and Practice of Sustainable Development in EU Perspective. In *The Politics of Sustainable Development: Theory, Policy and Practice within the European Union*; Baker, S., Kousis, M., Richardson, D., Young, S., Eds.; Routledge: London, UK, 1997.
45. Fischer, F.; Miller, G.J. *Handbook of Public Policy Analysis: Theory, Politics, and Methods*; Routledge: London, UK, 2017.
46. Magro, E.; Wilson, J.R. Policy-Mix Evaluation: Governance Challenges from New Place-Based Innovation Policies. *Res. Policy* **2019**, *48*, 103612. [CrossRef]
47. Bynner, C. *Rationales for Place-Based Approaches in Scotland*; What Works Scotland: Aberdeenshire, UK, 2016.
48. Innocenti, N.; Capone, F.; Lazzeretti, L. Knowledge Networks and Industrial Structure for Regional Innovation: An Analysis of Patents Collaborations in Italy. *Pap. Reg. Sci.* **2020**, *99*, 55–72. [CrossRef]
49. Al-Kfairy, M.; Khaddaj, S.; Mellor, R.B. Evaluating the Effect of Organizational Architecture in Developing Science and Technology Parks under Differing Innovation Environments. *Simul. Model. Pract. Theory* **2020**, *100*, 102036. [CrossRef]
50. Nie, P.; Nie, P.; Wang, C.; Wang, C.; Lin, L. Cooperation of Firms Yielding Industrial Clusters. *Area* **2020**, *52*, 731–740. [CrossRef]
51. Filippetti, A.; Gkotsis, P.; Vezzani, A.; Vezzani, A.; Vezzani, A.; Zinilli, A. Are Innovative Regions More Resilient? Evidence from Europe in 2008–2016. *Econ. Politica* **2020**, *37*, 807–832. [CrossRef]
52. Nathan, M. Does Light Touch Cluster Policy Work? Evaluating the Tech City Programme. *Res. Policy* **2020**, *51*, 104138. [CrossRef]
53. O'Clery, N.; Kinsella, S. Modular Structure in Labour Networks Reveals Skill Basins. *Res. Policy* **2022**, *51*, 104486. [CrossRef]
54. Oh, D.-S.; Phillips, F.; Park, S.; Lee, E. Innovation Ecosystems: A Critical Examination. *Technovation* **2016**, *54*, 1–6. [CrossRef]
55. Clevenger, R.A. *Working Draft: Study Overview*; European Institute of Interdisciplinary Research: Paris, France, 2021.

56. Correia, E.; Garrido-Azevedo, S.; Carvalho, H. Supply Chain Sustainability: A Model to Assess the Maturity Level. *Systems* **2023**, *11*, 98. [CrossRef]
57. Etzkowitz, H. Innovation in Innovation: The Triple Helix of University-Industry-Government Relations. *Soc. Sci. Inf.* **2003**, *42*, 293–337. [CrossRef]
58. Mebratu, D. Sustainability and Sustainable Development: Historical and Conceptual Review. *Environ. Impact Assess. Rev.* **1998**, *18*, 493–520. [CrossRef]
59. Al Shammre, A.S.; Benhamed, A.; Ben-Salha, O.; Jaidi, Z. Do Environmental Taxes Affect Carbon Dioxide Emissions in OECD Countries? Evidence from the Dynamic Panel Threshold Model. *Systems* **2023**, *11*, 307. [CrossRef]
60. Lyulyov, O.; Pimonenko, T.; Kwilinski, A.; Dzwigol, H.; Dzwigol-Barosz, M.; Pavlyk, V.; Barosz, P. The Impact of the Government Policy on the Energy Efficient Gap: The Evidence from Ukraine. *Energies* **2021**, *14*, 373. [CrossRef]
61. Goldstein, H.A.; Luger, M.I. Science/Technology Parks and Regional Development Theory. *Econ. Dev. Q.* **1990**, *4*, 64–78. [CrossRef]
62. Parr, J.B. Growth Poles, Regional Development, and Central Place Theory. In *Proceedings of the Papers of the Regional Science Association*; Springer: Berlin/Heidelberg, Germany, 1973; Volume 31, pp. 173–212.
63. Żak-Skwierczyńska, M. Energy Transition of the Coal Region and Challenges for Local and Regional Authorities: The Case of the Bełchatów Basin Area in Poland. *Energies* **2022**, *15*, 9621. [CrossRef]
64. Yao, L.; Shi, X.; Andrews-Speed, P. Conceptualization of Energy Security in Resource-Poor Economies: The Role of the Nature of Economy. *Energy Policy* **2018**, *114*, 394–402. [CrossRef]
65. Liou, H.M. Policies and Legislation Driving Taiwan's Development of Renewable Energy. *Renew. Sustain. Energy Rev.* **2010**, *14*, 1763–1781. [CrossRef]
66. Chang, C.-T.; Lee, H.-C. Taiwan's Renewable Energy Strategy and Energy-Intensive Industrial Policy. *Renew. Sustain. Energy Rev.* **2016**, *64*, 456–465. [CrossRef]
67. Lee, H.-C.; Chang, C.-T. Comparative Analysis of MCDM Methods for Ranking Renewable Energy Sources in Taiwan. *Renew. Sustain. Energy Rev.* **2018**, *92*, 883–896. [CrossRef]
68. Chen, H.H.; Lee, A.H. Comprehensive Overview of Renewable Energy Development in Taiwan. *Renew. Sustain. Energy Rev.* **2014**, *37*, 215–228. [CrossRef]
69. Yue, C.-D.; Liu, C.-M.; Liou, E.M. A Transition toward a Sustainable Energy Future: Feasibility Assessment and Development Strategies of Wind Power in Taiwan. *Energy Policy* **2001**, *29*, 951–963. [CrossRef]
70. Chuang, M.C.; Ma, H.W. Energy Security and Improvements in the Function of Diversity Indices—Taiwan Energy Supply Structure Case Study. *Renew. Sustain. Energy Rev.* **2013**, *24*, 9–20. [CrossRef]
71. Lu, S.-M. International journal of engineering sciences & research technology a review of renewable energies in Taiwan. *Nat. Gas* **2010**, *1*, 490.
72. Dulal, H.B.; Shah, K.U.; Sapkota, C.; Uma, G.; Kandel, B.R. Renewable Energy Diffusion in Asia: Can It Happen without Government Support? *Energy Policy* **2013**, *59*, 301–311. [CrossRef]
73. Chen, T.-Y.; Oliver, S.Y.; Hsu, G.J.; Hsu, F.-M.; Sung, W.-N. Renewable Energy Technology Portfolio Planning with Scenario Analysis: A Case Study for Taiwan. *Energy Policy* **2009**, *37*, 2900–2906. [CrossRef]
74. Tsai, W.-T. Sustainability Policies and Regulations for Renewable Energy Development in Taiwan. In *Renewable Energy Production and Distribution Volume 2*; Elsevier: Amsterdam, The Netherlands, 2023; pp. 493–527.
75. Taiwan's Greatest Vulnerability Is Its Energy Supply. Available online: https://thediplomat.com/2022/09/taiwans-greatest-vulnerability-is-its-energy-supply/ (accessed on 26 June 2023).
76. Economic Statistics Data Analysis Statistics. Available online: https://dmz26.moea.gov.tw/GA/common/Common.aspx?code=M&no=9 (accessed on 29 June 2023).
77. Grubb, M.; Butler, L.; Twomey, P. Diversity and Security in UK Electricity Generation: The Influence of Low-Carbon Objectives. *Energy Policy* **2006**, *34*, 4050–4062. [CrossRef]
78. Wood, G.; Dow, S. What Lessons Have Been Learned in Reforming the Renewables Obligation? An Analysis of Internal and External Failures in UK Renewable Energy Policy. *Energy Policy* **2011**, *39*, 2228–2244. [CrossRef]
79. Sorrell, S. Interactions between the EU Emissions Trading Scheme and the UK Renewables Obligation and Energy Efficiency Commitment. *Energy Environ.* **2003**, *14*, 677–703. [CrossRef]
80. Wood, J.; Emmett, K. *Renewable Electricity in the United Kingdom and Recent Electricity Market Reform: Policy Lessons for Transition Markets*; European Bank for Reconstruction and Development: London, UK, 2011.
81. Management of General Waste-Solid Waste-Resources Circulation-EPA Topics | Environmental Protection Administration, EY. Available online: https://www.epa.gov.tw/eng/1503E5CFEF44E352 (accessed on 26 June 2023).
82. Sehnem, S.; Jabbour, C.J.C.; Pereira, S.C.F.; de Sousa Jabbour, A.B.L. Improving Sustainable Supply Chains Performance through Operational Excellence: Circular Economy Approach. *Resour. Conserv. Recycl.* **2019**, *149*, 236–248. [CrossRef]
83. Velenturf, A.P.; Purnell, P.; Tregent, M.; Ferguson, J.; Holmes, A. Co-Producing a Vision and Approach for the Transition towards a Circular Economy: Perspectives from Government Partners. *Sustainability* **2018**, *10*, 1401. [CrossRef]
84. Fletcher, C.A.; Dunk, R.M. In the Search for Effective Waste Policy: Alignment of UK Waste Strategy with the Circular Economy. *Detritus* **2018**, *4*, 48–62. [CrossRef]

85. Prendeville, S.; Cherim, E.; Bocken, N. Circular Cities: Mapping Six Cities in Transition. *Environ. Innov. Soc. Transit.* **2018**, *26*, 171–194. [CrossRef]
86. Managing Waste. Available online: http://www.gov.scot/policies/managing-waste/ (accessed on 27 June 2023).
87. Developing Scotland's Circular Economy: Consultation on Proposals for Legislation. Available online: https://www.gov.scot/publications/delivering-scotlands-circular-economy-proposals-legislation/pages/3/ (accessed on 26 June 2023).
88. Antunes, P.; Kallis, G.; Videira, N.; Santos, R. Participation and Evaluation for Sustainable River Basin Governance. *Ecol. Econ.* **2009**, *68*, 931–939. [CrossRef]
89. Water. Available online: http://www.gov.scot/policies/water/ (accessed on 26 June 2023).
90. Administration, E.P. Environmental Protection Administration—Air Quality Protection Web. Available online: https://air.epa.gov.tw/airepaEn/EnvTopics/AirQuality_9.aspx (accessed on 26 June 2023).
91. Air Quality | Scottish Environment Protection Agency (SEPA). Available online: https://www.sepa.org.uk/regulations/air/air-quality/ (accessed on 26 June 2023).