

Unfolding Tacit and Explicit Knowledge: An Exploratory Study to Broaden The Concept of Flood Resilient Urban Park

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Abstract: Urban centres worldwide experience severe nuisance by flooding. In Vietnam this impact is increasingly negative caused by a process of rapid urbanisation. Traditional spatial planning and flood mitigation planning are not able to deal with this growing threat. This article therefore proposes to focus on increasing the participation of local communities in flood control and management. It explores, on the basis of a design studio exercise, how lay people knowledge on flooding can be integrated within planning processes. The article presents a theoretical basis for the structured criteria for site selection for a flood resilient urban park from the perspective of science, then discloses the tacit and explicit knowledge of the flood-prone area and finally integrates this knowledge into the design strategies for flood resilient urban park design.

Keywords: Analytic Hierarchy Process, AHP, design resilience, flood resilient urban park, knowledge integration.

1. BACKGROUND AND RESEARCH QUESTIONS

1.1 Traditional Planning and Flood Mitigation Planning in Vietnam

The formal planning of landscapes in Vietnam can be divided into three main branches: 1) overall socio-economic development planning (on a national to local level); 2) spatial planning (including land use and master planning); and 3) sector planning. In general, the planning framework envisions that the lower-level plans should follow the directions laid out in the upper-level plans. However, experience shows that, in reality, this workflow is often broken up, and planning processes are rather disjointed and characterized by synchronizing low-level between the vertical and horizontal sectors (Birkmann et al., 2010). Moreover, a lack of financial support from government and provincial budgets are obstacles to the monitoring, maintenance, improvement, design, and funding of flood control projects (Pilarczyk & Nuoi, 2005). In the context of the general urbanization, management, and planning challenges in Vietnam, climate change has increased the pressure on local urban governments, with inefficient planning often exceeding their capacities and resources.

In the period from 1970 to 2000, Vietnam experienced 5858 storms, 4859 floods, and 1310 disasters; thus, flooding is the most important issue facing Vietnam (Pilarczyk & Nuoi, 2005). According to the available statistics, Vietnam has approximately 5000 km of river dikes, 1000 km of estuary dikes, and 2000 km of sea dikes that provide protection against flooding. Dike rehabilitation and infrastructure construction is a fundamental strategy for

flood mitigation in Vietnam (Pilarczyk & Nuoi, 2005).

Ho Chi Minh City (HCMC) has witnessed a very rapid urbanization by attracting an increase in the number of migrants from rural areas. After reunification in 1975, the population doubled 5.17 million people by in 2000 (Vo, 2007). In 2019, the figure has accelerated to 8.598 million (*Statistical Office in HCMC. 2018*). The urbanization and traditional planning have affected the urban form of the city, urban spatial development, followed by real estate market dynamics; it is not surprising that local governments struggle to deal with this.

In Vietnam, all the strategies for flood mitigation have been developed and are being used to cope with floods. A key challenge for Vietnam is to manage its (rapid) urbanization in a sustainable manner and to prevent the adverse impacts of environmental degradation and climate change caused by flooding (Asian Development Bank, 2013). Environmental consideration in the policy planning process has therefore recently changed towards environmental sustainability and resiliency planning.

1.2 Introducing Flood Resilient Urban Parks

The Millennium Ecosystem Assessment (2005) defines ecosystem services as benefits that human beings obtain from ecosystems. The ecosystem services are grouped into four broad categories: provisioning, regulating, supporting, and production services that help to place value on ecological functions. Urban parks are referred to as the ecosystem services at the urban level. For example, urban parks create habitats for pollinators, which in turn provide pollination, beneficial to society. Moreover, urban parks also constitute biodiversity hotspots in the cityscape and thus provide habitats for wildlife (Palliwoda et al., 2017), educate urban dwellers, and contribute to the interaction with biodiversity among the activities of park visitors (Nielsen et al., 2014). While literature on ecosystem services evaluation has grown in recent years, its application to urban contexts is still limited.

Nowadays, urban parks could contribute to ecological sustainability through the resilience approach. The approach is built on resilient natural systems, which acknowledges that flood resilience is built on the existing water systems, floodable lands and natural floodplains (Liao, 2012). With this focus, adaptation is used in this paper to refer to increased design resilience (Moura Rezende et al., 2019). Flood Resilient Urban Parks (FRUP), for instance, “provide a range of environmental, social, cultural, education and economic functions while integrating flood adaptation infrastructural strategies” (Le et al., 2019). For example, a reservoir could temporarily store a large volume of rainwater and provide outdoor activities for local people, such as paddle boats, fishing, and sightseeing.

Scientific literature is reviewed to assess local-scale urban projects that intend to minimize the risk of flooding and provide co-benefits to eco-system services (such as water storage, biodiversity, water treatment, quality public spaces, etc.), based on the application of strategies grounded in nature-based solutions and innovative design. The experience of adaptation to urban floods by the Planning and Design approaches is analyzed in detail to prepare a case study research, taking into account the current situation with regard 1) planning regulation 2) stakeholders involved, 3) needs 4) opportunities (Landa Mendez, 2014). Those interventions are used as guidelines for an adaptive management strategy for adaptation to climate change and flooding. The scope of this article is to involve stakeholders to implement concepts of FRUPs in the landscape design field within the context of Vietnam. In order to understand the role of FRUPs in the ecosystem services and the challenges of such parks on adaptation planning and implementation in Vietnam, this paper aims to identify and analyze the value of FRUP generated by ecosystem services at the urban level, and implement

concepts such as FRUPs by involving stakeholders.

1.3 The Role of Knowledge Integration and Stakeholder Involvement

Acquiring explicit, implicit and tacit knowledge can also facilitate a process of combining this lay knowledge with expert knowledge. Tacit knowledge could consist of tradition, inherited practices, implied values, and prejudgements, which is a crucial part of scientific knowledge. Tacit knowledge, also known as local knowledge, can play a transparent, democratic, effective, and efficient role in the urban planning process (Pulles, 2017). The design process is being asked to focus on the knowledge-to-practice gap, to increase the involvement of multiple stakeholders. It is clear that knowledge integration has a critical role during the design process. More work is needed to understand the role of tacit knowledge in decision-making and practice. For instance, the involvement of local communities introduces a challenge of knowledge integration; equally important however is the balance of explicit and tacit knowledge of the entire design process.

Experiential knowledge as a part of tacit knowledge is perceived to be important for design because the use of experiential knowledge and tacit knowledge can provide valuable data and can verify theoretical conjectures or observations (Niedderer & Reilly, 2010). The problem is that experiential knowledge cannot easily be made explicit because it is contrary to practices of justification and lacks recognition in research. Scientists (experts) become more specialized and more removed from tacit knowledge; hence, the distance between scientists and the community also increases in the context of climate change (Naustdalslid, 2011). For instance, scientists want their knowledge translated into action through expert engineering solutions without relying on other types of knowledge such as societal interest and nature. When the managers get consultants from specialists who do not clearly understand the local context, it is a risk for the city because the governments make decisions without taking the real-life situation context into account. For example, forecasting the ecological response of a wetland is not feasible with hypothetical flooding scenarios (Fazey et al., 2006). According to (Naustdalslid, 2011), the ‘knowledge–action paradox’, which is what scientists take for granted and is one kind of ‘tacit knowledge’ within the scientific community, may conflict with the immediate experience and ‘tacit knowledge’ of lay people.

Knowledge integration has provided many opportunities to create networks and collect a large amount of data that can constantly be updated, which is aimed at improving urban planning. The level of integration can occur in different degrees based on a real situation. For example, distinctions are made between multidisciplinary and interdisciplinary research in landscape ecology (Tress et al., 2005). Examining knowledge in this way highlights that the criteria used to compare knowledge types are often not distinct and/or overlap (Raymond et al., 2010). To integrate and interact between local and expert knowledge is a challenge in the design process. Through focus groups (Puchta & Potter, 2004), we both bring together different perspectives of laypeople and experts; and we observe together the scientific knowledge and physical settings of a case to give a comprehensive analysis. The scientific knowledge (theory powered) or emerging from the data (data powered) will be coded and analysed, new perspectives can emerge, a new concept development can be created as a result of making connections or inconsistency between categories. Generally, we can explore abstract concepts through concrete criteria, cope with defined problems and build bridges between experts and laypeople.

1.4 Aim and Research Questions

This research hypothesizes that the improvement of mutual understanding by experts and local communities of flooding challenges in Vietnam would enhance the success of actual realizations. This paper aims to (1) disclose the tacit and explicit knowledge of a variety of actors on flood-prone areas and (2) integrate this knowledge in order to be able to apply it to concepts such as FRUPs. This overall aim is further operationalized into the following research questions:

- Analysis 1: Which issues do (or don't) all actors (e.g. experts and laypeople) that operate in flood-prone areas focus on?
- Analysis 2: Which of these issues, do these actors view in a similar way?

In this paper, we focus on the empirical case study of Thanh Da, Binh Thanh District, HCMC. We first present the general approach of the method. Four major steps and four types of knowledge are interpreted by quantitative and qualitative evidence. The case study aims to understand the (physical) flooding issues that the Thanh Da is facing and identify the challenges that current planning processes have in addressing these challenges. The article will specifically focus on the challenge of defining criteria to select locations for the development of FRUPs. The criteria should relate to the FRUP as the activities to the needs of the local community, the local water system as well as the national and local flood mitigation. Therefore, the FRUPs have balanced the conceived activities related to the needs of the local community; the flood-mitigation potential of the FRUP depends on the degree to which it is integrated into the local water system. Consequently, it requires the integration of expert and lay knowledge. This paper presents a theoretical basis as the analysis criteria for a FRUP from scientific knowledge, then discloses the tacit and explicit knowledge of the flood-prone area from expert knowledge, on-site knowledge and laypeople knowledge and finally integrates this knowledge into the strategies for FRUP design in Thanh Da practice.

2. METHOD

2.1 General Approach

This section will discuss the methodological steps that were taken in order to formulate answers to the research questions. This paper is based on theoretical and explorative research. An online survey was conducted with 12 experts and a community of 292 lay people was approached with structured interviews.

Externalisation is not an easy process. Its challenge is in how a knowledge owner can effectively articulate their possessed knowledge into a written document. Thus, it can be shared by experts and lay people to become the basis of new knowledge. So, it requires a process of four steps, namely gathering, validating, consolidating, and synthesising criteria to select locations to develop a FRUP (Figure. 1). In the gathering step, we identified and defined selection criteria based on a literature review. In the validating and consolidation steps, we developed a hierarchy among these criteria on the basis of the interviews with experts and the local community by defining links and relationships. In the consolidating step, we started coding the criteria. Coding is an iterative process in which we explore ideas and meanings embedded in data. This step resulted in three groups of criteria, in line with the two research questions: (i) which selection criteria are of importance to both the experts and the local community, (ii) which criteria are of no importance to any of the actors, and (iii) which

criteria are of importance to some of the actors. The fourth step is synthesizing criteria as ‘knowledge integration’ in order to find out if these actors view in a similar or different way.

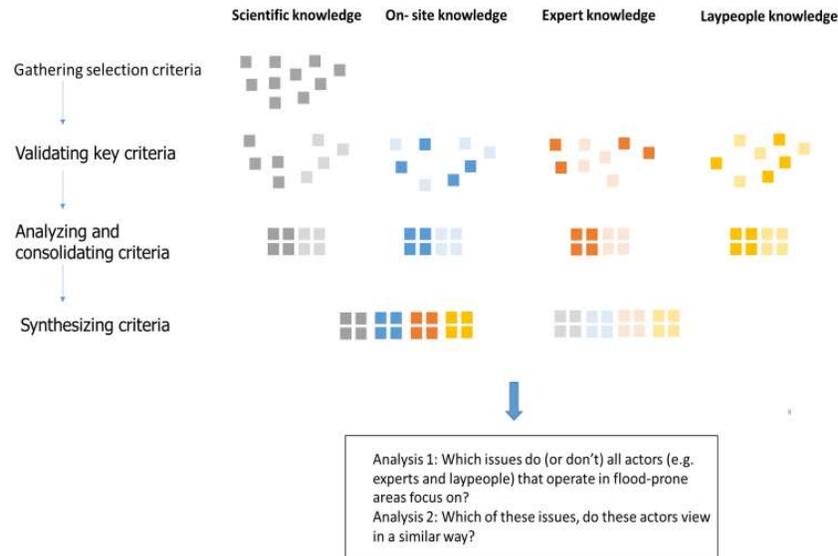


Figure. 1 Model of Methodology

2.2 Four Types of Knowledge

2.2.1 Scientific Knowledge

Scientific knowledge is one of domain knowledge in design and all fields of study. The use of scientific knowledge is to solve problems or reach goals. A systematic literature review provided a theoretical basis of criteria for the site selection of FRUPs. This knowledge takes the form of codified knowledge found in documents, databases such as professional knowledge and scientific publications. The central research question for the systematic review was: What is the current scientific evidence for the site selection of urban parks/urban green space?

2.2.2 On-Site knowledge

An understanding of the site and its environment is an essential part of a design process. Site analysis is a research activity that focuses on the existing and potential conditions on and around a research site. These data are then analysed in terms of their implications for the development of the site for the stated purpose. A first step is to identify the factors and then analyse each factor's potential impact on the proposed development. On-site knowledge is contained in written and visual documentation (explicit knowledge). It provides insights into the resources and environmental features, which consist of strengths, opportunities, weakness, and threats, in order to deal with the environment and socio-economic problems.

2.2.3 Expert Knowledge

Knowledge is possessed by experts in a particular domain. The term ‘experts’ in this paper refers mainly to urban planners, yet also includes architects, engineers and governors who are

specialized in planning. Expert knowledge reflects a depth of experience, which may or may not have been derived through structured and formalised processes (Martin et al., 2005). It is characterised by research or explicit use of reflection in practice (Raymond et al., 2010). Typically, experts have many years of experience and practice. Much of experiential expert knowledge is tacit, and some can be made explicit.

Expert knowledge typically implies the interviewing of experts in order to explore their experience and their perspective. However, technical assistance from experts must be balanced. Too much influence of experts over a process can lead to a decrease in participant empowerment and their trust in the outcome (Pulles, 2017).

2.2.4 Laypeople Knowledge

This knowledge is often linked with the concept of local knowledge in verbal communication and not in any codified or written form. The potential of tacit knowledge for better urban planning can be easily demonstrated by noting that the people living in a specific environment own the true experience of local dynamics and know the needs around them better than anyone else. Locational information provided by laypeople could help design more effective strategies to tackle (flooding) issues.

3. RESULTS

We follow the methodology of four steps including gathering, validating, consolidating, and synthesizing. We use the inductive approach to condense wide and varied text data, link it with research objectives, and develop a deep understanding to improve the working definition. Analysis of focus group data on four types of knowledge can be conducted in various ways. We can analyze our data with both quantitative and descriptive evidence. Insights from all those results can be integrated to develop the concept. Thematic analysis is a method of identifying categories. We conduct a foundation theme/criteria based on theory, then broaden the emergent criteria through an analysis of focus group data. The foundation criteria from scientific knowledge are categorized into 4 main groups with 10 criteria. The 11 emergent criteria are conducted via the narrative data of on laypeople knowledge. The 4 main criteria group, its 11 criteria as subcategories, description, and significant (statement) evidence are resumed. After we break data to produce categories, we look for patterns across all data, understand the phenomena and compare them in different aspects. Summary results are highlighted as follows:

- ‘Existing water surface’, ‘vegetation cover’, ‘landform’, ‘cultural and historical value’ are the most important criteria to both experts and the local community.
- The criterion ‘food providing’ in the park is the most commonly unidentified.
- Six criteria, including ‘access to road’, ‘soil’, ‘local economy’, ‘land use’, ‘land donation’, and ‘tourism resources’ are important to some of the actors.
- Similarities and differences of the lenses on the issues among actors can be questioned.

3.1 Gathering Selection-Criteria

In this study, in the first step, the theoretical foundations have been investigated to extract the ecological development indicators of urban green space in the light of literature. The main

source for the theoretical foundation is based on the ecosystem services indicator of The Millennium Ecosystem Assessment (2005). These include provisioning services such as food and water; regulating services such as regulation of floods; supporting services such as soil formation and nutrient cycling; and cultural services such as recreational and spiritual benefits. The indicator of ecosystem services could be measured to place value on ecological functions, often to the direct benefit of human populations in terms of physical health, or in economic or social terms (Ahern, 2007).

The indicators are categorised in four groups including the physical, biological, social and economic.

- Physical indicator: the physical settings of existing urban green spaces;
- Biological indicator: the sustainable resources of planting, animal species, water according to the local climatic conditions;
- Social indicator: physical activities, recreation facilities, frequent contacts among neighbours;
- Economic indicator: provision of land for economic and commercial activities.

This step was conducted by systematically putting all relevant literature content in Table 1 to create an overview. The structuring criteria include 4 criteria groups, 11 criteria, references, and a general description. The criteria are collected due to the popularization of the geographic information system (GIS) for site selection in the urban green space suitability (Li et al., 2018; Teimouri & Yigitcanlar, 2018), urban park at local scale (Tahmasebi et al., 2014), and local forest park (Salehnasab et al., 2016). Urban parks have demonstrated to provide benefits relevant ecosystem services to urban citizens (Buchel & Frantzeskaki, 2015). Most of the criteria are related to the GIS field. The food providing criteria is extracted in provisioning services which is one of four categories of ecosystem services (Buchel & Frantzeskaki, 2015), (Millennium Ecosystem Assessment, 2005). The outcome will provide for a theoretical basis that will support the subsequent steps.

Table 1. Theoretical Basis

Criteria group	Criteria	References	Description
Physical	A. Existing water surface	(Li et al., 2018)	Reflects the conditions of water resources and maintenance of the ecological balance
	B. Access to road	(Tahmasebi et al., 2014)	Characterizes the basic conditions of traffic Distance to access roads
	C. Landform	(Teimouri & Yigitcanlar, 2018)	Reflects the degree of impact slope and elevation on living
	D. Soil	(Teimouri & Yigitcanlar, 2018)	Reflects the stability of the development of soil
Biological	E. Vegetation cover	(Teimouri & Yigitcanlar, 2018)	Reflects the degree of impact on vegetation distribution, the stability of the development of green space
	F. Food providing	(Buchel & Frantzeskaki, 2015), (Millennium Ecosystem Assessment, 2005)	Reflects the degree of impact on food providing by nature
Economic	G. Local economy	(Salehnasab et al., 2016)	Reflects the degree of local dependency

	H. Land use	(Li et al., 2018), (Salehnasab et al., 2016)	Reflects the ecological value of land resources
	I. Land donation		Reflects the degree of local people accept compensation cost or donate own land to move out the other place.
Social	J. Tourism resources	(Li et al., 2018)	Reflects the development degree of tourism resources and facilities
	K. Cultural and historical value	(Salehnasab et al., 2016), (Millennium Ecosystem Assessment, 2005)	Distance to cultural and historical places Sense of community and aesthetic appreciation

3.2 Validating Key Criteria

3.2.1 Validating Key Criteria on Scientific Knowledge

Scientific knowledge has been known for being private work, in which scientists take place only in their own groups within a research sphere (Oliveira et al., 2005). A scientific knowledge role, aims to encourage knowledge dissemination, knowledge reuse, expert localization, and collaboration. Using knowledge in other disciplines and applying it is really a new challenge in the way of transferring new knowledge. Most of the criteria in this paper relate to the GIS domain, however, we have boldly introduced other criteria from the field of environmental science and the practical understanding of the research context. One of the criteria is food providing that reflects the degree of impact on food provided by nature. This criterion which is found in environmental science, provides benefits relevant to ecosystem services to urban citizens, such as providing food (Millennium Ecosystem Assessment, 2005). Another criterion is the land donation which is added based on emerging data from the lay people perspective during fieldwork. This criteria is relating to people who accept to donate land when the construction site is on their house or property.

3.2.2 Validating Key Criteria on On-Site Knowledge: the case of Thanh Da peninsula

The Thanh Da peninsula is located 8 km northward of District 1 (the city centre of HCMC) and is surrounded by the Saigon River (Figure. 2). This area is the only remaining natural island in HCMC, covering almost the entire area of Ward 28 in Binh Thanh District, with an area of 426.93 ha and with 13.360 inhabitants. The topography of the area is plain consisting of only flat lands. The area has an important function as a flood prevention reservoir for the rest of HCMC. The closeness to water in combination with the generally underdeveloped agriculture has challenged Thanh Da to cope with floods due to tides and heavy rains.

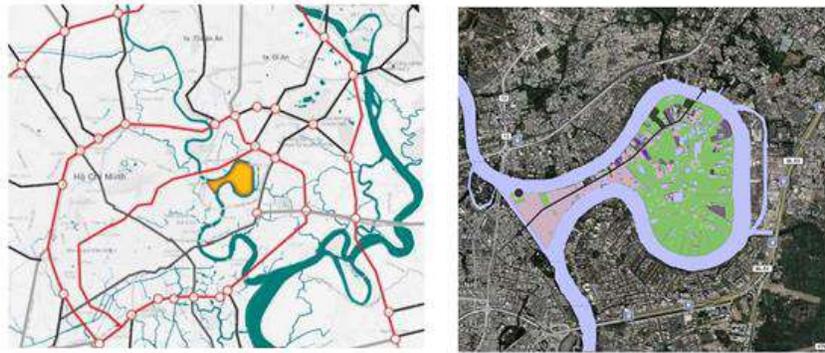


Figure. 2 Thanh Da Peninsula, Binh Thanh District, HCMC, Viet Nam

In 1992 the city commissioned a masterplan for Ward 28 including residences for 4000 households, namely the Binh Quoi–Thanh Da Ecology Urban Development. This plan was never developed. At the end of 2015, a joint venture of Bitexco Group and Emaar Properties PJSC (Dubai) was appointed by the HCMC People's Committee as the investor of the Binh Quoi - Thanh Da. The project duration is 50 years from the date of signing the contract. However, the project has been suspended to date. There are still more than 3,000 households living with the project since 1992. The area was earmarked for the long-stalled development for 27 years while thousands of locals are still living in dilapidated houses and are not allowed to build new houses.

Ironically, the master plan had initially been considered too ambitious and impractical but became outdated shortly after approval (Huynh, 2015). The plans fall short of the sufficient applicability to cope with the issues pointed out earlier in this paper, such as the rapid urbanization and climate change. According to Hoang Minh Tri, the deputy director of the HCM Institute for Development Studies, the main problems are land clearance and compensation (VIR, 2018). The initial development cost was estimated to be \$1.35 billion, of which approximately \$979 million would be used for land clearance, and \$310 million would be used for infrastructure construction. Table 2 applies the selection criteria, defined on the basis of the literature study, to the case of Thanh Da.

Table 2. The socio-economic and environmental characteristics on case

Criteria group Level 2	Criteria Level 3	Significant evidence
Physical	A.Existing Water Surface	The closeness to water together with generally underdeveloped agriculture. The site has several existing canals and, depending on how they incorporate in the built environment, they can be excavated to connect.
	B. Access to road	Binh Quoi Street is the only main road on the peninsula The rest of the internal roads are mostly gravel/unpaved roads with narrow roadways built not according to road standards.
	C. Landform	The topography of the area is plain or flat lands. Land elevation is below 2.0 m and common elevation is 0.5 m.

	D. Soil	There are signs of erosion at some point on site Through the analysis, 430 households can be affected by landslides around the riverbank.
Biological	E. Vegetation cover	More rural and natural area with agricultural land, wetlands known as the "city garden" in HCMC.
	F. Food providing	Orchards, bananas, fish and <i>Nypa fruticans</i> from the natural product but not many.
Economic	G. Local economy	Two-thirds of people are based on service and trade as a fishing resort, restaurant, or small business; One-third of people are farmers.
	H. Land use	Land prices vary greatly from agricultural area to urban area
Social	I. Tourism resources	Community- based tourism ecologically and a cheap price service.
	J. Cultural and historical	Retaining the native values and local traditions can farm their greens and fishing.

3.2.3 Validating Key Criteria on Expert Knowledge

On the basis of the on-site knowledge collection, we decided to slightly alter the selection criteria before presenting these to the experts. Namely, we added the sub-criterion ‘land donation’, referring to people who agree to donate land when the construction site is on their property. For this article, 12 experts were interviewed representing different stakeholder groups within Vietnam and from foreign countries. The participants were selected according to their profession related to landscape and urban design (be it inter or multi-disciplinary). Besides, they understand clearly the local context; even the foreign experts have also lived and worked in Vietnam for a couple of years. A total of 12 experts presented in a distribution of nationalities (Vietnamese 75%, foreign 25%). The experts, who are professors and specialists of different disciplines such as ecological science (3 people), urban design and management (5 people), city level authority (1 person), GIS (2 people), social science (1 person), were invited to participate in the focus groups.

An online questionnaire of the project "FRUP site selection" was directly emailed to them via the link <https://bpmmsg.com/academic/ahp-hiergini.php?sc=gUvugu> (present in the Appendix section). On the basis of this extended list of selection criteria, we formulated an online questionnaire asking experts to weigh the criteria. To obtain the relative importance of factors, they are paired for comparison. The method, which combines qualitative and quantitative attributes, may help to discover the relevant criteria for a new structural concept of FRUPs. The Analytic Hierarchy Process (AHP), introduced by Thomas Saaty since 1980, is an effective tool for dealing with complex decision making from non-structure to hierarchical structure, and may assist to set priorities and make the best decision (Wind & Saaty, 1980). The AHP techniques aim to reduce complex decisions to a series of pairwise comparisons within criteria or between pairs of criteria. The AHP helps capture both subjective and objective aspects of a decision making. In addition, the AHP evaluates the consistency of the matrix. It accepts some small inconsistency in decisions (i.e.10%). Pairwise comparison matrix obtained by decision maker must satisfy Saaty’s Consistency Ratio condition

$$C.R = \frac{C.I}{R.I} < 0.1$$

As a result, the consistent ratio: CR = 6.8% < 10% and weight calculation results are acceptable.

As Figure. 3 illustrates, the highest important criterion by experts is the ‘physical’ criteria at 0.395. The most significant criterion that experts consider is ‘vegetation cover’ (19%); next are ‘existing water surface’ (14.7%) and ‘landform’ (11.5%) as essential elements; and ‘soil’ (5%), ‘food providing’ (4.6%) and ‘local economy’ (3.9%) are the unimportant elements.

Decision Hierarchy			
Level 0	Level 1	Level 2	Gib Prio.
Flood Resilient Urban Park site selection	Physical 0.395	Existing Water Surface 0.373	14.7%
		Access to road 0.209	8.2%
		Landform 0.290	11.5%
		Soil 0.128	5.0%
	Biological 0.235	Vegetation cover 0.805	19.0%
		Food providing 0.195	4.6%
	Economic 0.212	Local economy 0.185	3.9%
		Land use 0.493	10.4%
		Land donation 0.323	6.8%
	Social 0.158	Tourism 0.378	6.0%
		Cultural and historical 0.622	9.8%
			1.0

Figure. 3 Results from criteria after expert evaluation

3.2.4 Validating Key Criteria on Lay People

We used a one-on-one interview to understand how the local community of Thanh Da approaches the selection criteria defined on the basis of the literature review. Lay people have been mostly involved in developing concepts in the local context. We conducted structured interviews with the lay partners and tourists in data collection as an approach to engaging with the community. To support data collection, the questionnaire was built, which included 31 predetermined structured questions, divided into 2 main topics: 1) Understanding family and community lifestyle, 2) Identifying the activities and functioning that people think would be appropriate or inappropriate for a floodable park. The participants were selected according to their representativeness, adults more than 20 years old and play no role in the connectivity and implementation for regional and local authorities and other agents. A total of 292 participants whose attributes are human identity (the local citizens 80.8%, coming from the

other places 20.2%), gender (male 49,3% female 50,7%). Table 3 summarizes a series of statements that relate to particular criteria. The findings investigate what criteria they suggest and in the nature of their expected activities, and the data generated within all groups and ages are presented. The following are the meaningful responses; local interests are a key concern. Issues emerging from the data analysis are categorized into four main criteria groups:

- 1) Regarding the physical group, people feel strongly about the potential of FRUPs to mitigate flooding and about the ability to use FRUP as part of accessible road network;
- 2) Regarding the biological group, a green space plays a very important role for their community, and they also appreciate the role of greenery in their lives. The potential of a FRUP to provide food is not considered by any of the respondents;
- 3) Regarding the economic group, tacit knowledge revealed very little. Profitable activities, such as commercial fishing, are the most common attractive activity, but people do not link such economic activity to the idea of a park. Land donation is a critical challenge for the majority of respondents, who did not agree with moving to another place;
- 4) Regarding the social group, the residents agree that cultural and historical values can be an economic resource, itself creating a reason for tourists to visit.

Table 3: Laypeople knowledge evidence

Criteria group Level 2	Criteria Level 3	Significant statement evidence	Result from questionnaire
Physical	A. Existing Water Surface	“Big river transmits water from the inside out estuaries and then lead to the small canals. If the water level is higher than the canal level, we pushed up ground to prevent flooding issues.”	
	B. Access to road	“Why don’t we renovate the roads and build dikes instead of the urban park to cope with flooding?”	
	C. Landform	“My house is lower than the road surface so it is flooded. I cannot elevate the ground floor because my house height is too low; I have to use pumps during emergencies.”	
	D. Soil	“The soil used to be good agriculture, but now it is not productive, so I did not cultivate anymore.”	
Biological	E. Vegetation cover	“I like to live here because it has a lot of green space. By looking out of the windows, the green space	Of the respondents, 84.5% consider natural green space to be important or very important. A high percentage of

		is everywhere.” “Just go deep inside, you will feel cool and breathing is easier.”	respondents also stated fresh air (20.3%) as their main motive for visiting urban parks.
	F. Food providing		Regarding the most unexpected activities, animal husbandry (61.4%) is a factor that people disagree with and strongly disagree with activities in the park.
Economic	G. Local economy		Regarding the most unexpected activities, commercial fishing (43.8%) and are disagree and strongly disagree activities in the park.
	H. Land use	“I don't live anywhere else because the house for rent is cheap.”	
	I. Land donation		A high percentage of respondents, more than 57% in this study, disagree for compensation, 29% agree and Of the respondents, 15% have no idea. Similar results were found for land donation criteria; 70% disagree, 16% agree and 14% have no idea.
Social	J. Tourism resources		Regarding the most expected activities, the tourists (62%) strongly agree and agree.
	K. Cultural and historical	“I like to live here because the environment is pure, cool and quiet. I like living here and going to work elsewhere.”	Regarding the most expected activities, the tourists (64.7%) strongly agree and agree.

3.3 Analyzing and Consolidating Criteria

To develop a spreadsheet for explicit and comprehensive findings of qualitative studies, in this step we compare all the previous steps and, as such, integrate knowledge gained from literature review, on site analysis, expert questionnaires and local community surveying. In concrete we combined Table 4 for structure, we can begin with the criteria group – criteria – as a core focus, with two categories: focus (a +) and not focus (a–). The focus has strong evidence in science, socio-economic and environmental features, local statements and the Glb priority from experts is higher than 10%. In contrast, the not focus has weak evidence in science, socio-economic and environmental features, local statements and the Glb priority is lower than 10%.

Table 4. Knowledge evaluation

Criteria group	Criteria	Scientific Knowledge	On-site knowledge	Expert knowledge	Lay people knowledge
Physical	A. Existing water surface	+	+	+	+
	B. Access to road	+	+	-	+
	C. Landform	+	+	+	+
	D. Soil	+	+	-	-
Biological	E. Vegetation cover	+	+	+	+
	F. Food providing	-	-	-	-
Economic	G. Local economy	+	+	-	-
	H. Land use	+	+	+	-
	I. Land donation	-	+	-	+
Social	J. Tourism resources	+	+	-	+
	K. Cultural and historical value	+	+	+	+

3.4 Synthesizing Criteria

Analysis 1: Which Issues Do (or Don't) All Actors (e.g. Experts and Laypeople) that Operate in Flood-Prone Areas Focus on?

In light of the constructed database of categories as presented in Figure. 4, synthesizing criteria can be proposed. Among the possible analyses are the resulting classifications in light of the following question: Which issues do (or don't) all actors (e.g. experts and laypeople) that operate in flood-prone areas focus on? There are three themes, in line with the first research questions: (i) which selection criteria are of importance to both the experts and the local community, (ii) which criteria are of no importance to any of the actors, and (iii) which criteria are of importance to some of the actors.

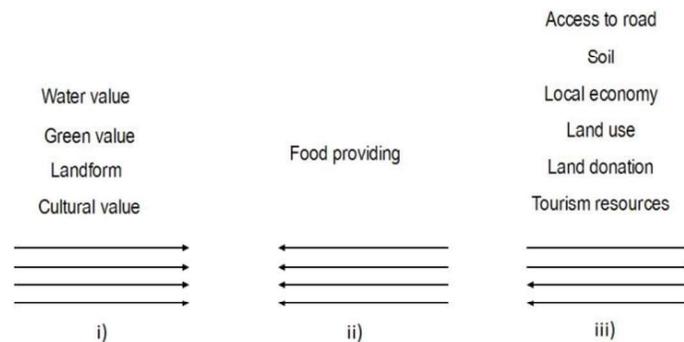


Figure. 4 Themes emerging from the data analysis

'Existing water surface', 'vegetation cover', 'landform', 'cultural and historical value' are the most important criteria to both experts and the local community. An analysis of the findings showed that natural value and cultural values are commonly referenced (e.g. scenic attributes, aesthetical experiences, green value), while under ecological benefit and values education (e.g. opportunity to learn about the environment by observation or experimentation, learning from direct experience of nature), and 'food providing' in park are the most commonly unidentified. There are six criteria, including 'access to roads', 'soil', 'local economy', 'land use', 'land donation' and 'tourism resources', of importance to some of the actors.

Analysis 2: Which of These Issues, Do These Actors View in a Similar Way?

There are three themes in which all actors that operate in flood-prone areas focus on. The question we want to investigate here is: Which of these issues, do these actors view in a similar way? As a result of the overall analysis of the way that actors view each issue, it is a similar and different lens on the issues. For instance, the existing water surface criteria, which are of importance to both actors, seem to be a commonly used criterion. This criterion reflects the conditions of water resources and maintenance of the ecological balance, such as water quality, water quantity, and distance to water (Salehnasab et al., 2016). In contrast with social knowledge, evidence about the existing water surface is also related to the role of the advantages and disadvantages of the water area as a threatening factor that was described by the local residents during interviews. Local residents recognize the importance of water as a solution to reduce flooding. The advantage of a water system exists, but a water system can also be a barrier due to distance to a river, a place with historic flooding. Similarly, for the vegetation cover criteria, the consulted experts consider diversity, distribution, and density as main criteria for site selection (Salehnasab et al., 2016). However, local residents do not envision such complex technical criteria; they only consider the comfort for users because of the fresh and comfortable air. Experts mainly think about technology and engineering as a fundamental solution whereas the community considers user's satisfaction. These are two criteria that look similar but manifest in two different ways.

Cultural and historical value criteria are characterized as embedded knowledge. These criteria reflect a sense of community and aesthetic appreciation, and people respect the native values and the local tradition. Cultural criteria are also regarded as being the most valuable source of knowledge. Cultural criteria are one of the social criteria groups and the resource of physical criteria, namely, what is visible on the surface. What is culture? The question is as common as it is difficult. Many people can benefit from public green spaces because of their accessibility, such as an indicator of the distance to cultural places (Salehnasab et al., 2016). However, a broad benefit of cultural value is greater in ecosystem service (Millennium Ecosystem Assessment, 2005). These values include aesthetic, cultural heritage and historic, biological diversity, recreational, spiritual and religious, and place-based values (Breuste et al., 2013); these values could be a combination of water index, vegetation index, or road index, for example. Knowledge integration has great difficulty in handling this type of knowledge. The physical and cultural groups are the most important criteria for landscape design.

Providing food is the only criterion that is neither scored by experts nor by lay people (-) meaning that it is of no importance to any of the actors. However, the potential to provide food, such as crops of sunflower and rice fields, draw excess nutrients from the water and makes the landscape productive and educational in Houston Park, China, which is a good example of a floodable park.

In all, there are 6 criteria of importance to either experts, on site observant or lay people. These criteria recognize the most distinct group because there are many different opinions between focus and not focus. The gap and disparity of knowledge types are also the highest. Therefore, spanning this gap requires the approach of measurement to define the problem and to find the cause of their differences and their connections. In general, from the results, on-site knowledge always has a (+), which shows that on-site knowledge has value when the other knowledge is ambiguous or unclear. All economic groups' criteria are missing in this theme, which shows that people and experts think that FRUPs do not need economic activities in general. The local economy in Thanh Da is distinctive, but it does not manifest in the people's desires, which may be a flaw in the way we share information and ask questions. FRUPs have the potential to include both benefits to visitors and income opportunities for nature tourism service providers.

Actors expressed a range of views and the intensity of their concerns varied, some distinguish and connections emerge. The paper presents a case study in knowledge integration of a FRUP design to raise issues about the evidence for decision making, and for policy implications. The policy makers can consider that these issues are located at three modes (consensus, no consensus, neutral), as well as the strategies- knowledge correlation are shaped at three levels: macro (global strategies-scientific knowledge), meso (national strategies-expert knowledge) and micro (local strategies- laypeople and on-site knowledge). Note that all those issues operate a cross impact at all those modes and levels. The policy maker should strengthen a tool of evaluation and pose a key question in explanatory terms : 'what works for whom under what circumstances, and why?' (Sanderson, 2002), where policy is shaped under conditions of uncertainty and complex social initiatives.

4. CONCLUSION

The findings of this survey contributed to a better understanding of different types of knowledge on FRUPs in Thanh Da fieldwork. This study examined evidence from both quantitative and qualitative information impressed by strong and weak evidence performance. The findings investigate two analyses to demonstrate which issues all actors (e.g. experts and laypeople) that operate in flood-prone areas do (or don't) focus on and the way they view issues. Distinctly, all knowledge is a mixture of tacit and explicit elements rather than being one or the other (Alavi & Leidner, 2001). Nevertheless, in order to understand this mixture, it is important to make the contradictions explicit among the constituting knowledge, such as the theoretical and expert opposites, the observed context and laypeople opposites, etc.

As a result of the two analyses of the classifications made for each example, it is possible to inaugurate some findings regarding the strategies related to each type of issue. For the group criteria are important to both the experts and the local community, a translation to further design should be seen to integrate local knowledge into existing water systems (to later support infrastructural strategies) and existing socio-economic dynamics (linked to water). There is both strong and weak evidence of the issues. One way to validate data contributed by the public can be by using IT assistance, such as map overlays with expert knowledge to check spatial congruence (Burkhard & Maes, 2017; Maes et al., 2012). For effectively surveying the status quo, fieldwork can be conducted with experts. Collecting experiential knowledge from designers and architects in Architectural Design Education has been an approach implemented to integrate experience knowledge into design (Salama, 2008). The experiential knowledge from specialists should be a main driver when the lay people

knowledge is not embraced. The recommendations should be integrated from expert knowledge (innovative activities and facilities) into cultural value (linked to water). However, the increasing complexity of the design process makes experience competency insufficient as the key component for knowledge-supporting design (Fazey et al., 2006). A transfer of expert knowledge and on-site knowledge could be a main driver when there are many gaps among the different types of knowledge. “Design is not about creativity, it is about problems” (Gregory, 1966). Field studies must take into account the domain knowledge of the design disciplines involved and facilitate feedback loops from the ongoing design processes. Visual aids increase the interest of receivers and help the givers to easily explain the concepts (Arcidiacono & Piga, 2008). Regarding economic issues, the design strategy should integrate on-site knowledge into local economic development based on tourism service. Field studies play a critical role in acquiring contextual and human-centred knowledge from social interests. Hence, “Knowledge acquisition results from individual participation and interactions with tasks, technologies, resources, and people within a particular context”(Thuc Anh et al., 2006) .

APPENDIX

Questionnaire to Experts

AHP Scale: 1- Equal Importance, 3- Moderate importance, 5- Strong importance, 7- Very strong importance, 9- Extreme importance (2, 4, 6, 8 values in-between).

With respect to FRUP site selection, which criterion is more important, and how much more on a scale 1 to 9? (Figure. 5)

A - wrt Flood Resilient Urban Park site selection - or B?		Equal	How much more?
1	<input checked="" type="radio"/> Physical <input type="radio"/> Biological	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2	<input checked="" type="radio"/> Physical <input type="radio"/> Economic	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3	<input checked="" type="radio"/> Physical <input type="radio"/> Social	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4	<input checked="" type="radio"/> Biological <input type="radio"/> Economic	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5	<input checked="" type="radio"/> Biological <input type="radio"/> Social	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6	<input checked="" type="radio"/> Economic <input type="radio"/> Social	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9

Figure. 5 Criteria of FRUP site selection

With respect to Physical, which criterion is more important, and how much more on a scale 1 to 9? (Figure. 6)

A - wrt Physical - or B?		Equal	How much more?
1	<input checked="" type="radio"/> Existing Water Surface <input type="radio"/> Transportation	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2	<input checked="" type="radio"/> Existing Water Surface <input type="radio"/> Landform	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3	<input checked="" type="radio"/> Existing Water Surface <input type="radio"/> Soil	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
4	<input checked="" type="radio"/> Transportation <input type="radio"/> Landform	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
5	<input checked="" type="radio"/> Transportation <input type="radio"/> Soil	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
6	<input checked="" type="radio"/> Landform <input type="radio"/> Soil	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9

Figure. 6 Sub-criteria of the physical group

With respect to Biological, which criterion is more important, and how much more on a scale 1 to 9? (Figure. 7)

A - wrt Biological - or B?		Equal	How much more?
1	<input checked="" type="radio"/> Vegetation cover <input type="radio"/> Food providing	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
CR = 0% Please start pairwise comparison			

Figure. 7 Sub-criteria of the Biological group

With respect to Economic, which criterion is more important, and how much more on a scale 1 to 9? (Figure. 8)

A - wrt Economic - or B?		Equal	How much more?
1	<input checked="" type="radio"/> Local economy <input type="radio"/> Land use	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
2	<input checked="" type="radio"/> Local economy <input type="radio"/> Threatening factor	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
3	<input type="radio"/> Land use <input type="radio"/> Threatening factor	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9

Figure. 8 Sub-criteria of the Economic group

With respect to Social, which criterion is more important, and how much more on a scale 1 to 9? (Figure. 9)

A - wrt Social - or B?		Equal	How much more?
1	<input checked="" type="radio"/> Tourism <input type="radio"/> Cultural and historical	<input checked="" type="radio"/> 1	<input type="radio"/> 2 <input type="radio"/> 3 <input type="radio"/> 4 <input type="radio"/> 5 <input type="radio"/> 6 <input type="radio"/> 7 <input type="radio"/> 8 <input type="radio"/> 9
CR = 0% Please start pairwise comparison			

Figure. 9 Sub-criteria of the Social group

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