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Research Article

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Transformative Impact of Sustainable System Education with Cultural Ecosystem Service Innovation—A Case Study of Livable City in Taipei

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Abstract

Sustainable cities and communities have been recognized worldwide as one of the critical agendas for sustainable development, while systems thinking and education for sustainable development should be embedded.This paper explains the concept and benchmarked cases of using systems thinking and education innovation with a city-based cultural ecosystem service that helps to improve the efficiency and effectiveness of building a livable city and cultural development for social welfare. This paper proposes a sustainable system development (SSD) framework with the principles of cultural ecosystem service innovation (CESI) and case studies in Taipei City to support practical implications. Real-world cases of green infrastructure for sustainability and Eco-Museum cultural reforms in Taipei City has been benchmarked as a livable city and analyzed with empirical data. With in-depth expert interviews, the paper demonstrates the use of CESI framework to support policy design, strategic development, public participation, and global value creation for sustainable system development. Management implications were addressed to promote multiple positive feedbacks with the government, enterprises, and the general public and jointly strive to support the sustainable development of cities and communities.

Keywords: Open Innovation, Cultural Ecosystem Service, Sustainable City, Livable City, Eco-Museum, Sustainable System Development, Education Innovation, Education for Sustainable Development

1. Introduction

1.1. Research Background

Sustainable cities and communities have been recognized worldwide as one of the critical agendas for sustainable development, while systems thinking and education for sustainable development should be embedded. Community livability and sustainabilityin high multiple public participation haveearned greater commitment by governments(Gough, 2015). Sustainable development of countries increasingly depends on planning, designing, realizing, and continuously upgrading sustainability and livability of cities and neigh-borhoods at the meso and micro-scales, respectively (Sharifi, 2016, Al-Thani et al., 2016, Sharifi et al., 2018). Within the current context of growing urbanization, improving residents' livability conditions has become a key objective in city planning and management (European Commission, 2007, UN-Habitat, 2008, Major Cities Unit, 2010). Among top 10 livable cities in the world, Taipei is a city where the traditions of the past mingle with the evolving customs and attitudes of the present. There have been numerous heritage architecture preservation initiatives. From a city-based system perspective, Taipei City government has launched the Taipei Eco-Museum campaign, treating the city as a living museum (《TAIPEI》《21》,2018). This concept is practicing differently in different countries within their regional museums.

The historical experience and statistics of Amsterdam is the most visited city in the Netherlands was declared World Heritage Site by UNESCO. Due to Amsterdam Attractions Map established by government successfully connect and shape environmental spaces, cultural practice enable the interaction to Cultural Ecosystem Benefit of Amsterdam (Amsterdam Attractions Map, 2021). An Eco-Museum is a museum focused on the identity of a place, largely based on local participation and aiming to enhance the welfare and development of local communities. Eco-Museums originated in France, the concept being developed by Georges Henri Rivière and Hugues de Varine, who coined the term ecomusée in 1971 (Marie-

Odile et al.,1994). The term éco is a shortened form for écologie, but it refers especially to a new idea of holistic interpretation of cultural heritage, in opposition to the focus on specific items and objects, performed by traditional museums (Davis, 1999). There are presently about 300 operating Eco-Museums in the world, about 200 are in Europe, mainly in France, Italy, Spain, and Poland (Clémence ,2005). Taipei City has experienced numerous changes enabled the city to evolve from a traditional agrarian hamlet into a major political and economic nucleus noted for its livability and sustainable practice. Taipei City Government launched a series of public housing policies and projects, smart city program, and immersive playground experiences to make Taipei a better place to live, its future more sustainable (Taipei Yearbook, 2019).

As revealed by County/City Macro Competitiveness Survey published in Global Views Monthly Magazine, 2019, Taipei City again ranked topmost in the nation in multiple areas. Taipei City also ranked the 2nd smartest city in Asia reported by IMD Smart City Index 2019, released by International Institute for Management Development (IMD) in Lausanne, Switzerland on October 3, 2019 (IMD Smart City Index, 2019). In the report, Taipei is, and 7th smartest city in the world, suggesting that the city's smart city program is yielding results. Taipei is ranked the 10th most livable city for quality of life in the latest survey conducted by U.K.-based global lifestyle magazine Monocle in 2022.Describing the city as a hidden Asian gem. Taipei's convenient public transport as an urban planner's dream, with more than 1,000 shared U-Bike stations, trains and buses that run regularly and an MRT system that continues to develop and expand. Also highlighted the city's walkable streets, tempting food stalls that cook around the clock, hiking trails and the nearby Yangmingshan National Park, with its lush greenery and beautiful scenery, as well as hot springs (Taiwan Today, 2022).

Museum must have three values including Resilient, Relevant, Representative of all society (Museological Review, 2020). Cultural ecosystem services are primarily driven by human experience, such as entertainment, health, tourism, educational value, aesthetic appreciation, culture diversity, inspirational perception, body and mind relaxation, and local sense (Stålhammar, & Pedersen, 2017).

The key to the sustainable development of the Eco-Museum model of the Taipei City is whether the Cultural Ecosystem Service Innovation (CESI) framework in public facilities can be practiced. CESI is an important framework for future development strategy. Under the premise of pursuing efficiency and profit, the application of CESI strategy not only enables governmentto increase their reputation, but also enables the entire relevant people, even the society and the country to obtain the overall benefit, emulating the mutual benefit of the nature ecosystem. It is only possible to operate sustainably when the government is an inseparable whole for society and the country (Yan et al., 2019). Therefore, the CESI framework is the sustainable business and management theory that helps the Cultural Ecosystem of Museum of the Taipei City. In this study, we practice Cultural Ecosystem of Museum of the Taipei City and its adopter Taipei City Government to show how academia and industry can be practiced with CESI framework. For the industries, many studies have suggested that CESI is a critical framework for strategic business de-velopments. Yan et al. (2019) identified that CESI business strategy not only allow enterprises to grow up their benefits, but also allow the entire relevant people, even the society and the country to obtain the overall benefits, reproducing the mutual benefit of the nature ecosystem. It is only possible to operate sustainably, when the enterprise is an inseparable whole for society and the country. Taipei Eco-Museum is one of the largest examples of the inseparable objective for Taiwan economic, society and social practice. Therefore, the CESI framework can be an integrated model that help sustainable system development for City Government.

1.2. Research Objectives

The motivation of this study is to explore how the principle of sustainable system development and CESI framework helpto facilitate a livable and sustainable city with continuous improvement. There have been numerous heritage architecture preservation initiatives in Taiwan. As such, the Taipei City government has launched the Taipei Eco-Museum campaign, treating the city as a whole living museum, tying together its unique treasure trove of humanities, the lives of ordinary people, physical resources, and history into a tourism focused whole for visitors to explore. Based on studies of the city of Taipei: a museum without walls. Five Living Museums — Old and New, Modern, and Traditional, Coexisting in Harmony, this work proposes three strategies for solving the three main problems associated with Eco-Museums (community participation, local development, preservation)—which are establishing a public–private collaborating platform, initiating tourism community empowerment, and legally defining the cultural landscape. Eco-Museums require better strategic planning, both to guide the long-term development of organizations and to allow delegation of power from the founder group to a wider community (Davis, 2011). This study aims to raise public awareness by educational practices and explore how the city government, private sector can use the CESI framework in the Taipei Eco-Museum campaign to improve the management strategy of the Taipei city, which is important to the tourism, leisure and art industry, business activities, social economy, people's lives and continuously upgrading sustainability and livability of cities. Taipei City providing environmental spaces for cultural practices shapes green infrastructure maintains, boots public participation and develops the cultural ecosystem benefits.

Smart governance development requires strategic architecture. This strategy does not refer to a single plan, but looks at the development of the entire urban ecosystem through a systematic framework for the entire city. The concept of Ecosystem Service is very important, which is different from the ecosystem of the natural envi-ronment. Adding Service means citizen services. Therefore, the integration of ecosystem and citizen services forms the spirit of urban innovation ecosystem citizen services, which contains three-dimensional values and considers inclusive development from the three aspects of environment, economy, and society.

2. Literature Review

2.1. New Museology: Eco-Museum

Museums were originated in the fifteenth century, where this was the period for the big discovery era for science, art, and ancient civilization. Museums collected and preserved the results of the discoveries, and displayed to the public and enlightened them to discover. In recent years, the operation of the museums under the new museology has changed. Instead of object-oriented, museums are now more visitor-oriented. Collections are no longer the core component of the museums, and having a collection is not a crucial requirement for establishing a museum anymore. The interpretation and presentation of the regional culture are now the important factors for a museum. The operation of the museum should be based on the needs of the people in the community, the audience, and their interaction requirements (Marie-Odile et al.,1994).

Museums have always been recognized as the place for knowledge and serve for the elites. The modern museum begins to pay attention on their operation and consider more about the needs of the community. They are now trying to break the barriers between the museum and the audience, and also breaking the barriers of the tangible building and the intangible cultural awareness in order to let all audience with different educational background, age and class to use the cultural resources and services provided by the museums (Davis, 1999). As mentioned, Eco-Museum is a museum focused on the identity of a place, largely based on local participation, and aiming to enhance the welfare and development of local communities (Marie-Odile et al., 1994, Davis, 1999, Clémence,2005). The Eco-Museum is a tool for the participatory management of the natural and cultural heritage of a territory (Giuliano, & Hugues, 2018). An example is the Eco-Museum movement originated in France in the early 1970s initiated by George Henri Rivière and Hugues de Varine1. There are some definitions of the Eco-Museum Long Networks, Eco-Museums and Europe was held in Trento, Italy. It is defined the Eco-Museum as a dynamic way in which communities preserve, interpret, and manage their heritage for a sustainable development and an Eco-Museum is based on a community agreement, they also suggested that an Eco-Museum is a dynamic way in which communities preserve, interpret, and manage their heritage for sustainable development (Long Networks, Eco-Museums and Europe, 2004), where Davis said that an Eco-Museum is a community driven heritage project that aids sustainable development (Davis, 1999).

One of the purposes of the museum is the integration of technology and the participation of the community in a way to present a regional collective memory. This museum movement began to spread out and practice throughout the world, such as the Museum of Man and Industry in France, Ironbridge Gorge Museums in England, and the National Museum of American Indian. They are now trying to break the barriers between the museum and the audience, and also breaking the barriers of the tangible building and the intangible cultural awareness in order to let all audience with different educational background, age and class to use the cultural resources and services provided by the museums (Museumsblog, 2003). Recent studies suggest that museums can contribute towards social inclusion at individual, community and societal levels (Richard, 2003). With the rapid development of the multicultural society, globalization, science and technology, museums as an education and cultural institution to the community should provide the social interaction space and opportunity through the preservation of cultural values (IRES, 2004).

There have been many collaborative projects among educational and cultural institutions in real-world museum practices (Jung, 2011). For example, launched in 1998, many Chicago museums created a city-wide endeavor program called Cultural Connections to foster cultural understanding, the value of cultural differences, and community relationships by offering cross-cultural presentations and programs to diverse members of the Chicago community (Jung, 2011). Some museums have included community members as their full partners in their exhibition planning and content creation for exhibitions and programs. For instance, the Migration Museum in Adelaide, Australia, provides a community access gallery with contributions from community members themselves (Sandell, 2002).

2.2. Urban Planning and Green Infrastructure

Green infrastructure has the potential to promote planning and implementation of multifunctional green and blue spaces that tackle several urban sustainability issues. In any case, promoting urban biodiversity cannot be separated from complex urban realties, which must consider social, cultural, environmental, and economic concerns as well as functional, structural, and aesthetic aspects. To facilitate a diverse and multifunctional green infrastructure, all urban greening professions, from ecology to design to maintenance, as well as urban planning need to work in an integrative manner (Hansen, Mattes, Meier, &Kurths, 2023).

Green infrastructure in urban spaces is planned strategically, maintained and developed by a range of actors in government, business and civil society. In keeping with the objective of socially, economically and environmentally sustainable urban development, green infrastructure can help to support multiple societal objec-tives. These include, for example, the promotion of health and well-being, adaptation to climate change, and biodiversity conservation. Green infrastructure complements grey infrastructure and in some cases can replace it. Overall, it enhances urban quality of life and the attractiveness of cities and contributes to public service provision. (Hansen et al., 2017).

2.3. Citizen Participation

In theory urban planning offers a long legacy of knowledge co-production and stakeholder collaboration. Now, scholars have identified a need for wider participation to bridge community and higher-level decision-making, calling for participatory processes that engage diverse social groups, produce actionable knowledge, and develop adequate evidence-based policies (Istrate, & Hamel, 2023).

2.4. Smart City Governance

In the 21st century, there has been a shift from sustainability assessment to smart city goals (Ahvenniemi et al., 2017). Smart city performance should not only use output indicators that measure the efficiency of deployment of smart solutions but also impact indicators that measure the contribution towards the ultimate goals such as environmental, economic or social sustainability. Smart city transitions are a fast-proliferating example of urban innovation processes, governance mechanisms remain among the most undertheorized and relatively overlooked dimensions of smart city transitions (Mora et al., 2023).

2.5. Sustainable Development Goals

Wealth of research on smart cities but lack of studies examining interlinkages between smart cities and Sustainable Development Goals (SDGs). Sharifi et al. (2023) Highlights governance/policy challenges that should be addressed multi-scale and transparent governance mechanisms and regulatory frameworks are crucial for ensuring that smart city solutions support the transition toward sustainable and resilient cities also ensure smart cities can better contribute to the SDGs. The Smart City concept is also premised on optimal resource consumption such as alternative mobility is promoted to replace fossil fuel-dependent urban activities. With sensors and smart devices, smart cities can champion the prudent consumption of water and energy (through smart metering) (Talari et al., 2017).

2.6. Cultural Ecosystem Service Innovation

In this part, we concentrate the concept of CESI in Taipei Eco-Museum is defined as a comprehensive and diverse benefit of the environmental spaces which can be interaction between human and ecosystem. Ecosystem services are the benefits people obtained from eco-systems, which depend on biodiversity and sustain human well-being in everyday life (IRES, 2004). López-Hoffman et al. (2010) mentioned that concept of ecosystem service is patterns of supply and demand for services and their consequent flows (López-Hoffman, Varady, Flessa, &Balvanera, 2010). Thus, it can be used as a way of better understanding Taipei Eco-Museum.

In this study, we focus on perspective of CESI which is contained by Cultural Ecosystem Services (CES), Cultural Service Innovation (CSI), Corporate Social Responsibility (CSR), and Creating Shared Value (CSV), to apply into Taipei Eco-Museum system.Particularly, Taipei Eco-Museum which considered as a complete environmental ecosystem and it is the ecological, societal, cultural and economic lifeline of Taiwan. This paper analyzes how Taipei Eco-Museum can more effectively integrate the interactive feedback between the human and environment. Furthermore, we form a sustainable business philosophy to apply in management strategy of the protected national area and to promote the sustainable development of Taipei Eco-Museum.

3. The Benchmarked Cases Studies

Through the 2030 Agenda for Sustainable Development, the international community has recognized, for the first time, the essential role of culture as an enabler of development. Among the 2030 Agenda's 17 Sustainable Development Goals (SDGs), the 11th goal on sustainable cities and communities makes it clear that culture has an essential role to play in realizing sustainable urban development, particularly through strengthened efforts to protect and safeguard the world's cultural and natural heritage (UNESCO, 2021). The relationship between urbanization and development is a vital policy concern. The potential of urbanization to promote growth is likely to depend on how conducive the infrastructure and institutional settings are. Removing barriers to rural–urban mobility may enable economic growth, but the benefits will be much larger with supportive policies, markets and infrastructure investments. Governments should seek out ways of enabling forms of urbanization that contribute to growth, poverty reduction and environmental sustainability, rather than encouraging (or discouraging) urbanization (Turok, &McGranahans, 2013).

Through dialogue and interaction with each other, the boundary between art and life is gradually blurred (Clark, 1965, Kaprow, 1967, Kaprow, 1990, Morris, 1971). Urban Space Policy in Taipei is to make the best platform for art, history and good social communication. Therefore, whether it is a portal project, a regeneration project, or a city museum, through hardware updates, software integration, and full dialogue with local communities, Taipei has formed a big platform that will drive many changes (Ko,2018). Humans of Taipei is living in it are all performers and cultural practitioners who create urban culture together. Taipei City Government practiced the City Museum to open the imagination of Taipei's urban space, and use the five living museums without walls as the concept to integrate the existing characteristics of the urban area, allowing aesthetics and people to enter the community and derive the community from it. Taipei City promotes the Museum Without Walls plan, reinventing the entire city as a large museum, and considers historic buildings such as Beitou Hot Spring, Dadaocheng, Chengbei Corridor, Wanhua Cape, and Chengnan National Taiwan University. Integrate with the neighborhood (Tsai, 2021). These are the results we collect can imagine in the next years. Taipei Eco Museum will open up the urban space of Taipei one by one, flip the imagination of the community, and let the citizens see a city that knows where they come from and has an imagination for the future.

3.1. City System Development with Cultural Ecosystem Service Innovation in Taipei

Fig. 1 proposes a city system development framework with cultural ecosystem service, which uses humanities and social participation to promote the value of ecosystem citizen services.

Various cultural and creative activities that link urban innovation and social development in the environmental field to co-create value are not just formal activities such as music festivals or exhibitions, but also various interactions between urban infrastructure and residents. Link, referred to as cultural and creative activities (Cultural practices). Once there is public participation, the city will become active, and more citizen participation will promote recognition, and recognition will strengthen social practice. This is a system view, and there must be a relationship between the

city's infrastructure and the users of the facilities. There must be a mechanism for continuous interaction.

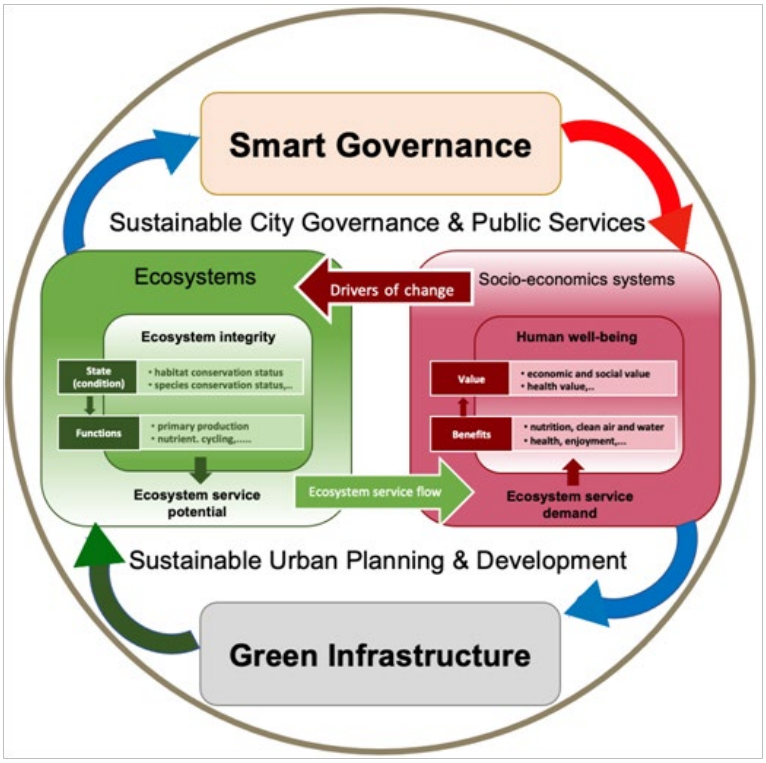


Figure 1: Framework of Citizen Service Ecosystem for a Livable and Sustainable City

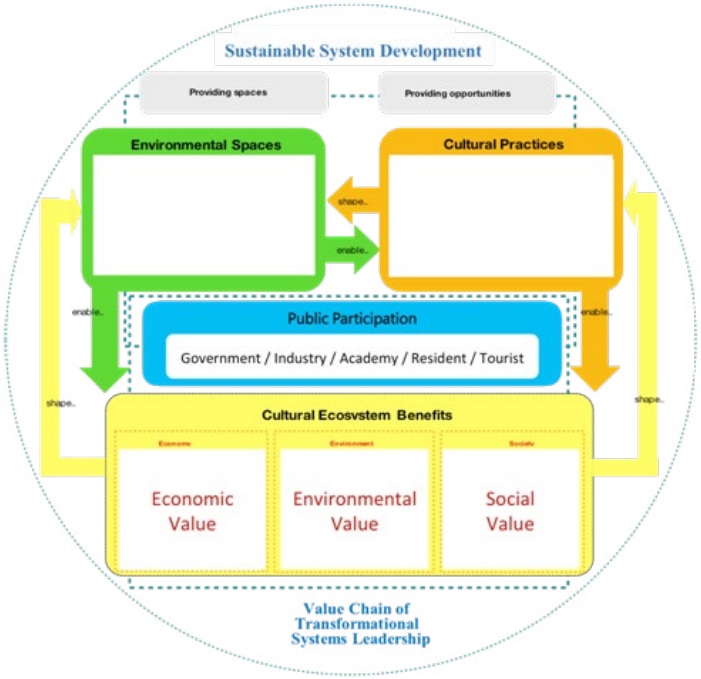


Figure 2: Evaluation Model of Urban Development and Social Innovation System

3.2. Livable City Infrastructure and Eco-Museum Education Projects in Taipei

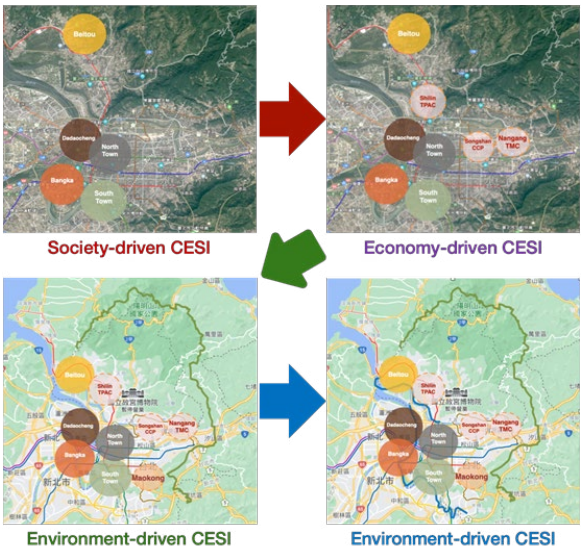


Figure 3: Types of CESI and Benchmarked Systems

A city-wide green infrastructure of livable city and Eco-Museum education projects have been conducted with the principles of sustainable system development. Urban planning and development, sustainable city governance, and public services were connected as a system.To promote sustainable system education, 10 repre-sentative city spaces and cultural practices were selected as enablers to drive benefits to social, economic, and environmental values. CESI framework has been applied to society-driven, economy-driven, and environment-driven areas for education.

Five major city zones of historical importance, each a living museum without walls that possesses a unique look, style, and story, have been chosen for integrated planning and marketing, "collectively creating a new cultural exploration map of the city" that tourists can explore individually or in its entirety, depending on time and interest. Running north to south, they are: Beitou, Dadaocheng, Bangka, North Town, and South Town. The five Eco-Museums in Taipei City, are identified as Society-driven CESI system in this study. (Figure 4)

3.2.1. BEITOU Monuments & Architecture (with Hot Springs)

Beitou hot-spring resort area was the first such leisure and recreation area developed in Taiwan. Created by the Japanese starting in the late 1890s, it was once reached from central Taipei by a special branch railway. Today, this area is a dense, rich mix of old and stylish new architecture, including a small forest of heritage and modern-style hot-spring inns and hotels.

Beitou Hot Spring Museum–Beitou Cooling Summer Festival which hosted every year is very famous Cultural event in Taiwan.

3.2.2. DADAOCHENG Local Industries, Theater–Culture Express

The Dadaocheng neighborhood, perhaps Taipei's richest in terms of physical heritage, is spread out along the Tamsui River in Datong District. Dihua Street, the main street in Dadaocheng, also Taipei's oldest commercial street, with tons of historical buildings. Dadaocheng is the incubator of traditional Taiwanese operas were nurtured. Dadaocheng Theater is a great venue for performances, promotional events, and preservation of traditional operas. During spring and autumn, the theater offers cultural and art workshops on traditional op-eras, tea making, cloth arts, etc., as well as free arts and cultural seminars, and films of traditional operas.

3.2.3. BANGKA Lives of the Common Folk

Taipei's oldest settlement, Wanhua/Bangka, took shape in the early 1700s. Bangka is sited where the Xindian and Dahan Rivers meet to form the Tamsui River — optimal for trade within the Taipei Basin of imperial times. The Bangka–Longshan Cultural and Creative Base is located in Wanhua District, a cultural treasure trove that combines history, religion, and folk customs. At Bangka–Longshan can get a closer look at traditional tea ceremonies or experience Hanfu fashion (historically accurate old-style Chinese clothes). Culturaland creative marketing is used to showcase their achievements through special events, exhibitions, and audio-visual promotional materials. The aim is to have deeper interaction with visitors and enable them to have more moving experiences to give them a sense of Banka–Longshan's unique cultural and creative energy.

3.2.4. NORTH TOWN Cultural-Arts Corridor

North Town neighbors Dadaocheng's eastern edge. Its boundaries are Chengde Road on its west side, Zhongshan North Road on its east, Changan West Road on its south edge, and Minsheng West Road on its north. Opened in May 2001, the Museum of Contemporary Art (MOCA Taipei) located here is the first mu-seum in Taiwan solely dedicated to contemporary art. MOCA Taipei, which has from the start utilized its historical building as a venue for exhibition and performance, has all the tensile strength of a place that juxtaposes cultural history and contemporary art.

Based on this characteristic, the museum regularly promotes cross-disciplinary forms of exhibition and performance. Exhibitions include diverse forms of contemporary media, such as photography, video installation, architecture and graphic design.

3.2.5. South Town Knowledge & Enlightenment

South Town Eco-Museum encompasses the National Taiwan University campus and the areas south, south-west, and west of it, centered on Roosevelt Road, Tingzhou Road, and Wenzhou Street. This area can be defined as an exemplar of the Taiwan democratic mosaic, where over time settlements and communities of disparate peoples have slowly congealed into a single whole. It is also renowned as an enclave of higher learning. The area was chosen as a demonstration space for urban modernization during the Japanese era, and a base for model education and student cultivation, built around institutions of higher education and learning societies. These have given South Town an unusually deep cultural inheritance, evidenced in the form of appealing heritage architecture, a pronounced literary air, and community pride in Taiwan's cherished dem-ocratic society. Treasure Hill Artist Village is the famous area here, have many events whole year.

Figure 4: Five Eco-Museum Maps of Taipei City Relative Location

Five urban-neighborhood Eco-Museums without walls located in Taipei City, each of singular character for cultural exploration. Old and New, Modern and Traditional, Coexisting in Harmony (Taiwan Scene, 2021).

Three areas, NANGANG, SHILIN, and SONGSHAN, are identified as Economy-driven CESI system in this study. (Figure 5)

Figure 5: Five + Three Eco-Museum Maps of Taipei City Relative Location

3.2.6. Nangang Smart City Taking Smart Cities to Brand New Heights

Taipei Nangang Exhibition Center, also known as TWTC Nangang Exhibition Hall or TaiNEX, is a super imposed purpose built exhibition complex in Nangang District, Taipei, Taiwan. 2023 Smart City Summit & Expo (SCSE) held in TaiNEX was concluded with a resounding success. It has 1,950 booths, 550 exhibitors, and 130+ thousand visitors. 2024 SCSE welcome international city leaders, stakeholders, buyers, business partners, and exhibitors to explore the opportunities with digital & green transformation in wide variety of smart city industries. Moreover, with the global consensus of reaching net zero by 2050, SCSE acted to launch a

series of activities for visitors to discover the net zero solutions, and all the participants to join the gathering of 2050 Net Zero.The Nankang Software Park (NKSP) is located in Nangang Trade and Economic Park, Taipei, Taiwan. The Software Park was developed three phases. IBM, TECO, Tradevan, NXP, and YAO5DX are a few of the 107 companies located in Phase I. Siemens Medical, HSBC, Sony, AMD, and two Biotech Incubator Facilities are located in Phase II. Phase III was completed in August 2008, this Phase is home to one of the Asian Headquarters for Hewlett-Packard, the Greater China Headquarters of Yahoo, the Microsoft Innovation Center, Asia Pacific Telecom, Alcor Semiconductor, TDK-Epcos, Freescale Semiconductor, IBM, Intel, ASE (USI), and several other technology firms (SCSE official website, 2024).

3.2.7. Beitou-Shilin Technology Park Smart Health Industry

The Beitou-Shilin Technology Park (BSTP) is an industrial park located in the Zhoumei area on the south side of Beitou District, Taipei City, Taiwan. BSTP bordering on academic landmarks such as Taipei Children's Amusement Park, National Taiwan Science Education Center, and Taipei Astronomical Museum. There are several hospitals, National Yang Ming Chiao Tung University, Taipei Veterans General Hospital and other landmarks nearby. Therefore, the park is developed with the "smart health industry" as the main axis, and is regarded by Taipei City as the next emerging industry development area in the city (Taipei Times, 2018).

3.2.8. Songshan Cultural and Creative Park

The 6.6-hectares Songshan Cultural and Creative Park in Taipei's Xinyi District was completed in 1937 as the Songshan Tobacco Factory, which was one of the seed companies of a monopoly system mandated by the Taiwan Governor General Office. For more efficient reuse of space, the Songshan Cultural and Creative Park was built on the historic site as a production base for designers and cultural & creative businesses, as well as a venue for performances and exhibitions.

3.2.9. Taipei Grand Trail National Leisure Hiking

Since 2018, the Taipei City Government has been promoting the "Taipei Grand Trail", a 92-kilometer long-distance urban hiking trail divided into seven sections, each of which can be completed in one day, Taipei Grand Trail starts from the Guandu MRT station in the north and ending at the backside of the Maokong, the rear mountain of National Chengchi University in the south, with one-third of the trail passing through Yangmingshan National Park. It offers a unique green infrastructure of livable city for the citizens and global communities.The trail connects all the famous mountains and scenic spots in Taipei, including the volcanic landscape of Mount Tatun, the highest peak of Qixing Mountain in Taipei at 1,120 meters altitude, the Bamboo Lake Calla Lilly Season as well as Hydrangea Flowers Season, the handicraft trail at Shuangxi groove, the campground at Bishanyan, strawberries at Baishihu, the "Old Place" at Yuanshan to watch the takeoff and landing of planes, the tea tasting at Maokong, and million-dollar night views of Taipei 101 area on the SIHSHOUSHAN. Combining scattered tourist resources into a healthy leisure, industry activation, self-challenge, and self-confidence building experience, the trail cultivates a route which facilitates "Hiking on the Top, Spending on the Bottom." (Taipei Grand Trail official website, 2024).

3.2.10. Riverside Trail Easy Cycling Trip and Maokong Regional Revitalization

Taipei Grand Trail Routes develop section 8 lately, starting from MRT Taipei zoo Station, ending at MRT Guandu Station. Total Riverside walking and cycling distance about 38 km (accumulated plus seven sections 130 km) (Taipei Grand Trail official website, 2024). Maokong is a quaint village located in Wenshan District of Taipei, Taiwan. The area used to be the biggest tea growing area of Taipei. There are many intertwining footpaths which have been used to transport tea. Now, widely known as the most scenic spot in Wenshan District of Taipei, to drink quality, locally grown tea, located at the top of a mountain providing breathtaking views of Taipei City (Taipei maokong official website, 2024). TAIPEI GRAND TRAIL and RIVERSIDE TRAIL, MAOKONG, are identified as Environment-driven CESI system in this study. (Figure 6)

Figure 6: Five + Three +Two Eco-Museum Maps of Taipei City Relative Location

The CESI architecture is connected systems, such as Beitou and Dadaocheng as the driving force for Society driven CESI, Nangang Software Park is used as an economic driving force for Economy-driven CESI, and the Maokong and Taipei Grand Trail & Riverside Trail as the environment-driven CESI, *co-creating* sustainable system for the city and communities.

4. Research Method

4.1. Research Process

This research is systematically designed for empirical studies based on the actual operating experience of the Livable City infrastructure and Eco-Museum education projects in Taipei with the following methods:

1. System analysis: a strategic architecture of sustainable city system development comprising environmental system, social and economic systems, green infrastructure, and smart governance is explained from the perspective of connected systems. Cultural ecosystem service innovation framework is proposed for supporting case studies and empirical analysis.
2. Case study: real world cases investigation and field research have been conducted, with the documentations and historic data collected from Taipei City Government over the years. Expert interviews with the relevant officers and participants were also conducted supporting empirical investigations.
3. Evidence-based empirical analysis: a focus group questionnaire survey has been conducted to evaluate the social engagement and satisfactions from the public participants. Taking the city as a whole system, real data regarding to social welfare, environmental considerations and economic performance from the Taipei City Government were statistically evaluated.

4.2. Indicators of Cultural Ecosystem Development

Based on literature review, this study proposes that Eco-Museums differ profoundly from both traditional museums and traditional businesses and concentrate the concept of CESI in, adopted a preliminary indicator framework including community symbiosis, cultural inheritance, and regional revitalization. The relevant literature on each of these dimensions and their impact factors are summarized in Table 1.

Concept of CESI	Dimension	Impact Factor	References
CSV/CSR	Community symbiosis	Resident identification	(Hsu et al., 2018, Liu, 2008, Tsai, 2012)
CES		Community participation	(Liu, 2008, Tsai, 2012, Liang, 2004, Wang, 2011)
CSI		Local organization operations	(Hsu et al., 2018)
CSV	Cultural inheritance	Preservation of cultural heritage	(Hsu et al., 2018)
CSI		Presentation of cultural values	(Tsai, 2012)
CSI		Promotion of cultural activities	(Liu, 2008, Wang, 2011)
CSR	Regional revitalization	Local brand marketing	(Hsu et al., 2018)
CSR		Satisfaction of tourists' requirements	(Hsu et al., 2018, Tsai, 2012, Wang, 2011)
CES		Local industrial development	(Tsai, 2012, Wang, 2011)
CSR		Environmental improvement	(Hsu et al., 2018,Tsai, 2012)

Table 1: The Dimensions and Impact Factors of The Preliminary Indicator Framework

5. Evaluation of System Development and Transformative Impacts

5.1. Public Participation and Social Engagement

Twenty-four dimensions and impact factors of the preliminary indicator framework were used to interview 30 experts and participants from public sector, private sector, and academia communities. Result appears Strongly agree and Agree significantly (60% strongly agreed and over 25% agreed), no one chooses Disagree and Strongly Disagree. (Figure 7)

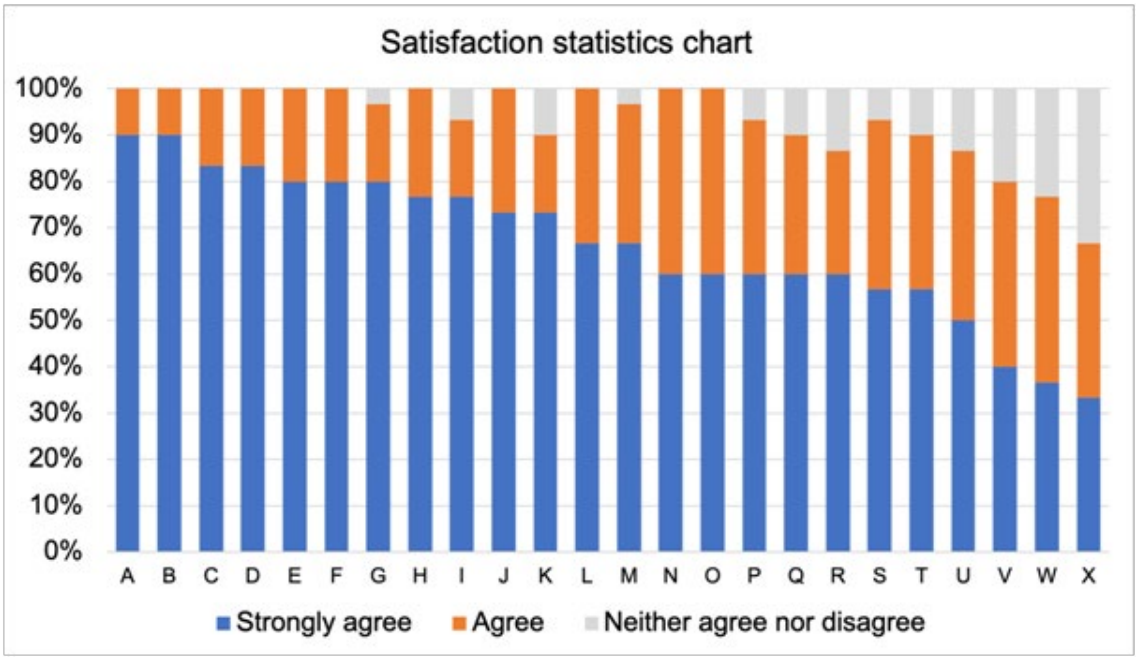


Figure 7: Evaluation of Public Participation and Social Engagement

Regional revitalization-Local brand marketing, regional revitalization-Environmental improvement, Community symbiosis-Community participation are the 1st to 3th ranking over the 10 impact factors.

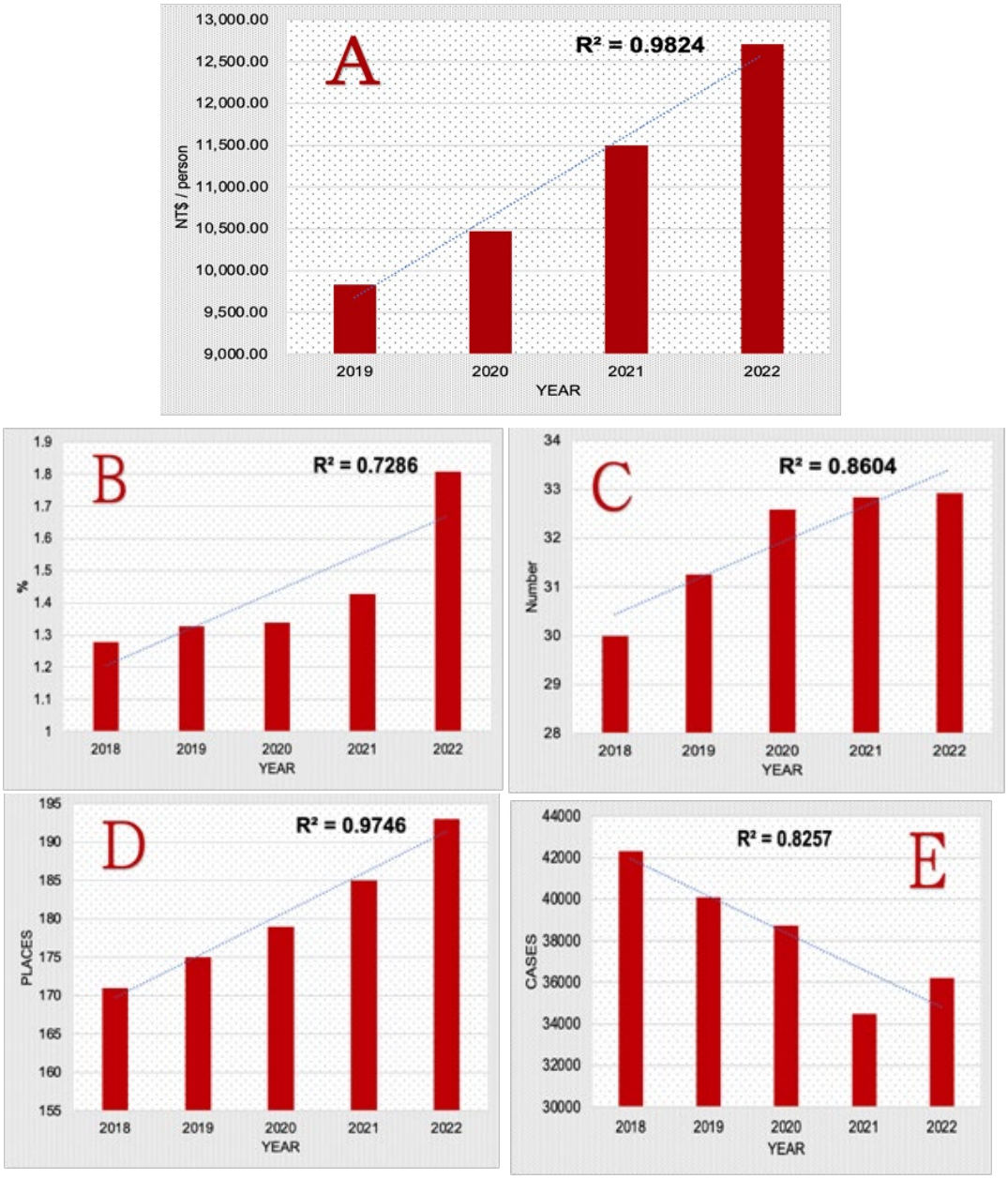
2019 as Taiwan's Regional Revitalization Year and positioned regional revitalization as a national-level security policy. Policy Stage 1 operations–searching for DNA and Setting regional revitalization vision (led by township offices). Stage 2 operations–forming proposal stage (joint participation by industry, government, universities, research institutes and civil society organizations) (Kuo, 2019). Yan et al. (2019) identified that CESI strategy not only allow enterprises to grow up their benefits, but also allow the entire relevant people, even the society and the country to obtain the overall benefits, reproducing the mutual benefit of the nature ecosystem (Stålhammar, & Pedersen, 2017). Taipei is the eighth smartest city in the world, according to an index published by the InternationalInstitute for Management Development (IMD) on 18th September, 2020 (Taiwan CNA NEWS, 2021). Prosperity& Inclusive City Seal and Awards (PICSA) report, Taipei stood out on the 2019 PICSA index mainly due to its sustainability development efforts, and the city's zero waste approach which aims to conserve natural resources and reduce pollution from extraction, manufacturing and disposal. The report also described Taipei as having a rich export-driven economy, and being a high-tech city known for its world leading information and technology industry (Taipei Competitiveness, 2021).

According to the InterNations Ranking, Taipei City ranks first among the global cities for expats. One South African national expressed, Taiwanese people love to help others and are considerate. The report also showed that 86% of people who are expatriated to Taiwan are satisfied with their lives (Taipei Competitiveness, 2021).

5.2. Benefits to Social Development

To evaluate the impacts of city-based sustainable system development from the perspective of social development, five indicators and measurable performance over time has been statistically examined with the empirical data provided by Taipei City Government and central government agencies.

There are significant trends for positive social developments through the past five years supported by statistical regression analysis.The average net government social welfare expenditure per person in Taipei City is increasing. Other evidences for positive social developments including number of volunteers under the jurisdiction of the local government social affairs department (bureau) as a proportion of the population over 15 years old (%), the average number of community development associations in each township, town, or city, and total number of monuments (places). Meanwhile, the number of criminal case is well controlled with a tendency of decreasing criminals. All of the aforementioned evidences supported the benefits to social development.

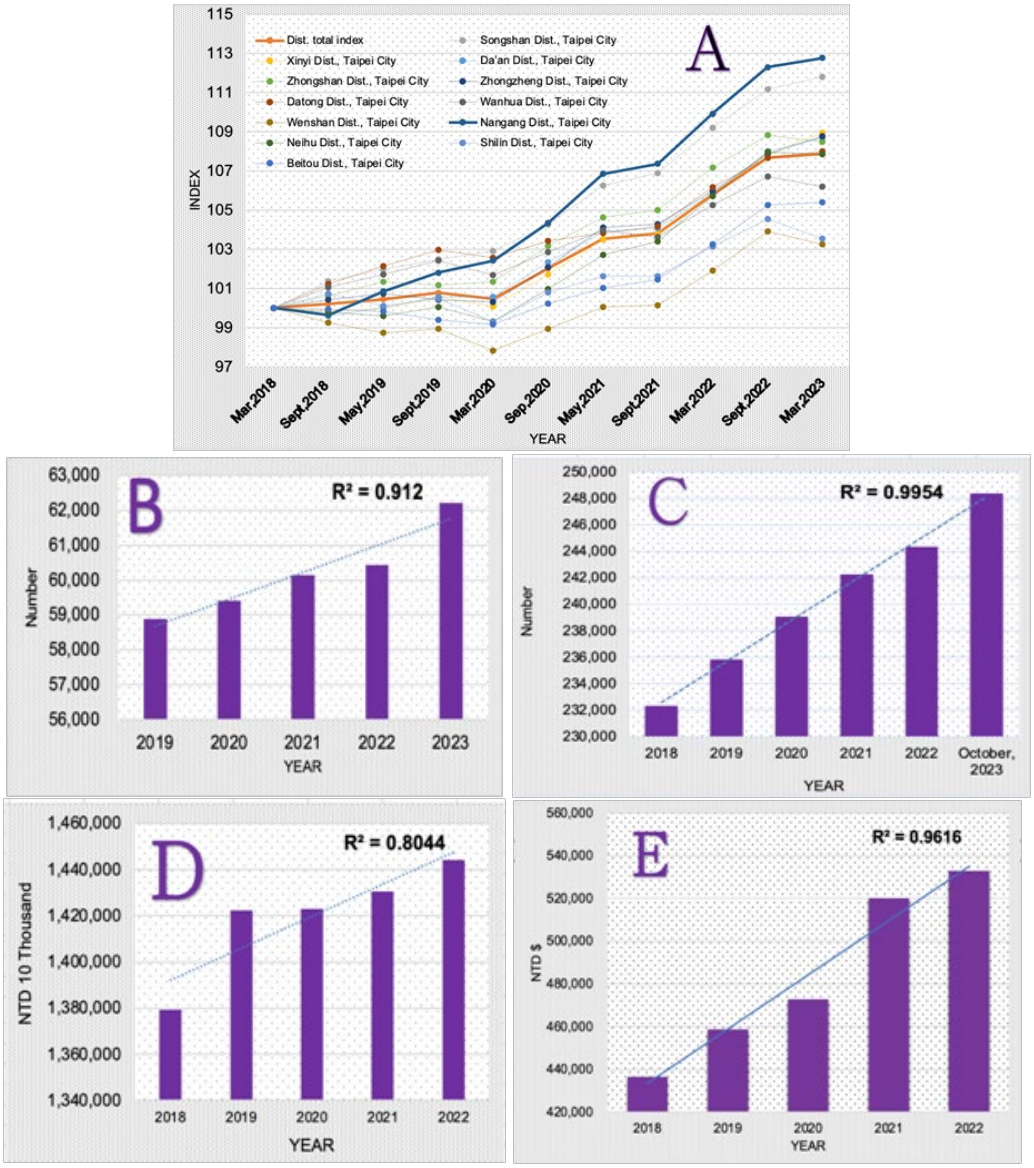


A. Average net government social welfare expenditure per person in Taipei City (NT$/person). Source: Audit Department.
B. Number of volunteers under the jurisdiction of the local government social affairs department (bureau) as a proportion of the population over 15 years old (%). Source: Ministry of Health and Welfare.
C. The average number of community development associations in each township, town, or city. Source: Ministry of Health and Welfare.
D. Total number of monuments (places). Source: Ministry of Culture.
E. Indicator item: Number of criminal cases. Source: Ministry of Interior.

5.3. Benefits to Economic Growth

To evaluate the impacts of city-based sustainable system development from the perspective of economic growth, five indicators and measurable performance over time has been statistically examined with the em-pirical data provided by Taipei City Government and central government agencies.

There are significant trends for positive economic growth through the past five years supported by statistical regression analysis. The urban land prices in 12 administrative districts in Taipei City are increasing, while Nangang district is the leading area directly connected to the case in this paper.Other evidences for positive economic growth including number of industry &business registration in Taipei City, number of companies and firms in Taipei City, average disposable income per household, and average annual disposable income per person in Taipei City. All of the aforementioned evidences supported the significant development and benefits to economic growth.



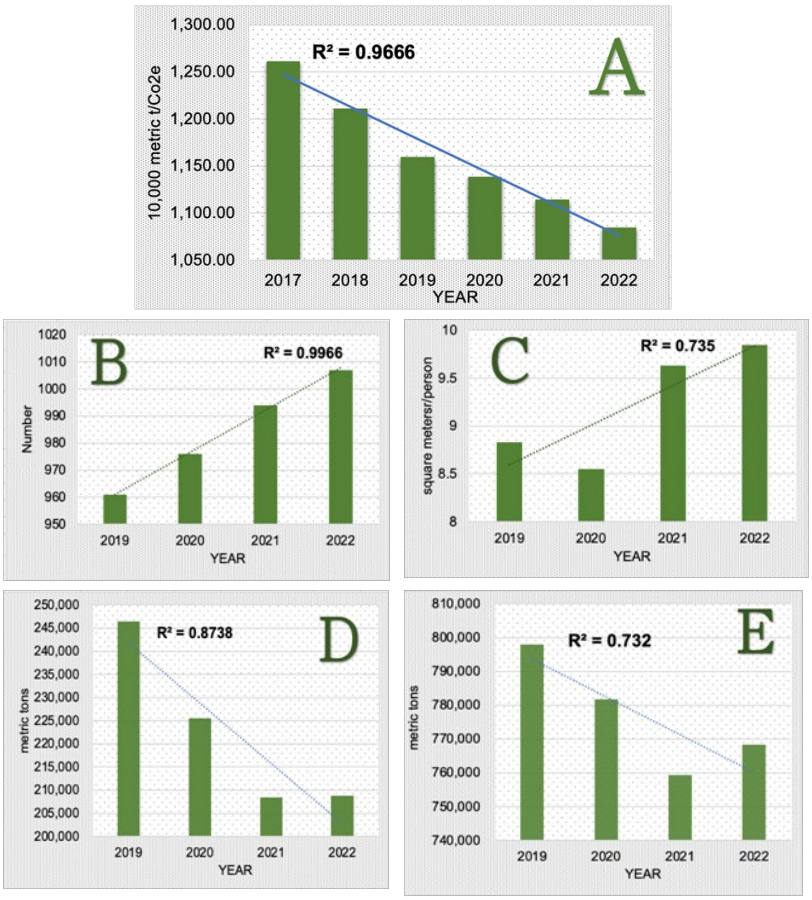
A. Comparison of regular base index for urban land prices in 12 administrative districts in Taipei City from 2018 to 2023. (half-yearly as base period).
B. Industry & Business Registration in Taipei City (Number). Source: Taipei City Office of Commerce.
C. Number of Companies and Firms in Taipei City. Source: Ministry of Finance.
D. Average disposable income per household.(NTD 10 thousand) Source: Department of Budget, Accounting and Statistics (DBAS), Taipei City Government.
E. Average annual disposable income per person in Taipei City. (NTD) Source: Local Statistics Promotion Center, Accountant General Office, Executive Yuan.

5.4. Benefits to Environmental Sustainability

To evaluate the impacts of city-based sustainable system development from the perspective of environmental sustainability, five indicators and measurable performance over time has been statistically examined with the empirical data provided by Taipei City Government and central government agencies.

There are significant trends for better environmental sustainability through the past five years supported by statistical regression analysis.In accordance with the global trend and governmental net-zero policies in Taiwan, Taipei City's greenhouse gas emissions is well controlled with reduction of emissions.Other evidences for the reductions of environmental impacts including amount of waste incinerated (metric tons) in Taipei City, general waste generation (metric tons) in Taipei City. Meanwhile, green resources in Taipei City are increasing including number of park green spaces developed and accessibility to urban and suburban park green space area (square meters).

All of the aforementioned evidences supported the benefits for improving environmental sustainability.



A. Taipei City's greenhouse gas emissions over the years. Totalemissions (10,000 metric t/Co2e). Source: Department of Environmental Protection, Taipei City Government.
B. Green resources in Taipei city. Number of park green spaces developed/total (location)
C. Green resources in Taipei city. Each person is entitled to urban and suburban park green space area (square meters).
D. Amount of waste incinerated (metric tons) in Taipei City. Source: Ministry of Environment.
E. General waste generation (metric tons) in Taipei City. Source: Ministry of Environment.

6. Conclusion

Taking a livable city and sustainable system education as the benchmarked case, this paper demonstrates how a strategic architecture of livable city and sustainable system development can be applied to drive the CESI for transformative impacts. With the proposed CESI framework and sustainable system education, 10 representative city spaces and cultural practices are identified as enablers to drive benefits to social, economic, and environmental values. This research results suggest the importance of connecting urban planning and development, sustainable city governance, and public services as a system. In this process of leading and piloting public policies, the next step is to deepen the interaction with citizens and tourists. The proposed 10 CESI projects have good green infrastructure that residents and tourists enjoyed, forming a cycle of good cultural ecosystem servicesin practices. When a city or region has developed a good place and cultural ecosystem, the mechanism to continuously drive the flows of the ecosystem and a living culture is important. The benchmarked case studies demonstrate that forward-looking projects can improve social engagements getting people involved in the city and communities. They are "people-oriented" and care about what activities residents and tourists are engaged in the city. The mechanism for the city to interact with people is not a one-time interaction but an ecosystem for continuous social engagement. From the original top-down one-way citizen service to a sustainable system of inclusion and co-creation, a bottom-up citizen participation mechanism should be considered as a system. Traditionally, citizen service is a bit of a top-down concept, that is, the government plans and promotes policies to serve the people. Sustainable system education can help to improve public participation. The research results confirm a consistent principle with the policies from world leading countries including United Nations' concept of systematic urban education, Japan's inclusive growth of Society 5.0, and European Capitals of Culture that emphasizes the awareness of people and urban citizens. A sustainable system requires good city governance and participating people, while places create stronger connections between diverse practitioners. These possible contributions and practices are not necessarily entirely the responsibility of the government. In fact, everyone can play a participatory role and become a systems leader with the proposed CESI framework and sustainable system education, including enterprises, universities, schools at all levels, non-profit organizations, and societies, etc. A

well-developed ecosystem is not only a fixed system but also an open innovation system evolves with new inputs and connected benefits to the society. Towards SDGs and ESG in practices with public-private partnership, this paper offers a benchmarked case and reference model for further developments.

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