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ICT-Mixed Community Participation Model for Development Planning in a Vulnerable Sandbank Community: Case Study of the Eco Shezi Island Plan in Taipei City, Taiwan

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Abstract

Community participation is considered a key factor for planning related to disasters and environmental issues in an international context. This paper proposes a new model combining conventional face-to-face interaction and information and communication technology-based (ICT) approach's so-called ICT-Mixed Community Participation (ICTMCP) model. By demonstrating the planning process of the Eco Shezi Island (ESI) plan, developed through sustained face-to-face community participation and an ICT-based citizens' referendum by those living on Shezi Island in Taipei City, this paper evaluates and discusses the effectiveness of the ICTMCP model during both the face-to-face community participation on planning to conquer vulnerability and the ICT-based community participation for the decision making of ESI. This paper finds that the success of the ICTMCP model requires a steady face-to-face community participation in the preceding stage for the final decision making through ICT-based approach, and the effect can be exhibited only by properly combining both of them.

Keywords: community participation, vulnerable communities, ICT-Mixed Community Participation (ICTMCP) model, Taipei City

1. Introduction

This paper proposes a new model of community participation combining conventional face-to-face interaction and the information and communication technology-based (ICT) approach's so called ICT-Mixed Community Participation (ICTMCP) model and aims at verifying the efficacy of this model. The paper is structured as follows. Section 1.1 present a literature review, considering community participation a key factor for planning regarding disaster and environmental issues, which is the theoretical basis of the above model. Second, Section 1.2 presents a systemic review on the efficacy of ICT-based community participations and the original concept of ICTMCP model proposed by this paper.

1.1 Community Participation as a Key Factor for Planning Regarding Disaster and Environment Issues

Community participation is a key factor for planning regarding disaster adaption issues due to the rising disaster risk in the international context. Despite the widespread implementation of flood control infrastructure, modern cities around the world remain vulnerable to flood hazards [1]. Urban adaptation to climate change is a complex challenge that requires multilevel and multidimensional solutions. Studies over the past two decades suggests that if local governments make the right choices in crafting land-use-planning programs, communities will be less likely to suffer severe loss of life and property in natural disasters [2]. Urban planning now emphasizes process as much as product, if not more so. The more people are involved in developing the plan, the more likely that the plan will appropriately address the issues that are important to the community. Plans that involve many people have the support necessary to bring them to fruition [3]. Communities characterized by higher levels of physical, human, and social capital have been demonstrated to be better prepared and more effective responders to flooding [4].

Nowhere is this more evident than in Taipei, Taiwan, a city whose population has doubled over the last 40 years, during which urban flooding has also increased [5]. To increase the awareness of natural disasters and the importance of community safety, Taiwan has long made efforts to increase the resilience of its community [6,7]. Urban governance in Taipei has been reshaped by party politics, public–private partnerships, and public participation since the 1990s [8,9]. Despite numerous policies, Taipei is still highly vulnerable to flooding, and the risks are not distributed equally among the population [5].

It is widely argued that increased community participation in government decision making produces many important benefits[10]. For instance, Liao et al. [12] argue for a paradigm shift towards flood adaptation in flood hazard mitigation. Further, community participation has been

one of the key factors for the success of the watershed management facing disaster risk [13]. Chou [14] demonstrates the application of actor network theory (ANT) on the evolution of river management network for the Keelung River and demonstrates the way the actors have affected flood drainage and the supply of land in the region. To enhance local flood disaster mitigation, participatory approaches for community-based risk communication are crucial [15]. Importantly, Eisenman et al. [16] point outs that effective disaster plans must account for the specific obstacles encountered by vulnerable and minority communities. Similarly, community-based disaster preparedness (CBDP) has received attention as an important tool for development planning, especially for vulnerability community [17]. From the perspective of disaster management planning, if mitigative strategies are to be successfully implemented, then the disaster management process must incorporate public participation at the local decision-making level [18]. Thus, the importance of promoting community participation in disaster mitigation planning, especially the participation of vulnerable residents and communities, has been widely emphasized.

The importance of community participation was also discussed from the viewpoint of the management and planning of natural resources. Practical experiences of community participation focusing on natural resources management imply an effect on poverty elimination, economic improvement, and appropriate resource management through these conceptual frameworks. First, community-based adaptation (CBA) presents an opportunity for local-level participation in framing adaptation planning and activities, with wider transformative potential for urban governance [19]. Further, Ecosystem-based adaptation (EbA) and its sister, community-based adaptation (CBA), have gained traction over recent years; opportunities for scaling up EbA and CBA through mainstreaming and also replication and diversification to other sectors need to be explored to reach the millions of poor people facing a climate change-constrained future [20]. The experience of Community Based Natural Resource Management (CBNRM) in Namibia shows how CBNRM has been conceived to deal with problems of poverty, biodiversity preservation, and, more importantly, as a driver of rural development [21]. Similarly, community participation in managing community-based ecotourism (CBETM) for the sustainable development of Marine Protected Areas (MPAs) in Peninsular Malaysia has ensured the public's involvement in effective sustainable management as well as supporting environmental conservation practices [22]. The importance of community participation of vulnerable residents and communities has also been confirmed from the viewpoint of nature management.

However, various barriers to community participation have also been indicated by international experiences. Although the indispensable role of community participation was illustrated based on the experience of the Mutengene self-help water project in Cameroon, barriers to community participation in development planning, such as the paternalistic posture of authorities, prescriptive role of the state, selective participation, inattention to negative results, intra- and inter-group

conflicts, gate-keeping by leaders, excessive pressures for immediate results, lack of interest, population size, and belief systems, were also indicated [23]. Based on the case of the Cordillera Azul National Park in Peru, it was suggested that to achieve more effective community participation in conservation, long-term adaptive co-management approaches that clearly define local participation, build capacity of all stakeholders and monitor levels of participation across all stages of project management are needed [24]. Further, findings on the barriers to community participation in tourism development in the city of Shiraz in Iran suggests that community members have restricted access to decision-making and lack resources, knowledge, skills, education, and a sense of ownership regarding tourism. The centralization of government is a further problem [25]. Further, a case in Turkey revealed that different interest groups expected different types of community participation to achieve their own aims that may conflict with each other [26]. Considering the numerous barriers that hinder community participation, it is necessary to proactively improve the methods and opportunities for participation.

1.2 Efficacy of ICT-based Community Participations and the ICTMCP model

A major concern for successfully implementing development planning is how the government can be more responsive to the governed through community participation. Though many cities use an extensive range of face-to-face methods like workshops, charrettes, open houses, and public meetings in addition to more formal hearings, these methods do not attract wide groups of participants. These methods are undoubtedly valuable, especially during certain phases of the planning process. Nevertheless, the face-to-face nature and the place and time commitment of these methods narrow down the number of participants and highlight the exclusivity of participation [27–29]. Current community participation methods are laborious, reach few participants and are ineffective at gathering usable information for planning [29]. However, the more citizens that participate, the more costly it is to govern. The application of new information and communication technology (ICT) seems to be a cure for this limitation. Indeed, ICT, also called “e-participation’, not only improves public service delivery but also enables governments to better engage citizens [30,31].

Many governments around the world are currently using Information and Communication Technologies (ICT) to build a more transparent, efficient, and inclusive relationship with citizens [32]. The concept of open government, having been promoted widely in the past years, has promised to be a broader notion than e-government in regard to fundamentally transforming governments to become more open, participative, and collaborative. Unfortunately, this has not significantly resolved a set of fundamental problems regarding e-government [33,34]. The mediating role of ICT is critical in the relationship between socioeconomic conditions and open government. By using ICT in an innovative method, governments can improve their delivery of

services and interactions with stakeholders, whereby citizens perform the role of partner rather than customer in the delivery of public services [35,32]. Moreover, opening up government data with the ICT approach potentially increases community participation, interaction and social inclusion [36].

With the use of ICT, urban planning authorities are more likely to be able to define and monitor the public policies, suitable for each situation, reinforcing the democracy and transparency of local governance [37]. Khan et al. [38] argued the effectiveness of participatory ICT tools for supporting bottom-up decision-making in urban planning through the study of four European cities. Further, it has also been proved that ICT-based community participation has a dominant position to alleviate rural poverty and strengthen agriculture productivity through ICT approach [39]. An integrated approach involving Geographical Information Systems (GIS) and Multi-Criteria Decision Analysis (MCDA) techniques in facilitating community participation using the case study of the planning of wind farms was proposed to encourage public participation in environmental planning [40]. However, community participation combining the existing face-to-face and ICT-based approaches, especially in terms of handling the planning for disaster mitigation in vulnerable communities, is quite limited.

An evaluation of Shezi Island planning indicates some potential for incorporating participatory GIS into the process. As Peng [41] indicates, internet GIS, serving spatial data and GIS functionality on the web might offer a potentially important means to facilitate public participation in the planning and decision-making process. For example, in the case of Shezi Island, the possibility of combining i-Voting with online GIS with information regarding each plan might be more effective and objective for the decision making of local residents.

Based on the above background, this paper argues the efficacy of a new model of community participation, the ICT-Mixed Community Participation (ICTMCP) model, which combines face-to-face community participation with ICT-based community participation. This ICT-based approach was used for disaster planning in the vulnerable community of Shezi Island in Taiwan. By describing the features and method of delivery of the development plan that emerged through the use of the ICTMC model in Shezi Island and the process of community participation involved, this paper evaluates the efficacy of the ICTMCP model. To evaluate the efficacy of the ICTMCP model through the case of ESI, this paper first focuses on how the ESI especially helps to resolve the issue of Shezi Island as a vulnerable community, namely its land use, including housing and industry. Further, it focuses on how the ICTMCP model enables the decision making in the planning process. This paper can be considered an innovative piece of pioneering research, as this type of sandbank development is the first of its kind in Taiwan and no prior research on the matter exists. It holds important significance as a socially leading experience for improving the disaster prevention capability of the sandbank in a way that incorporates community participation.

2. Research Outline

2.1 Study Area

Shezi Island of Shilin district in Taipei City, is located about 11 km upstream from the mouth of the Danshuei River estuary, near the Guandu Nature Reserve and at the tip of the confluence between the Danshuei and Keelung Rivers, in northern Taiwan. It is a sandbank sandwiched between two rivers that has remained underdeveloped due to a ban on development because of the danger of flooding. The island's history dates to 1875, during the Qing Dynasty. Today, Shezi Island expands across 302.1 ha (30,210 m2) and is home to 2,059 buildings with a total floor space of 576,362.6 m2, around 72.3% of which are irregular architectural structures (see Figure 1 and Table 1). It is an island at high risk for disaster. Thus, Shezi Island can be clearly characterized as a vulnerable community.

The history of flooding in Taipei from 1991–2012 indicates that this area is the most flood-prone area of the region [42,43]. In Taipei City, especially in the Keelung River basin near Shako Island, the government has taken many flood control measures. The prohibition of development on Shezi Island goes back to the implementation of the Shihlin and Beitou Master Plan in 1970 and the Flood Damage Prevention Plan in the Taipei Area formulated by the Taiwanese Water Resources Agency, which marked out Shezi Island as "an area of restricted development to prevent flood damage', reasoning that "lowlands have a high risk of flooding and low population density and economic value', resulting in restrictions on any development works, including new construction or renovations outside of agriculture and green spaces.

However, from the late 1970s onwards, the evolution of a high-speed transportation network throughout Taiwan led to the development of a nationwide distribution network for agricultural products, which in turn damaged the formerly thriving agricultural industry on Shezi Island, accelerating its decline. Shezi Island (323 ha) and Guandu (924 ha) have faced increasing developmental pressure to serve as a city sub-centre since the late 1980s. Through the remodelling of traditional industrial zones, the redevelopment of military land, and the reclamation of land from the river, further urbanization and industrialization in the Keelung River watershed has generated a considerable number of new businesses and jobs, and provided a kick-start for renewed expansion. The Keelung River watershed recently began serving as the strategic centre from which Taipei City is attempting to accommodate globalization spatially (Chou and Li 2012).

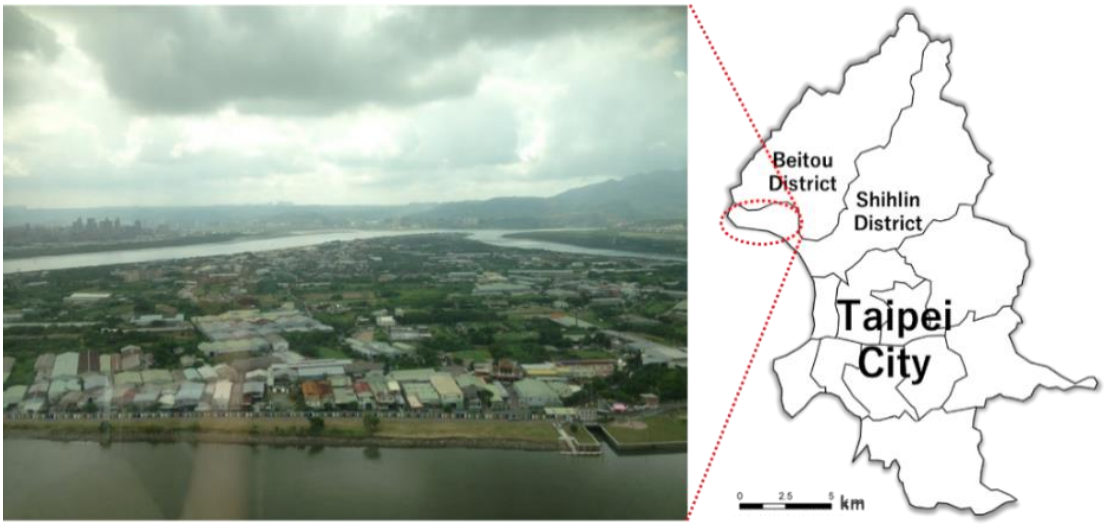

Figure 1: Location of Shezi Island (photo source: author; map: Google Maps [44])

Table 1: Current Property Conditions on Shezi Island

Type	Area (m2)	Percentage
Irregular architectural structure	416,553.4	72.3%
Reinforced concrete	113,754.0	19.7%
Brick	42,865.4	7.4%
Wooden	3,189.8	0.6%
Subtotal	576,362.6	100.0%

Shezi Island's population of approximately 11,068 people reside in two areas, making up 4,435 households (see Figure 2 and Table 2). Residing in a high disaster risk watershed area, the community of Shezi Island is disadvantaged and suffers social exclusions [45]. The community's vulnerability is demonstrated by the characteristics of its residents. For instance, as shown at the bottom of Table 1, 48.6% of eligible voters have their household registered to Shezi Island but have no ownership of land or housing, meaning that half of the island's population are low-income renters living on the island under rental contracts. Meanwhile, 35.4% of eligible voters are landowners and property owners without Shezi Island household registration and do not reside there, indicating tensions between the residents and landowners of the island.

Shezi Island's status as an area at high risk for disaster has had the sorting effect of establishing a general trend on the island whereby landowners with comparatively high incomes move away to other areas, leading them to lease their land and property to renters with low incomes and little choice. As shown in Table 1, 72.3% of the island's property, accounts for more than 416,553.4 m^2 of floor space on Shezi Island, have irregular architectural structures, indicating poor living conditions due to undesirable living environment inside the housing with irregular structure.

Figure 2 further shows that urban planning in Shezi Island is currently focused on residential

zones with some land given over to commercial and entertainment use. However, while recent years have seen a rise in illegal factories, farmland predominates in terms of current land use; it accounts for approximately 58.0% of total land use. This demonstrates significant deviation between urban planning and actual land use. These points concretely establish the characterization of Shezi Island as an island at high risk for disaster that is home to a vulnerable, socially disadvantaged community where many are low-income renters.

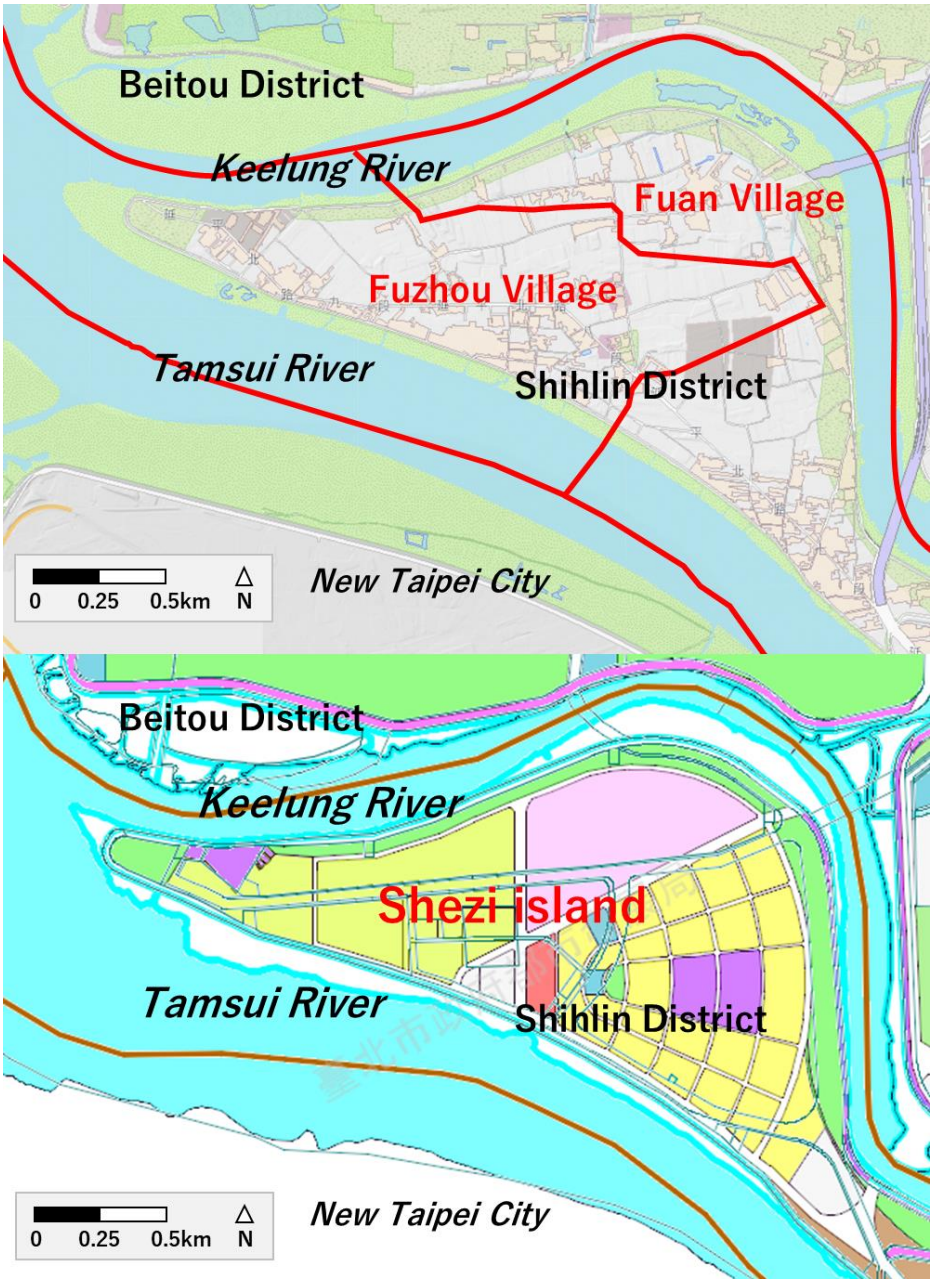

Figure 2: Current Urban Planning on Shezi Island (Drawn by the author using relevant literature (UDD[46,47])

Table 2: Current Population of Shezi Island

Current Population	Area	Population (people)		Households		Current living area (m2)	
	Fuan Village	4,966		1,884		53,900	
	Fuzhou Village	6,103		2,551		72,900	
	Total	11,069		4,435		126,800	
Eligible Voters	Voter attributes	No ownership of land or property on Shezi Island		Land/property owners		Subtotal (people)	
	Voters registered to Shezi Island	7,043	48.6%	2,307	15.9%	9,350	64.6%
	Voters not registered to Shezi Island	0	0.0%	5,128	35.4%	5,128	35.4%
	Subtotal	7,043	48.6%	7,435	51.4%	14,478	100.0%

2.2 Research Purpose and Research Question

Based on the above background, this paper argues the efficacy of a new model of community participation, the "ICT-Mixed Community Participation" (ICTMCP) Model that combines face-to-face community participation with ICT-based community participation. The research question explored in this paper is: can the ICTMCP model be an effective tool for development planning in disaster-vulnerable community? ICTMCP is an ICT-based approach for disaster planning in vulnerable communities, originally based on the theoretical review of the previous research discussed in Section 1. Indeed, in the case of Shezi Island, in addition to traditional face-to-face workshops and direct discussions between residents and relevant local officials, an advanced online voting system was introduced and a community participation program developed to encourage greater numbers of residents to vote in local referendums. In 2016, these efforts resulted in the ESI development plan being finally formulated on the basis of many years of efforts of community participation.

By describing the features and method of delivery of the development plan that came about due to the ICTMC model on Shezi Island and the process of community participation involved, this paper evaluates the efficacy of ICTMCP model. To evaluate the efficacy of ICTMCP model through the case of ESI, this paper first focuses on how the ESI helped to resolve the issue of

Shezi Island as a vulnerable community, namely its land use, including housing and industry. Further, this paper focuses on how the ICTMCP model enables decision making in the planning process. The model proposed by this paper combines both face-to face and ICT-based community participation is shown in the Figure 3.

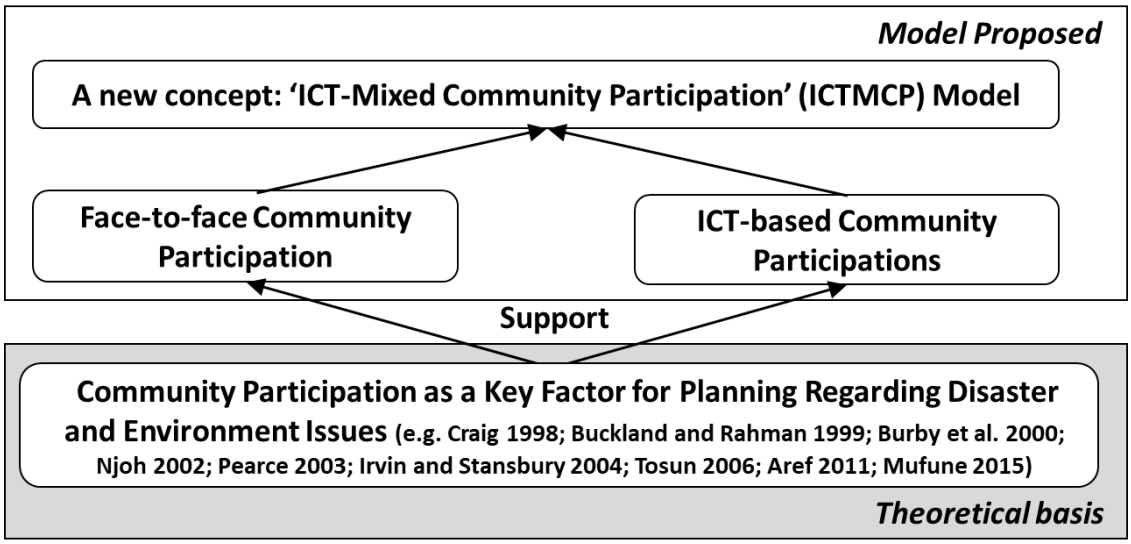

Figure 3: Conceptual framework of ICTMCP model (created by the author)

2.3 Research Methods

The study's analysis is based on conditions understood from multiple field surveys carried out in Taipei between August 2016 and December 2017, interviews with city officials conducted on 27 August and 9 September 2016; 9 February, 15 February, and 9 December 2017; and 14–15 and 20–21 August, 2019, and relevant plans and internal documents obtained from the City during the survey period. The materials for analysis are based on the following data derived from the above survey including: 1) statistical analysis using public open data acquired from databases including the Electronic Map of Taipei City (https://maps.taipei/#), i-Voting (https://ivoting.taipei/), Tomorrow Shezi Island (https://shezidao.gov.taipei/), and the Database of Urban Plans (https://www.webgis.udd.gov.taipei/upis/Default) of the Taipei City Government regarding the ESI development plan and statistical data about the socio-demographic situation of Shezi Island. 2) A Questionnaire survey (135 responses) targeting 249 factory operators on Shezi Island from May to August 2019, conducted by the Taipei City Government. 3) Semi-structured interviews conducted with a total of ten people, including representatives from the Taipei City government (five in total: one former deputy director, two deputy directors, one section manager, one section chiefs of the Taipei City Government), two local leaders of community organizations from the offices of Fuan Village and Fuzhou Village of Shezi Island.

In response to the above purposes, Section 3 will clarify the socio-demographic situation of Shezi Island, and then focus on the transition of urban planning regarding ESI so far and the outline of community participation realized in the planning of ESI. Section 4 examines the effectiveness of the ICTMCP model, focusing on two aspects: how the ICTMCP model facilitates coping with the vulnerability issue and decision-making. The overall research flow showing the research method used and the corresponding research framework of each section is shown in the Figure 4.

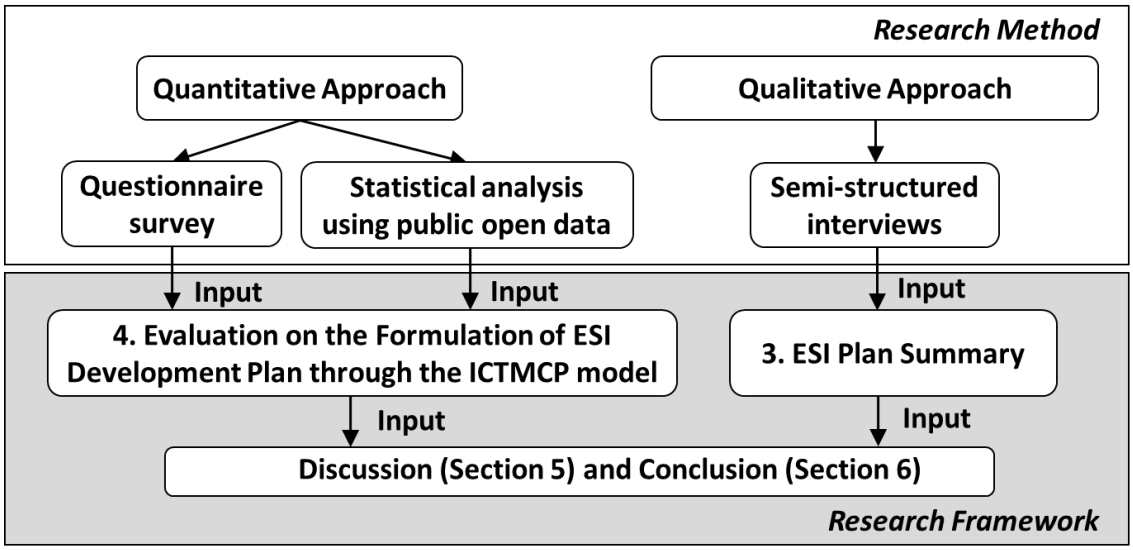

Figure 4: The overall research flow of this paper (source: author)

3. ESI Plan Summary

3.1 Development Planning

The case of Shezi Island provides a unique experience compared to previously reported cases of CBDP due to its location. As a sandbank, Shezi Island is home to a rich natural environment, and there is also a longstanding awareness of the high flood risk on the island, making it essential to find harmony between conservation and development. As mentioned in Section 2, although development was restricted for a long time on Shezi Island, repeated requests from residents pushed the Taipei government (henceforth "the City') to start working on a Shezi Island Urban Planning Proposal in the 1980s, although the City repeatedly withdrew and revised the plan over the course of a long consultation period with residents. The City held regional workshops over several years to take in residents" views more carefully. On the basis of frequent conversations with local residents following the establishment of a field office and considering an environmental

impact assessment, the City formulated three different draft plans that included the Eco Shezi Island (ESI) proposal, which was then chosen in a local referendum in 2016. Urban planning was then newly formulated, and development implemented, to turn the proposal into reality. Such an initiative on Shezi Island was highly innovative in that decisions were made as a result of sustained community participation and the local citizens' referendum.

Most important, the planning process of ESI was realized through mixed community participation. In addition to traditional face-to-face workshops and direct discussions between residents and relevant local officials on Shezi Island, an advanced online voting system was introduced and a community participation program developed to encourage greater numbers of residents to vote in the local referendum; in 2016, these efforts resulted in the ESI development plan finally being formulated on the basis of many years of efforts of community participation. Through the efforts of the ESI, the possibility of a new mixed type of community participation is about to emerge on Shezi Island.

3.2 Transition of Urban Plans Regarding Shezi Island

This section begins with a summary of the relationships between the various ESI-related plans for Shezi Island. The ESI plan decided in the 2016 local referendum is based on the Revised Taipei City Shihlin Shezi Island Master Plan (henceforth, "Master Plan'), a major revision of the Formulated Shezi Island Plan which was the originally proposed Master Plan decided in 2002, and is complemented by the Formulated Taipei City Shihlin Shezi Island Detailed Plan (henceforth the "Detailed Plan'). Both plans were approved by the City's Taipei Urban Planning following inspection in June 2016. The Detailed Plan designated zone expropriation (Note 1) as its method of delivery. The City's Department of Urban Development formulated both plans in compliance with the Revised Report on Taipei Districts (Shezi Island and Wugu District) Flood Prevention Plan, which was carried out by the Ministry of Economic Affairs in 2010 based on the flood prevention standards for a 200-year return period. The City's Department of Land Administration formulated a separate Taipei City Shihlin District Shezi Island Development Plan for the details of the method of delivery relating to zone expropriation [48]. The overall picture of each plans related to ESI is shown as Figure 5.

The scope of the development plan for the sandbank in the Detailed Plan was 294.1 ha. In terms of zoning, provisions were made for rental accommodations in private residential zones to prioritize the resettlement of former tenant households, particularly those renting without any ownership of land. Meanwhile, and regular residential zones were categorized into one of three types of developmental intensity. The total population (population capacity) of the residential zone was set at 32,000 residents, a capacity of just under three times the current population of 11,069.

Shezi Island is currently home to a significant amount of agriculture and illegal factories with land use permission. To establish new industries, 13.4 ha will be given over to commercial usage, while 16.8 ha are designated for science and technology industry usage on the north side of Shezi Island to promote economies of scale with the high-tech industrial parks of the neighbouring districts of Beitou and Shihlin, in anticipation that the island could act as an incubator, driving the creation of new industries in Taipei. These uses of land amount to a total area of 118.8 ha, accounting for 40.4% of the planned scope.

Another important feature of the sandbank development plan is the site planning of various public facilities. To improve the sandbank's disaster defenses and safety, the ground level of the beds across the entire island will be raised to a height of 8.2 m. Furthermore, the sandbank land allocated to parks and embankments, which control flooding and are essential public facilities, will account for 60.0% of all public facilities and 30.0% of the entire planned scope. New public facilities include a site for an industrial support facility to support the usage of the science and technology industrial zones, and a transportation site to provide a bus terminal. These land uses will amount to a total area of 175.3 ha, accounting for 59.6% of the planned scope. This kind of land use is planned and provided as a part of the support system for the existing land use issue (based on an interview of a former deputy director of the Taipei City Government, Dec. 9, 2017).

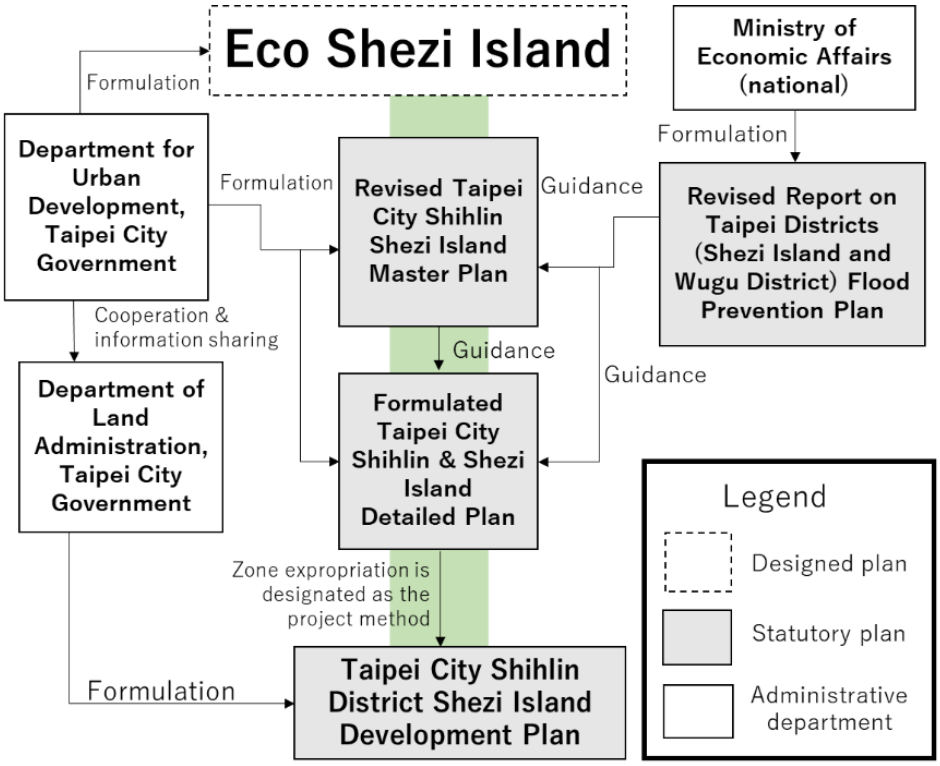

Figure 5: ESI-related Plans (created by the author)

3.3 Proposal of Development Plan through Community Participation

The combination of face-to-face and ICT-mediated communication was a critical element of the mayor's plan on Shezi Island. in addition to the ordinary face-to-face community participation, since 2015, the latest information about Shezi Island planning has been released through the Island's Facebook page, the official site of Shezi Island called "Tomorrow Shezi Island." Further, in 2016, the decision making about the formulation of the detailed plan was conducted through an online voting system called i-Voting.

While the formulation of the ESI development plan was finally realized through community participation in 2016, the series of community participation goes all the way back to the 1980s. Since the 1980s, urban planning on Shezi Island has been met with opposition by residents who oppose development and insist on nature conservation, leading to repeated cycles of proposal and withdrawal [47,49,50]. However, a major shift in policy by the City to introduce community participation, proposed by Taipei's mayor, Ko Wen-je, following his election in 2014 and as part of his public promises to date, has been actively promoting housing justice. Following a series of initiatives involving active community participation after Taipei's change in policy, gathering the views of local residents and reflecting them in plans finally led to the Revised (Formulated) Shezi Island Plan (which later became the draft for the current plan), which was approved and settled on in 2002 by the Taipei Urban Planning Council. Later, in 2010, a revised plan was made based on the Ministry of Economic Affairs' flood prevention standards for a 200-year return period, and the City genuinely began to formulate a development plan that utilized community participation [48].

The City began a series of initiatives (Table 3) in 2015 to build consensus around the formulation of the Shezi Island development plan, attempting to actively engage citizens in conversation primarily through participatory workshops. Based on conversations with residents, these initiatives had the following results: (1) the zone expropriation construction land was set at a maximum of 40% of the total area, with public facilities to take on 60%; (2) provisioning of private housing for former residents; and (3) the creation of three proposals—ESI; Canal Shezi Island, a plan that emphasizes the promotion of a water transport network; and Our Shezi Island, a plan that emphasizes preserving more existing elements or No Development—that take into account basics such as the new flood protection standards given by the central government's Water Resources Agency in 2010, and put them to a local referendum. Details of the plan were published on the City-run "Tomorrow Shezi Island" website alongside the installation of exhibition panels and models around the local area to spread the word to an even greater number of local residents and citizens (Figure 6).

Table 3: City Initiatives to Promote Community Participation

Date	Initiative promoting community participation
Jan 2015	Cross-departmental Shezi Island PJ Team formed within Taipei government.
June 2015	The Taipei Government Shezi Island Field Office established at Kuntian Temple, the religious center of Shezi Island.
June 2015	Establishment of special website for Shezi Island on Facebook.
June 2015	Participatory workshop held at Shezi Island Fuan Middle School.
July 2015	City establishes special Tomorrow Shezi Island website.
Aug 2015	Cross-departmental Taipei Government Shezi Island PJ Office set up within the City government, to coordinate development plan formulation.
Oct 2015	Community participation workshops held in two areas of Shezi Island (Fuzhou Village, Fuan Village).
Nov 2015	Taipei Mayor Ko Wen-je holds an overnight homestay on Shezi Island, engaging in direct exchange of opinions with residents.
Dec 2015	Information sessions for residents and participatory workshops held three times.
Jan 2016	Information sessions for residents and participatory workshops held twice.

Figure 6: Models used in the participatory workshops and elsewhere (the author's own photograph); three proposals presented on the Shezi Island website [51]

4. Evaluation on the Formulation of ESI Development Plan through the ICTMCP model

4.1 Face-to-face Community Participation for Planning to Conquer Vulnerability

As mentioned above, the improvement of the living environment of the residents without property rights and the land use of irregular architectural structures as factories are the most important issues to resolve through ESI. In order to cope with these issues, in terms of implementing zone expropriation on Shezi Island, it should be noted that Taipei Mayor Ko Wen-je has made a public commitment to "Housing Justice'; hence, the various housing support measures for former residents are of the utmost importance. A variety of housing support measures have been enacted to enable all former residents—both landowning households and tenant households—to return to Shezi Island once the zone expropriation process is complete. Former residents can be divided into four categories: owning land, not owning land, owning housing, and not owning housing.

According to Deputy Director B of the Taipei City Government (interview August 21, 2019), in order to cope with this issue, a housing support system was proposed within ESI, based on the discussion with local residents during the process of face-to-face community participation. The private housing on offer in the private housing zone includes for-sale and for-rent properties, and all four categories of former residents are able to move into the for-rent private housing. The for-sale private housing is only available for purchase by property-owning households. Meanwhile, landowning households are provided with the further option of cooperative housing (Note 2). As shown in Table 4, the private housing provision should respect the current local relationships of existing residents, and has therefore been divided into two regions and five sections, mimicking the current housing configuration. Furthermore, the households and surface area of the planned private housing provision will exceed the present number of households and contain a doubled surface area to guarantee the right of residence for all inhabitants.

Facing the issue of Shezi Island as a vulnerable community with high disaster risk, the main objective of the zone expropriation is to establish public facilities and develop housing. Importance is also placed on harmony by preserving existing buildings and structures. There are 3 religious structures and 4 traditional structures of historical value and 26 trees to be preserved (based on the interview of deputy director A of the Taipei City Government, Aug. 14, 2019).

Another issue is the existing local industry embedded in irregular architecture and land use. Shezi Island is already home to various industries including a large number of factories, so support

measures for these factories are another important aspect. In fact, as shown on the left-hand side of Table 5, 75.6% of the 135 factories on Shezi Island are small-scale factories employing ten or fewer people. It will be difficult for these to survive without public support.

To cope with this issue, based on the same process as the housing support system, a factory support system was proposed within ESI. The City is offering various support measures to Shezi Island factories as outlined on the right-hand side of Table 5. Take-up of these measures totals 570 support measures by all 135 factories, demonstrating that each factory is being generously supported with four types of support. In particular, the most common forms of support to help companies remain in business are securing a site to continue operations (21.1%) and compensation for construction costs associated with factory relocation and similar activity (19.6%). According to the questionnaire survey of the Taipei City Government, 92 of 135 factory managers (68%) revealed a strong preference to continue operating on Shezi Island in the future, and the land and floor space (Table 6) needed for this to happen has already been considered and reflected in the zoning of the Detailed Plan.

The housing and factory support system proposed through face-to-face community participation might be considered the key factor for realizing the ESI.

Table 4: Comparison of Private Housing Provision Plan and Current Living Conditions

Area	Private Housing Provision Plan (as of 2020)			Current Living Conditions	
	Section	No. of houses	Surface area (m2)	No. of households	Surface area (m2)
Fuzhou Village	1	2,800	80,500	-	-
	2	1,500	43,900	-	-
	Total	4,300	124,400	2,551	72,900
Fuan Village	3	1,500	44,000	-	-
	4	2,000	56,500	-	-
	5	2,000	56,300	-	-
	Total	5,500	156,800	1,884	53,900
Subtotal	-	9,800	281,200	4,435	136,800

Table 5: Current Factory Conditions in Shezi Island and Support Measures

Current Factory Conditions			Support Measures for Factories		
No. of Employees	No. of Factories	Percentage	Measure Details	Take-up of measure and Percentage	
1-5	54	40.0%	Securing Relocation Site	120	21.1%
6-10	48	35.6%	Compensation for construction costs associated with factory diversion and relocation	112	19.6%
11-15	13	9.6%	Industrial development incentive grant	99	17.4%
16-20	9	6.7%	Factory registration procedure consultations	83	14.6%
21-50	10	7.4%	Financing	82	14.4%
100 or more	1	0.7%	Employee employment support and unemployment benefits	74	13.0%
Subtotal	135	100.0%	Subtotal (multiple)	570	100.0%

Table 6: Area Required for Future Continuation of Factories

Rights to current factories	No.	Necessary land & floor space (m2) for future continuation	
Own	25	24,100	25,700
Own and rent	3	4,100	5,000
Rent	64	58,100	55,000
Subtotal	92	86,300	85,700

4.2 ICT-based Community Participation for the ESI Development Plan

Decision Making

The local referendum over the formulation of Shezi Island's development plan was held on 27 and 28 February 2016 through the City's open platform, i-Voting. In 2015, the City introduced i-Voting, an online citizen voting system that can be used easily by anyone, to enable full citizen participation. i-Voting was used to cast votes on a total of 24 bills between 2015 and2017. Residents were eligible to vote provided they were 18 or over and had registered as living on Shezi Island before October 12, 2015, or if they owned land or property on Shezi Island. As shown

in Table 1, the number of eligible voters was 14,478, including 9,350 and 5,128 citizens living inside and outside the island, respectively, and of whom a respective 5,091 and 2,168 voted, comprise 54.4% and 42.3% of eligible voters (Table 7). Further, out of all 5,091 voters on Shezi Island, 4,292 (84.3%) voted online using i-Voting while only 799 (15.7%) voted at the local polling station, proving the popularity of i-Voting and verifying the efficacy of the ICT-based approach (voting for Taipei citizens living off of Shezi Island was limited to i-Voting.).

The vote on the four proposals (ESI, Canal Shezi Island, Our Shezi Island, and No Development) resulted in a clear majority for ESI, which won approximately 60% of the votes. It should be noted that given that turnout was 35.2%, the fact that ESI won 59.6% of the votes means that actual support for the plan came from only 32.4% and 26.3% of eligible voters inside and outside the island, respectively. Meanwhile, while the vote by Taipei residents living outside Shezi Island resulted in ESI having the most votes at around 60%, the fact that 2,168 of Taipei's 5,128 eligible voters participated suggests that about 42.3% of eligible Taipei residents paid attention to this vote, which is considered quite positive. After much consideration by the City, the election-result-based determining criterion was initially set so the voting results from the Taipei residents outside of Shezi Island would be weighted at 20%, while the election results of the Shezi Island residents would be weighted at 80%. Calculations on this basis produced a vote of 60.1% for ESI, meaning that in all cases, ESI was the proposal that received the most support. The voting results can still be viewed on the i-Voting website (Figure 7).

One of the primary reasons that ESI received the most support is that it is more generous (Table 8) than the other two proposals in terms of private housing provisioning, which is the residents' greatest area of concern. However, one cannot ignore the 617 residents who voted against development in the referendum. It should also be noted that the plan decided upon in the 2016 local referendum was later revised, in light of views given and after deliberation, by the Taipei Urban Planning and Ministry of the Interior Urban Planning Committees to place greater importance on the natural environment, with modifications made to the Detailed Plan to restrict the area of development and floor area ratio. As a result, the site area and floor space for planned the private housing provision in the ESI were cut by 23.1% and 42.1%, respectively when comparing the 2020 ESI to the plan given at the time of the local referendum. This change reflects the opinions of experts and views of residents that were received during the deliberation stage of the two urban planning committees. Over four meetings of the Taipei Urban Planning Committee that took place leading up to June 2018, a total of 44 views, consisting of 15 matters relating to urban planning, 5 matters relating to disaster prevention and flood countermeasures, 5 matters relating to transportation planning, 1 matter relating to industrial development, and 17 matters relating to zone expropriation, were raised by residents and reflected in the plan.

Considering that the participation ratio of eligible voters inside and outside of Shezi Island

were 42.3% (2,168 out of 5,128 voters) and 54.5% (5,091 out of 9,350 voters), respectively, since there is no huge different between two values, it is considered an example of successful participative decision making according to the ICTMCP model.

Table 7: Results of Local Referendum

Election results		Canal Shezi Island	EcoShezi Island	Our Shezi Island	No development	Total
Shezi Island residents	Votes cast	825	3,032	617	617	5,091
	of eligible voters	8.8%	32.4%	6.6%	6.6%	54.4%
Taipei residents	Votes cast	523	1,350	143	152	2,168
	of eligible voters	10.2%	26.3%	2.8%	3.0%	42.3%

Table 8: Comparison of Private Housing in the Three Plans (No development excluded)

Proposal	Site area(㎡)	FAR	floor space(㎡)	Units supplied
Canal Shezi Island	100,000	450%	450,000	4,500
EcoShezi Island (initial)	108,000	450%	486,000	4,860
(amended 2020 version)	83,000	350%	281,200	9,800
Our Shezi Island	80,500	160%	128,800	1,288

Reference: amended 2020 version [47]

Figure 7: Display of Vote Results on i-Voting [50]

4.3 Process and the key factor of ICTMCP model on the Planning Process of ESI

The case of Shezi Island demonstrates the success of ESI planning using the ICTMCP model rather than top-down approaches. The key factor is a sufficient housing and factory support system for the local residents, proposed based on the discussion involving face-to-face community participation. The siting for private housing is planned to provide 9,800 units, which will fully meet the current population demands. The variety of housing support measures deserve commendation for offering different types of for-sale and for-rent private housing, with cooperative housing also provided as an option. In addition, considering the importance of the existing local industry to the local community, there has been an active attempt to preserve existing factories through the plan to resettle them on designated industrial land after the development of ESI, instead of maintaining the existing irregular architecture, to realize a more resilient Shezi Island. As a matter of fact, since many residents are actually working at factories on the island, the generous support measures for the factories are also considered to be a major factor in realizing the participation of so many residents (Based on the interview of deputy director B of the Taipei City Government, Aug. 21, 2019). Further, the flood disaster awareness of local residents might be another key factor to the success of the active community participation [52,53] . This situation is quite similar to the suggestion of previous studies [18,54] that argue the importance of disaster-related awareness in local decision-making processes, especially for the local residents, and indicate that participative residents display good preparedness behaviours. However, as one local leader emphasized the importance of hearing opinions by visiting all the households" residents directly (based on interview to the office of Fuan Village, Aug. 27, 2016) and another local leader claimed that the four proposals to be voted on were insufficient, a new proposal that carefully reflected the opinions of local residents was necessary (Based on interview to the office of Fuzhou Village, Aug. 27, 2016).

Further, the efficacy of ICTMCP can be mainly evaluated based on the decision making through the ICT-based participation approach, which, in the case of Shezi Island, is i-Voting. The outcome through a series of community participation efforts is the most significant achievement in delivering ESI. In the past, residents have repeatedly demonstrated opposition to the City's top-down planning and design, but the City's introduction of active community participation in the intervening period and the selection of ESI through a local referendum have served as opportunities for the residents to contribute to major advances in subsequent urban planning decisions

Regarding the planning policy of Taipei City Government, the key factor throughout the overall planning process of ESI in Shezi Island might be considered as, first, the shifting from the top-

down planning policy used until 2010s to a policy promoting community participation by 2015. Second, motivated by the disaster awareness, aggressive participation was realized by local residents mainly through face-to-face community participation, including participatory workshops. Further, the ESI plan was selected in the decision-making process of local residents through a local referendum by i-Voting, an ICT-based approach. Finally, considering the achievement derived from the ICTMCP model, including the above two different types of community participation approaches, formulation and proposal as official urban planning is then realized by Taipei City Government (Figure 8).

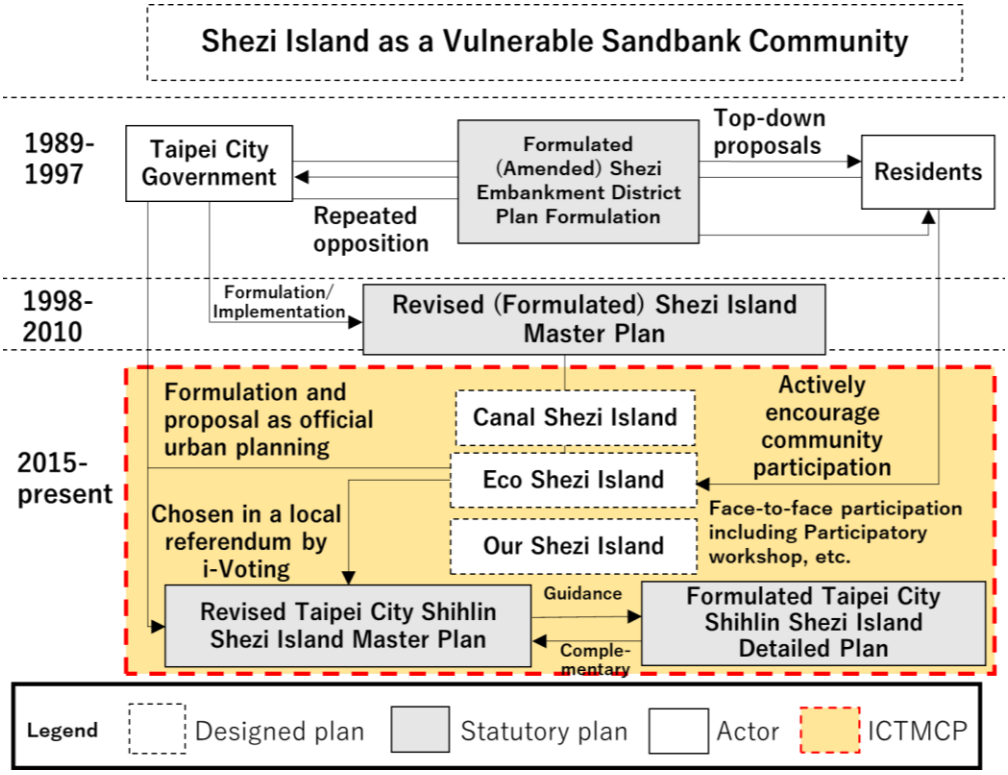

Figure 8: Chronology of Plan Formulation through Community Participation on Shezi Island (created by the author)

5. Discussion: Efficacy of ICTMCP model on the Planning Process of ESI

Although participatory GIS (PGIS), Participatory Approaches and GIS (PAGIS), and public participatory GIS (PP GISs) applications or community-based GIS have been discussed as tools that allow underprivileged groups to make their case for recognition, participation, and political access, these community-based applications have become the focal point for claims about public participation and empowerment [55–61], actually, GIS applications merely provide spatial information as a resource during the process of planning and has little to do with the process of

decision making. As Peng [41] indicates, internet GIS, serving spatial data and GIS functionality on the web, might offer a potentially important means to facilitate public participation in the planning and decision-making process. For example, in the case of Shezi Island, the possibility of combining i-Voting and online GIS with information regarding each plan might be more effective and objective for local residents' decision making.

The case of Shezi Island can be concluded as a successful example of participative decision making using the ICTMCP model, considering the fact that the participation ratio of eligible voters outside and inside of Shezi Island were 42.3% and 54.5%, respectively and that the amount of participation for each group was similar. This implies the possibility of an online voting system to assist eligible resident outside the community in actively participating in the decision making process. As Wellman et al. [62] noticed, residents' online interaction supplements their face-to-face communication without increasing or decreasing it, while heavy Internet use is associated with increased participation in voluntary organizations and politics. The ICTMCP model can be considered an important tool for not only the decision-making process, but also for discussion and each successive process of participation. further, as Yamada et al. [63] indicate, implementation of risk communication within community is found to be effective for the enhancement of residents' awareness of risk mitigation in their community, so the ICTMCP model might also be utilized as a tool for risk communication, especially in vulnerable communities.

In contrast, failed cases also exist. Focusing on ICT-enabled "citizen voice-government responsiveness" interventions, especially feedback platforms in the global South, Herringshaw [64] points out that when government willingness exists, ICT-enabled voices can help build the capacity to respond. But generally, if a pre-existing government commitment to respond is not in place, voices through the platforms will not create it, and response rates will remain low. This is a serious challenge to the theories of change of many such initiatives, whether stated or not. Based on this experience, the need to distinguish between "individual citizen" and "collective civic" voice; to unpack the "black box" of different entities and actors within the government; to distinguish between the willingness versus the capacity of all the key actors (of citizens and government at a minimum, and often also intermediaries and donors), was illustrated [64].

For example, in Marahau, a small community in New Zealand, due to increasing visitor numbers and tourism development, there are growing conflicts over common resource use [58]. Although PAGIS shows potential to play an important role in enhancing sustainable tourism development by involving multiple stakeholders in deciding the future of Marahau, a concrete outcome about decision making has not yet been realized. However, these cases do not actually contain a mechanism for residents to participate in the process of decision making.

However, this might be a consequence of potential geo-cultural differences or divergent results rather than concrete outcomes. In addition, the other examples were earlier than this paper, so

some improvements may be due to technological advances. Another case, focusing on the PPGIS survey in Wyoming, USA, showed that the response rate for those who completed the paper version of the survey was nearly 2.5 times the response rate of the Internet version. It was suggested that using a paper-based PPGIS survey results in a higher response rate, reduced participant bias, and greater mapping participation [59]. In the case of Shezei Izland, as already mentioned, i-Voting accounted for 84.3% of the total votes and was 5 times the volume of polling stations (15.7%). Further, the voting ratio by i-Voting was 42.9% (4,292 out of 9,350 eligible Shezi Island voters) and was almost 5 times the volume of polling stations, which handled 8.5% (799 out of 9,350) of the vote. This achievement suggests the high efficiency and possibility of the ICTMCP model. Decisions about the stage of the public policy cycle at which ICT projects intervene must be informed by the nature of local power relations and the distribution of access to ICT and participation opportunities across the intervention's target population [65]. In the case of Shezi Island, to get more residents involved in the final decision-making process, voting information was promoted and announced during September 2015 to February 2016 through diverse ICTMCP methods such as face-to-face community participation that included more than 20 different briefings, roundtable discussions, and handing out flyers, while the ICT-based approach included utilizing radio announcements, Facebook posts, and official websites. The success of the ICTMCP model requires steady, face-to-face community participation in the preceding stage for the final success of decision making through ICT-based approach, and the effect can be exhibited only by properly combining both face-to-face and ICT-based community participation.

6. Conclusion

This paper verified the efficacy of the ICTMCP model through a case study of ESI in Shezi Island. For Shezi Island, the ICTMCP model approach included not only conventional face-to-face community participation, but also more substantial community participation achieved by incorporating ICT in citizens' participation. It was found that the housing and factory support system for realizing a more resilient Shezi Island as well as the disaster awareness of local residents are two key factors of ESI planning through face-to-face community participation. Furthermore, the use of a simple, accessible ICT system in the form of i-Voting brought in a new form of community participation that engaged greater numbers of local residents and the general public in plan formulation.

The results of the ESI development plan formulation through community participation on Shezi Island were evaluated based on appropriate consideration of the vulnerability issue of former residents and decision making driven by ICT-based community participation. This paper provides

an empirical experience of the ICTMCP model and suggests the possibility to activate the decision making of development planning in vulnerable communities with disaster risk. More concretely, one important finding is that ICTMCP may facilitate the participative decision making of residents (eligible voters) both inside and outside the community at nearly the same level. However, a limitation of this paper is that the residents' opinions are only analysed based on the referendum and the opinions of their representatives; in the future, more detailed opinions of individual residents should be obtained. It is important to understand the opinions of the opposition residents and those of residents who do not join in the process of community participation, and to acknowledge the factors or reasons that they do not participate or oppose proposed measures. Another limitation of this study is that there were only 10 in-depth interviews were conducted, including representatives from the community and representatives of the Taipei City Government, and thus, only limited opinions were obtained. In the future, it will be necessary to carefully understand the detailed opinions of individual residents, which could not be supplemented from the referendum. Furthermore, according to local media reports [66] [67], as of 2021, the actual start of development and construction has been delayed due to the opposition of a certain number of residents and delay of environment assessment.

Based on the above, it is essential for the government to develop and provide infrastructure such as internet environment and online platform for ICT-based community participation to promote the ICTMCP model for practical use in the future. At the same time, it is also important to provide continuous support to residents who have difficulty with ICT-based community participation or those who desire face-to-face community participation. Constant face-to-face community participation must be supported before the decision-making process in the ICTMCP model. Therefore, the practitioners are expected to support and educate residents on the use of ICT tools, literacy, and information to realize active ICT-based community participation. Regarding the face-to-face community participation, which is an indispensable part of ICTMCP model, practitioners are expected to act as a bridge between residents and the government. By motivating participation, practitioners can produce an ideal ICTMCP model by successfully collecting detailed information on the opinions of the residents, which is indispensable for refining the development plan. The complaints of the residents can also be addressed and the blind spot of majority decision by referendum can be resolved.

Notes

Note 1) Zone expropriation is defined as "a method used to develop an area of land by consolidating and collecting land in a specific district following consultation with the landowners."

The term “zone expropriation” has strong connotations of land being expropriated by the government. As the words suggest, the aim is to acquire zone to carry out zone readjustment and put in place public facilities and so forth. As a general rule compensation will be paid, but landowners are also able to apply for an allocation of “construction land”, and after construction is completed all landowners who applied will receive their allocation of construction land in an order decided by a lottery. The construction land is essentially equivalent to the replotted land found in zone readjustment works.

Note 2) Cooperative housing is a type of home ownership where multiple people form a union, and that union becomes the business owner and chooses designers and builders for itself. In the case of Shezi Island, support and subsidies will be provided by the City. Moreover, Shezi Island will be the first case where cooperative housing has been introduced as part of zone expropriation in Taipei.

Disclosure Statement

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