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# PREFACE

Welcome to TAIPEI!

SPSD 2015 is organized by the International Community on Spatial Planning and Sustainable Development, and supported by the Taiwan Institute of Urban Planning, and Taipei University of Technology. For promoting the establishment of smart cities, the conference aims to gather researchers and planning consultants who will share their own ideas and the latest results of research and successful case studies in smart city governance. The concept of smart city is suggested as a new style of city for providing sustainable growth and encouraging healthy economic activities to reduce the burden on the environment while improving the Quality of Life (QoL) of city residents. Many experimental projects are currently being carried out in the world, which are varied and diverse. Many researchers are also actively involved in vitalizing smart city activities and improving the QoL of residents using ICT-representative technology (Information and Communications Technology). The topics of interest include, but are not limited to:

- Smart city management
- Smart infrastructure planning
- Smart mobility society, life style and community
- Human behaviors, spatial analysis and urban modeling
- Sustainable society and community development
- Sustainable society, smart city and planning frameworks

The field ranges from urban renewal, smart urban and rural planning, urban and rural industry, tourism and recreation, environmental planning and green building, to the field of infrastructure and transportation planning, planning tool and information technology.

We are very pleased to cordially welcome you to Taipei for SPSP2015, and hope you enjoy your stay in Taipei and your trip in Taiwan.

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**Urban Renewal & Smart Urban**  
**and Rural Planning**





NO.17

## An Investigation on the Relationship between Healthy Body Types and Public Facilities in the City

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**Key words:** Healthy body types, constructed environments, BMI, public facilities

**Abstract:** Rapid socio-economic developments and transformations of diets and lifestyles have led to improvements in living conveniences in the highly urbanized and dense living environments. However, compression of open spaces means that urban dwellers are exercising less, indirectly leading to gradual increases in the number of obese people with overly high body mass indexes (BMI), with possible signs that this increase may accelerate rapidly. Taiwan, being a small country with a sizable population, has a very high population density. Land is often overused, resulting in the lack of open public spaces for recreational purposes which is further compounded by sedentary lifestyles. This limited access to areas for conducting physical activities have reduced the motivation for exercising amongst urban dwellers. Large increases in obesity have attracted the attention of many countries around the world. This phenomenon has largely been associated with overeating and inadequate exercises, with the environment acting as a major factor influencing obesity. Public facilities in city environments play important roles in ensuring healthy urban development and quality of urban life while encouraging interaction between urban dwellers as well as their participation in and demand for healthy activities. These observations have thus provided the motive for investigating the relationship between healthy bodies and public facilities. The purposes of this study included providing adequate solutions in response to the growing obesity rate and identifying relevant influences caused by inadequate public facilities in the city. A literature review was first carried out to define a healthy body type, and understand relevant contributing factors between healthy body types and public facilities, and compile case studies on built constructed environments and public facilities around the world. A comparative analysis method was used to categorize public facilities and list their effects on the strategies and planning in response to urban obesity. Finally, the contents, targeted users, and layouts of public facilities were evaluated in order to strengthen multiple objective utilization of existing public facilities. Recreational areas that help to improve urban greening were further increased to help

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the public maintain a BMI range that is best for health, promote public physical fitness activities, and generate a healthy and dynamic urban environment.



NO.29

## **Prospects for Sub-Regional Cooperation in Fujian and Taiwan from Perspective of Urban Planning System : A Case Study of Pingtan Experimental Area**

Ninglong YOU<sup>1\*</sup>, Zhenjiang SHEN<sup>1\*</sup>, Jen-te PAI<sup>2</sup> and Fumihiko KOBAYASHI<sup>1</sup>

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**Key words:** Urban Planning System, Sub-Regional Cooperation, Fujian, Taiwan, Pingtan Experimental Area

**Abstract:** The pace of cross-border sub-regional cooperation is accelerating in the worldwide; ways of institutional cooperation guided by policy has become future trend of regional development gradually. The collaborative development of urban planning system is a significant deciding factor in sub-regional cooperation, especially in the part of joint development which is paid more and more attention by academia and the public. Fujian and Taiwan have deep connections and the strategic visions of cross-strait cooperation was formed after the ‘*Opinions*’ had been issued in 2009. The approval of Pingtan Experimental Area provided conditions and spaces for the realization of cooperation and it proposed a new pattern of joint planning, development and management at the same year. Based on that, this paper takes Pingtan Experimental Area as a case study and makes a comparison of the system of laws and regulations, the system of operation and the system of administration in urban planning system on both sides. Then it analyzes collaboration points of urban planning system in Pingtan Experimental Area in the background of cross-strait cooperation by summarizing the characteristics and differences. Finally this paper builds an operational framework for cooperation between Fujian and Taiwan in the sub-region to provide inspiration in cross-strait cooperation effectively.

## **1. INTRODUCTION**

With the trends of economic globalization and regional integration are developing in parallel, cross-border sub-regional cooperation is speeding up gradually (Yuejuan WANG (2014)). Sub-regional cooperation is a concept relative to region, it means a regional cooperation between adjacent areas in a

country and its contents and projects are more flexible (Chui Zheng QIU (2015)). Urban planning system is the mechanism in sub-regional cooperation and the guarantee of its policy function is to make fair and reasonable allocation adjustments and choices of public interests in whole society (Yu WANG (2009)). Since ancient time, there are deep roots and exchanges on both sides of Taiwan strait and their five geographical advantages (close in geographic sites, blood related, cultural background, commercial intercourse and laws) and complementary requirements of current development are promoters in cooperation. After 2000, both sides made great strides in relationship and economic cooperation. The growth of trade volume increased more than tripled in just ten years (Pingtan Statistical Yearbook (2014)). In 2003, the state proposed the strategy concept of 'Economic Zone on the West Side' (shortly for 'Economic Zone') and the construction of Economic Zone launched officially. In 2009, the State Council promulgated '*Opinions about Supporting to Accelerate the Construction of Economic Zone on the Western Coast of the Taiwan Strait in Fujian Province*' (shortly for '*Opinions*') and Economic Zone was upgraded to a national strategy. In 2010, both sides signed the '*Economic Cooperation Framework Agreement*' (shortly for 'ECFA') and opened a new channel of economic cooperation. Since then, how to open up a path to promote regional coordination development has been in-depth discussed by scholars on both sides. Finally, the path of 'selecting an appropriate region as pilot area of cross-strait cooperation to provide a reference for joint development' was formed gradually. Pingtan Experimental Area (shortly for 'Pingtan') emerged at a historic moment and proposed a grand plan of 'joint planning, joint development, joint operation, joint management and share earnings'.

Scholars discussed about sub-regional cooperation theories in the context of regional development. The prime minister of Singapore Zuodong WU proposed the 'Growth Triangle' theory for the construction of multinational economic development zones (Giok-Ling Ooi (1995)) which can be summarized as two or more countries set a certain geographical area aside and create an organism of highly economic coordination to promote economic development (Elisabetta Nadalutti (2014), Katircioglu, Salih Turan, et al. (2007)). Its conditions include geographical proximity, economic complementarity and possibility for mutual coordination among governments (Diao YU, Xuyang CAI, et al. (1999), Cynthia Chou (2006)). Some scholars considered that 'Sub-regional Economic Zone' is more suitable for areas which have geographical proximity, historical connection, close in culture but separated politically and easier to establish cooperative development with different institutional background (Guojun YANG (1994), Mirzokhid Rakhimov (2010)). Yuanji CHI, Shengda HE, etc took Tumen River as a representative of 'Transnational Economic Zone' pattern which is taking export-oriented economy as the goal to joint development and this pattern explores an open institutionalization cooperation actively that

exclude the impact of partial political factors (Yuanji CHI, Xiao LI (1992), Shengda HE (2005)). Nina P. David, etc. explored the 'New Regionalism' in the new situation is facing to social conflicts and physical planning cohesion in regional co-regulation and it makes a close coordination between physical planning and development plan of social and economic in different levels (Nina P. David (2014), Chao WU, Qingquan WEI (2004)). From these studies, ways of institutional regional cooperation has become a hot topic and indicates the trend of regional cooperation. As a significant determinant in regional joint development, the collaborative of urban planning system is gaining more attention. The urban planning system in Fujian and Taiwan have distinctive characteristics respectively especially in the system of laws, operations and administration. Therefore, there are existing different planning phenomenon (or means) under respective contexts.

Above all, this paper will take Pingtan as a case study and grasp factors in different political systems and policies on both sides. By making a comparison of the system of laws and regulations, the system of operation and the system of administration in urban planning system to summary differences and analyze the collaboration points of Fujian and Taiwan to promote Pingtan's joint development and management. Finally, this paper will build an operational framework of sub-regional cooperation and provide inspirations to promote sub-regional cooperation for cross-strait effectively.

## **2. STUDY AREA**

This paper uses data collected from government departments, local web-site, etc. in Pingtan. Pingtan County belongs to Fuzhou city, Fujian Province (*Figure 1*). After the whole county was planned to build Experimental Area (the only national experimental area in China at present), it obtained administration privileges of cities under the jurisdiction of Fujian province directly. Thus, the overall development of Pingtan is managed by district council and reported to the State Council for approval under the system of urban planning of Fujian and local development requirements. Due to the location of Remote Island and front frontier on both sides, the economic development and urban construction of Pingtan was lagging behind and lack of appropriate guidance policies. Based on 'The Urban Master Plan of Pingtan County (2008-2020)', the planning area of Pingtan is only 26.12 km<sup>2</sup> which was less than one-tenth of total area.

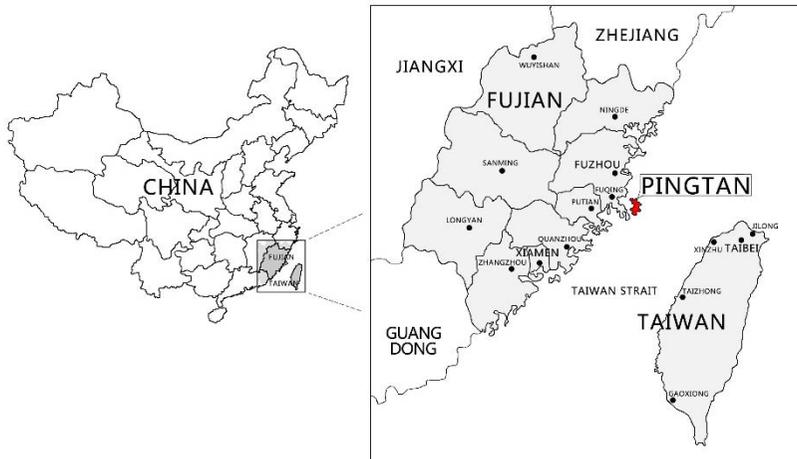


Figure 1. The location of Pingtan Experimental Area

In 2009, the master plan of Pingtan County was invalidated which had been implemented for only one year and the new master plan of Pingtan Experimental Area started to formulate. In July, the State Council issued ‘Opinions’ and proposed to ‘promote construction of Pingtan and makes it possible to build an experimental area that try first in cross-strait exchanges and cooperative and scientific development on Economic Zone’. In next years, both sides signed ‘ECFA’ and ‘Service Trade Agreement’ (shortly for ‘STA’) which negotiated basic principles and working mechanisms in economy, trade, investment. etc. and broadened channels of economic regional cooperation.

To implement these macro policies, the State Council approved ‘The Master Plan of Pingtan Experimental Area (2010-2030)’ in 2010 and put forward a new cooperative of ‘Five Joins’. Its contents include a space framework of ‘one city, multi region and groups aggregation’ and short-term construction plans was focusing on developing port-based economic and trade zone, central business district and tourism and leisure area in the southern of island. In 2011, the National Development and Reform Commission announced ‘Development Plan of Economic Zone on the Western Coast of the Taiwan Strait’ and ‘Master Development Plan in Pingtan Experimental Area’ that carried out cross-strait regional cooperation in Pingtan and explored a new pattern to develop a common home that joint construction, try first and scientific development in Pingtan by both sides. It also agreed to implement ‘Open Island’ and gave Pingtan more unique and preferential policies than any other special economic zones in pass model, fiscal support, investment access, finance and insurance, cooperation with Taiwan and land development (*Figure 2.*).

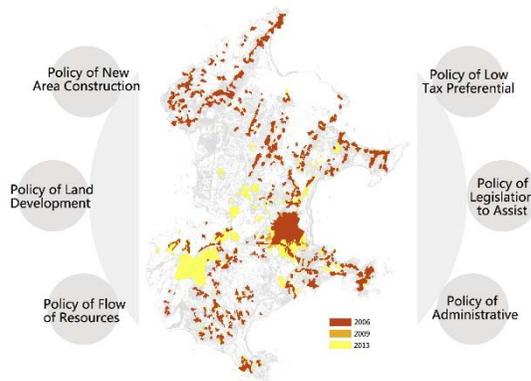


Figure 2. Land expansion of Pingtan Experimental Area and its policy-driven

Guided by the ‘Master Development Plan in Pingtan Experimental Area’, the state and Fujian provincial government design special policies in new area development, land, transportation and trade, tax, laws and management, etc. In particular, Fujian encourages Pingtan to learn advanced experience from Taiwan or the other countries, organize planning agencies on both sides to formulate special planning, establish a sound mechanism for regional cooperation to break the limit of administrative regionalization; gives priority to construction land and ensure land demands, especially the industry land for modern service; builds ports and provides convenient port services to move faster toward flow of people and goods, gives more preferential terms to Taiwan enterprises and products; implements fiscal and taxation independent and low tax regime in Pingtan and reduces business tax or preferential treatment for partial special enterprises; gives appropriate legislative authorities to Pingtan to make local laws and regulations, builds a green channel of judicial assistance between Fujian and Taiwan; sets up cross-strait cooperative commissions by agreement and confirm power sectors through legislation which including economic and social, development and construction, etc.

Fujian government issues a series of preferential policy and management details to thoroughly apply national policies. It supports the development of key industries and encourages intensive land use actively by the ways of preferential land price. Such as in industry development, Fujian gives construction projects at most 70% of land use right price according to ‘National Standards for the Minimum Transfer Prices of Land for Industrial Purposes’ which meeting to national industrial policies, encouraged by Fujian and belong to major projects or provincial key projects in industry revitalization planning adjustments. About intensive land use, Fujian gives construction projects which meeting the relevant provisions of urban planning, using advanced technology or land-saving measures in designs or

construction technique or investment intensity exceeding 10% of standards prices preferential from 3% to 10% according to saved land area or improvement of FAR. For general projects beyond the concentration areas planned by government, the minimum standards of selling lands will go up 10%.

All these system contexts support Pingtan's development in the phase of start-up. Because the development of Pingtan is accelerating under the guidance of policy documents which focusing on the joint construction and development on both sides, the collaboration of urban planning system of two places is inevitable to a great extent. Mainland also gives sufficient relaxation of policy and freedom to explore. These basic contexts call for analyzing differences of urban planning system in Fujian and Taiwan and finding collaboration points to improve the environment of a large number of state-owned and Taiwan-funded enterprises are drawn into Pingtan.

### **3. METHODOLOGY**

The contents of analysis for this study are urban planning system and the range is two provincial regions which cross administrative boundaries. Relevant principle data sources for determining urban planning system on both sides come from district government materials and rigorous literature review. What's more, Shift-of-Context Analysis (Henian LIANG (2003)) is used as a basic method in this study.

The Shift-of-Context Analysis is a kind of comparative method focusing on relationships between planning phenomenon (or referred to means, hereafter called means) and contexts in two or more countries and regions. In the field of urban planning, means include policy, system, program, laws and regulations, science and technology, etc. The key point of comparison between two places is the process of changing one means to another. The context of different places has particularity and they are not easy to change. The operation relations can be described as followed. Place A and place B have different planning means in their contexts. It is necessary to make an appropriate research for plasticity and some planning means need to be adjusted when move it from place B to place A. Because of contexts of place A is hard to change in this process, the special region background and policy become significant basis and criterion of analysis of plasticity. Revised planning means is the key point for studying from one another and planning collaboration between place A and place B (*Table 1*):

Table 1. The relevant variables, relations and process in brief

Variables
<p>•<b>Four variables:</b></p> <ol style="list-style-type: none"> <li>1. Phenomenon (means) of place A</li> <li>2. Context of place A</li> <li>3. Phenomenon (means) of place B</li> <li>4. Context of place B</li> </ol> <p>•<b>Two relations:</b></p> <ol style="list-style-type: none"> <li>1. Relationship between phenomenon (means) and context of place A</li> <li>2. Relationship between phenomenon (means) and context of place B</li> </ol>
Relations
Basic process
<ol style="list-style-type: none"> <li>1. <b>Confirm the means of place A.</b> Distinguish every details and level of this means and decide which one is most important.</li> <li>2. <b>Identify the context factors of place A that related to its means.</b> Distinguish the nature and impact of every factor and decide which one is most important.</li> <li>3. <b>Analyze the relationships between the means and background of place A.</b> Focus on the fit, conflict and tension between means and background.</li> <li>4. <b>Move the means of place A to place B just as it was and distinguish which context of place B will be led or depended on when the means of place A is used in place B.</b> This part usually called as mental experiment.</li> <li>5. <b>Analyze the ‘possible relationship’ between the means of place A and the context of place B.</b> Especially the possible fit, conflict and tension.</li> <li>6. <b>Research for the ‘plastic’ of the means.</b> Find out the limitation that can be amended on the premise of not changing the particularity of this means.</li> <li>7. <b>Shape a means that fit for the context of place B.</b> Make an assumption that the background factors are not change and shape a means that best fit, least conflict and lowest tension for the context of place B.</li> </ol>

By using this method in the research for cooperative development in Fujian and Taiwan, the basic framework and process can be organized as followed (*Figure 3.*):

1. Determine the overall objective of cooperative development by Fujian and Taiwan in Pingtan: joint planning and construction.
2. Find key differences of urban planning system on both sides by the comparative analysis.
3. Analyze key context factors behind the differences of urban planning system and their relationships.
4. Make a hypothesis of ‘possible relationship’ after the shift of key points in urban planning system and research for ‘plasticity’ according to the special region background and policy in Pingtan.
5. Build the framework of cooperative development in Pingtan based on the shift of feasible urban planning system which is both advantageous to the optimization of urban planning system in the

context of mainland and meet the planning means of Taiwan properly.

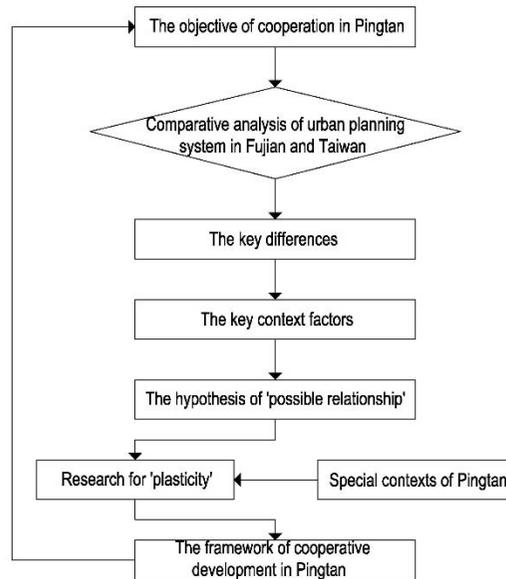


Figure 3. The Basic Framework of Cooperative Development in Fujian and Taiwan

## 4. RESULTS

### 4.1 The Comparative Analysis in Taiwan and Fujian

#### 4.1.1 The System of Laws and Regulations

The system of laws and regulations is the basic guarantee of urban construction and its characteristics are mainly embodied in structure, functions, purposes and core contents.

The planning system of laws and regulations in Fujian is composed of two levels from central to local in a centralized system. In national level, Fujian follows a horizontal system which consisted of basic laws, matched laws, related laws and corresponding technical specifications and it is a basis to build local planning regulations. In particular terms, Fujian takes the 'Urban and Rural Planning Law' as the basic law to direct lower regulations and involving principle provisions that covering planning formulation, management, operation and development control, etc. This part is assisted with administrative regulations and measures on planning formulation,

approval and management to improve detailed rules by making related technical specifications and standards. In addition, some related laws are also significant legal basis in urban construction. Like laws involving the land ownership and management: 'Land Administration Law' and 'Cultural Relics Protection Law', etc.; construction of important urban facilities: 'Regulations on Administration of Urban Roads' and 'Construction Law', etc.; environment and social security in urban: 'Environmental Protection Law' and 'Civil Air Defense Law', etc. Under the national macro-control, regions develop appropriate local planning regulations according to local needs to improve the management of urban planning. Like in Fuzhou, the capital city of Fujian Province takes 'Regulations of Fuzhou Municipality on Administration of City Planning' as the core of local regulations and assisted with management measures and technical specifications which contains cultural preservation, roads and greening construction, land and new area development to constitute the mainly regulatory network system that from top to bottom at present stage. In this system, planning regulations are defining two planning acts: urban planning operation (formulation and approval) and administration to achieve the purposes of strengthen urban planning management.

Different from Fujian, the system of laws and regulations in Taiwan has three main parts: urban planning, architecture management and land use control. Based on the 'Urban Planning Law', 'Building Act' and 'Regional Plan Act', Taiwan takes a large number of urban planning laws, building construction laws and land use laws as auxiliary laws. Related laws are concerning on the environmental protection, housing and common pipeline. Eventually Taiwan makes detail operating requirements of laws' contents by related enforcement regulations. All these formed a specific system of urban planning laws (Qian HAN, Yizhen SHI, et al. (2001)). Local governments in counties or cities set appropriate autonomous regulations of urban planning implementation to fulfill requirements of laws system. For example, Taipei City obeys the 'Autonomous Regulations of Urban Planning in Taipei' to assist the implementation of basic laws and enhance the environmental quality of city life. Taiwan takes three basic laws as a basis of laws system in urban planning at the same time and focusing on the relationships among urban planning, building management and land use control. According to 'Urban Planning law', urban planning should be implemented the buildings management in accordance with 'Building Act' after it was announced and the land use or zoning plans should be controlled by the license requirements and building tools. In land use control, Taiwan has introduced dozens of special decrees that covering all aspects of land expropriation, registration, planning and management and highlights the protection of non-urban land and agricultural land released in urban planning. The urban planning system of laws in Taiwan is more detailed in regulations of resources management and covering more spaces that reflecting the tendency of urban planning (Figure 4.).

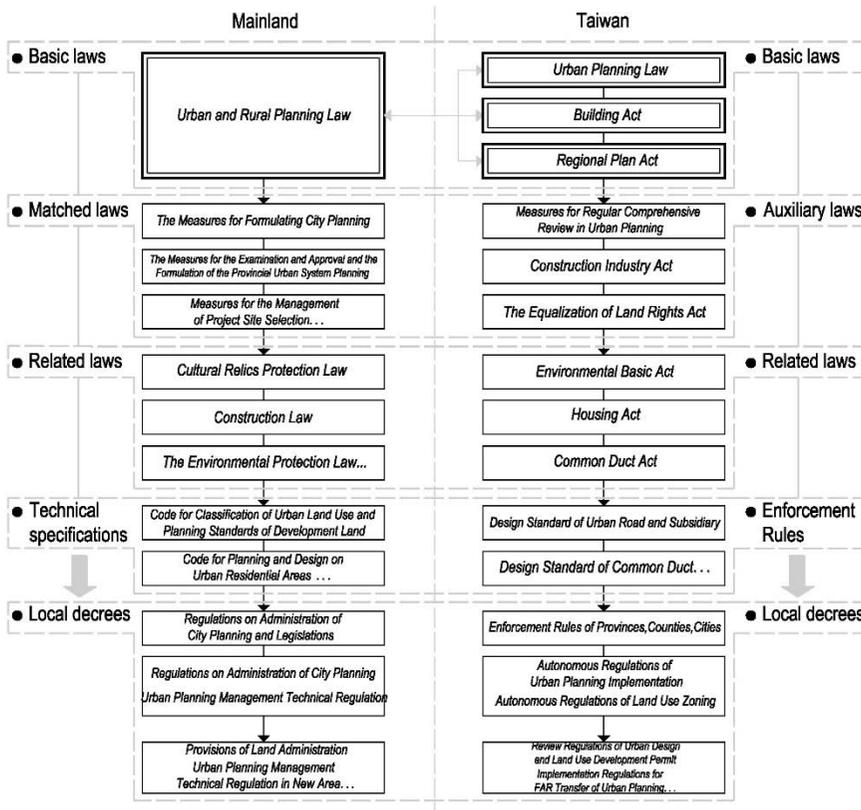


Figure 4. The comparative of urban planning system of laws and regulations in mainland and Taiwan

## 4.1.2 The System of Operation

The urban planning system of operation has mainly two parts: planning formulation and planning review. Its characteristics will be comprehended from planning types, function effectiveness and the process of administrative review in formulation.

### 4.1.2.1 Planning Formulation

The contents of urban and rural planning in mainland include urban system planning, urban planning, town planning, township planning and village planning. Urban planning and town planning are consisted of master plan and detailed planning. The backbone system of formulating in Fujian is

a statutory planning system of 'Urban Master Plan---Zoning Plan---Detailed Planning' and make guidelines and rules of regulatory detailed planning in each zone. In practice, Fujian establish planning support system which involve previous surveys and subsequent constructive planning. Therefore, the way of 'master plan---detailed planning' is used in planning formulation in Fujian. First, the master plan determines the planning natures, scale and spatial development strategies. Then it takes administrative areas as the special units of planning and management. Finally, the control requirements of these units will be broken down into each block. The regulatory detailed planning and site detailed planning are used to determine the indexes of develop control and guidance of urban design respectively in this process. In current system of formulating, approved detailed planning and statutory plan are legal basis of guiding urban construction and new area development directly and implement urban planning management through the full coverage of regulatory detailed planning to all blocks. The deadline of master plan is normally 20 years and it takes a long time to complete it from formulation to approval generally.

Taiwan's urban planning development turns to improving the efficiency of formulating and approval after the technological transformation and post-industrial economy (Zhengchang XIE, et al. (2012)). It formed a urban planning formulation system of 'Comprehensive Development Plan in Taiwan---Regional Planning and Department Construction Development Plan---Comprehensive Development Plan in Counties, Cities and National Park Plan---Urban Planning'. In this system, regional planning was separated from urban planning formulation system and used as upper planning to guide the comprehensive development plan of counties, cities and urban planning. The scope of urban planning is covering city (town), township (streets), special area and all these plans need to follow the program from main plan to detail plan (in the case of township, streets and special plan, main plan and detail plan can be merged together). Master plan is development visions and detail plan is practice standards. They have nearly the same operation procedure and detail plan increases concerns in urban design and land use management. As the basis for the implementation of urban planning, detail plan must be completed within two years after master plan was released. The ways of formulating from master plan to detail plan have some features especially in programming. Only when the relevant indicators of public facilities land (such as parks, playgrounds, green area, squares, children's playground, etc.) in master plan reaches the legal target, the detail plan can be organized. The construction of public facilities must be completed within five years after detail plan was released. Taiwan gives sufficient attention to needs of daily life and the improvement of overall function in urban. Another characteristic of Taiwan's urban planning is the mechanism of 'Comprehensive Review' in the process of formulating. Planning authorities need to operate it in at least three or five years and carry out relevant land use changes according to development situation, especially the land of public facilities. Changes need to be written into current plans in

the form of provision. The main plan and detail plan are joined closer whether in time or contents and space scope is contained layer by layer which makes relatively clear corresponding relationship between upper and lower plans (Figure 5).

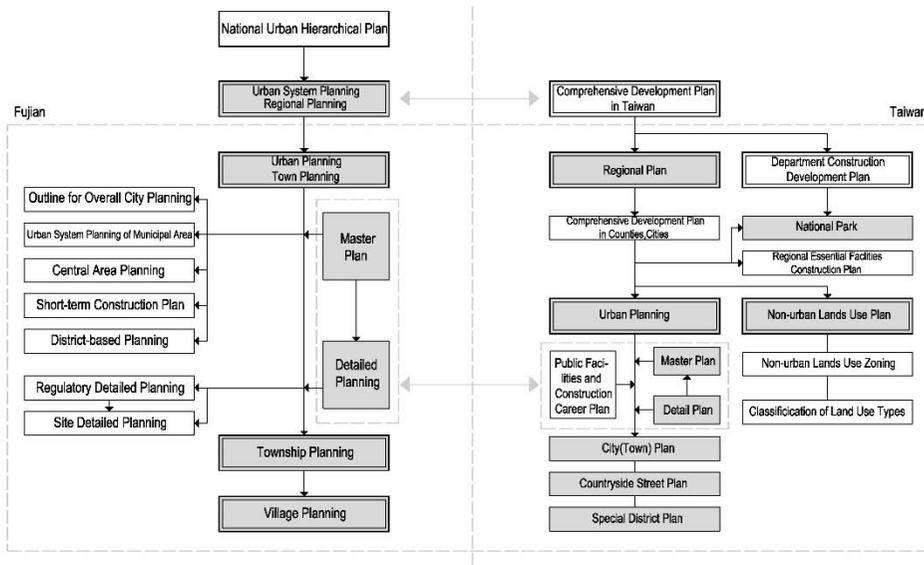


Figure 5. The comparative of urban planning system of formulation in Fujian and Taiwan

#### 4.1.2.2 Planning Review

The urban planning administration system of Fujian is in the framework of state administration. Governments set up departments of urban planning, urban construction, land management, etc. Local development and reform commission or urban and rural construction committee are mainly in charge of establishing related policies. Functions of land and resources bureau and urban and rural planning bureau are practicing formulation of land and urban resources, the supervision of planning management and implementation is consulted with the other relevant departments, like environmental protection bureau, etc. Under the approval mechanism of government-led and multi-sectoral participation, planning administrative departments in government at all levels are responsible for the formulation and review of urban planning in the administrative range (master plan and detailed planning). The review process contains the sector review by relevant sectors and technical review by experts and reported to upper governments for approval. For unqualified results will be sent back to formulation organs to adjust and reorganize reviews regularly.

The administrative system of Taiwan is relatively streamlined and practicing a vertical leadership. According to the ‘Urban Planning Law’, the

urban planning authorities from top to bottom are the ministry of interior, special municipality or county (city) government and township, town or city office. All levels of authorities set urban planning commissions to take responsible for planning review works of Taiwan, county, city, township and town. Special types of land use are coordinated by zone development authority (Yunnian SHI, Zhaoya LIAO, et al. (2009)). The urban planning reviewed by committee will be sent back to governments for checking in two ways: passed after revised and passed as original. Finally it will be reported to committees at higher level for deliberation. It is a basic flow of urban planning formulating and review in Taiwan (Figure 6.). The biggest feature is that the work of planning formulating and review are separated by governments appropriately and review works are focusing on public display and community participation in planning period. Staffs of constituting the urban planning commission are including governments, elected and business representative, scholars or experts and the other social groups that formed an urban planning mechanism of economic, urban and land experts are responsible for reviewing and making decisions (Wenhua ZHU (1999)).

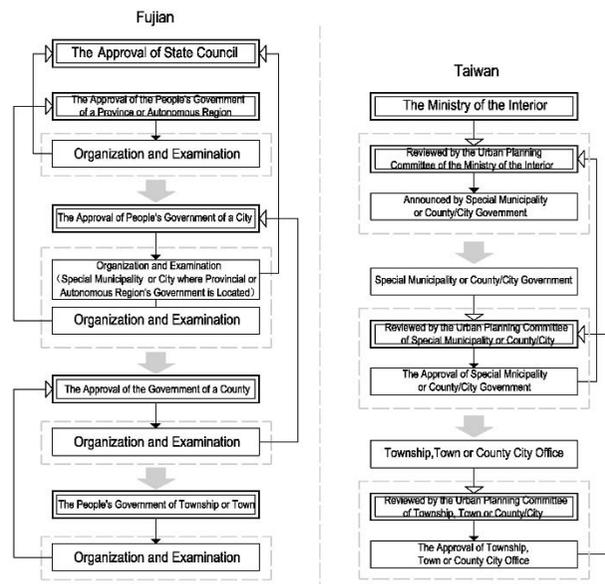


Figure 6. The comparative of urban planning system of review and approval in Fujian and Taiwan

### 4.1.3 The System of Administration

The core of urban planning management is the system of reviewing development projects based on various types of urban planning and it focuses on discussing issues about land development, public interest, etc.

The urban planning management in Fujian is a permit system called 'One Proposal, Two Licenses' to reach the control and guidance for various development activities. It is nearly all development activities involving location for construction project; land use plan and building construction need to apply for corresponding planning permissions through multiple review and approval by different levels of urban and rural planning authorities. Types of permits are proposal for site-choosing, license for construction planning and license for project construction planning. The main targets of development permission have two categories, construction of new area, expansion, renovation and buildings or structures and construction of infrastructures including roads, pipelines and the other facilities. Detailed contents are following local regulations and technical documents (Yingguang XIAO, Min ZHAO (2005)). The system of 'One Proposal, Two Licenses' is a kind of planning tool to realize space adjustment in the level of detailed planning (regulatory detailed planning and site detailed planning) and urban planning administrative departments are responsible for the implementation of development permission. Due to specific contents of permissions are not very clear at the statutory level that give departments wide discretions in planning review which increase the flexibility of planning control but a low administration efficiency and impacts on human factors.

Taiwan chooses different system of planning management for urban land and non-urban land based on land classification. Within the scope of urban planning, Taiwan implements control of land use zoning which is mainly used in detail plan according to urban planning law and local planning rules. The contents of land use zoning control are using zoning (residential area, business district or industrial site...), control of building density (the highest building density, the tallest building height, the maximum FAR...), control of using characters (compatibility assessment...), activities do not comply with zoning restriction (repair, change, migration...) and the other aspects (parking lot, advertising signboard...) (Xuwen YU, Haidong PENG (2001)). Any developments in territory need to confirm with the regulations in land use management to achieve expected land use type of original plans that benefit to orderly development to a certain degree and avoid overmuch human manipulations in land use development. For the system of non-urban land management in Taiwan is similar to Fujian, but still some differences in specific arrangements. The stage of development permits can be separated into three steps based on development process and the division of labor that in accordance with time strictly. Land developers need to apply for 'planning permission' when they change land function or intensity. Approved indicators are properties (public service, commercial projects or both), regional conditions, scale, intensity and impacts to public facilities, social economy and natural ecological environment. The second stage is 'development permission' which contains construct required public facilities; fill excavation, street or blocks design and boundaries, etc. The final part is 'building permit' which can be applied after the front two licenses are satisfied (Jian JIN, Xuan LV(2013)). This kind of system of land use

management which different from urban and non-urban land is easier to build different landscapes in urban development (Figure 7.).

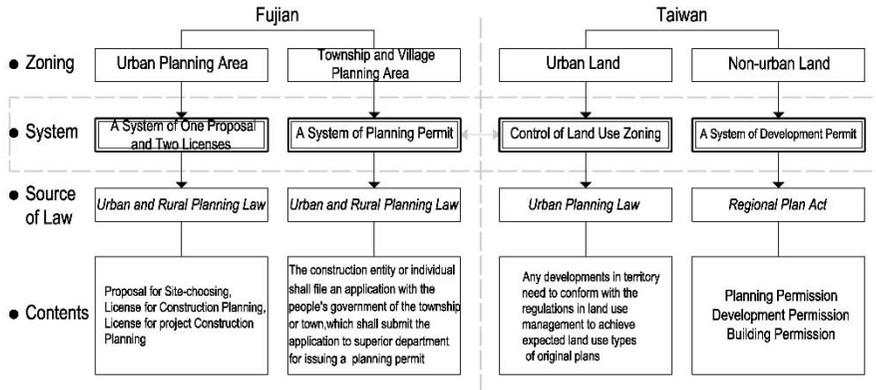


Figure 7. The comparative of urban planning system of administration in Fujian and Taiwan

## 4.2 Context Factors and Its Relationships

Based on the differences analysis, the key points of urban means in Fujian and Taiwan are planning laws and regulations, the way of planning formulation and review, land use control which corresponding to context factors.

1. Pay attention to building and land use control in the system of laws and regulations. The percent of residential land, commercial land and industrial land in urban land use constitution of Taiwan is lower (less than 20%) which brought high FAR and multiple function in the limited land resource utilization which caused the corresponding building and land use control is particularly significant in urban planning.
2. Focus on time limit and planning preconditions (public facilities) in the way from main plan to detail plan. Taiwan adopted capitalist institutions and private ownership of land which caused the land development must give priority to the construction of public facilities land after requisitioning land from citizens. At the same time, the purposes of implementing strict requirements on time limit in urban planning is to satisfied the demands for communal enterprise and protect public interest.
3. Work of planning formulating and review are separated appropriately. Taiwan government implements the management system of separation of legislative and execution and balance of power. The planning authority is led by local governments and used as auxiliary way of giving guidance to achieve the decentralization of power. That

is why Taiwan using a way of setting up specialized urban planning committee to improve the scientific of planning.

4. Give play to land use control of non-urban and urban land respectively.

More population with less land and the tensions between population and land are the current situation of Taiwan. Taiwan emphasizes the sustainable utilization of soil resources and divides most of lands into non-urban land. Especially nature and living environments in Taiwan are frequently threatened by disaster in recent years which brought continuous improvement of urban and non-urban land control methods. The system of land use zoning is used strictly in urban land to achieve the implementation of statutory planning and intensive land use.

### 4.3 Analysis of ‘Plasticity’ Based on Policy

Shift the idea of urban planning formulation and management in Taiwan to Pingtan, some changes will appear between planning means and contexts and the special background and development policy of Pingtan will become basis and criterion of analysis of plasticity (*Figure 8.*).

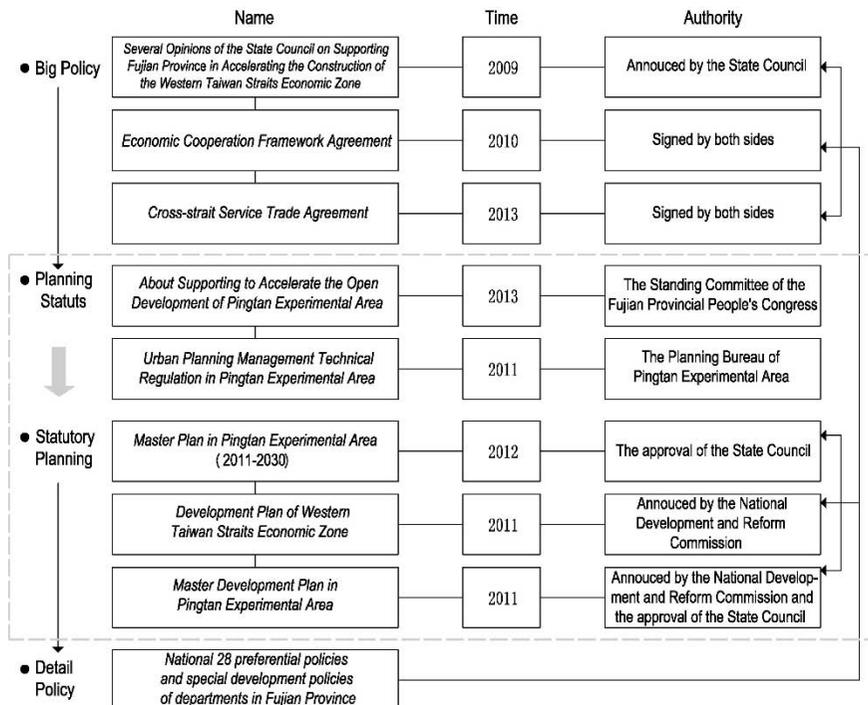


Figure 8. The structure of mainly development policies of Pingtan Experimental Area

First, urban development of mainland gives priority to the construction land and the percent of residential land, commercial land and industrial land are relatively high. Land use types are comprehensive covered and called for integrated mixed land use moderately and slightly which cause stress on land functional organization and less attention is paid to building and non-construction land. As a new area which located in Remote Island, Pingtan has much in common with Taiwan in development conditions. It is necessary to improve the system of laws and regulations in planning, building and land control in the early days of development. When using the concept of variety regulations in Pingtan, the strategy of 'Try First' and administration privileges of city furthers its legislation and take different approaches in ways on a level of urban planning according to the 'Decisions About Supporting to Accelerate the Open Development of Pingtan Experimental Area' (shortly for 'Decisions'). The Management Committee of Pingtan Experimental Area can apply to local legislation by the way of drawing attention to Fujian Provincial People's Government.

Second, urban statutory planning in Pingtan is following the patterns of mainland and distributed into three levels of master plan (including short-term construction plan), regulatory detailed planning and site detailed planning. Pingtan implements the public ownership of land and it is not free to use unless applying for approval. But its land development emphasises on public interests under socialism. According to the present 'Urban Planning Management Technical Regulation in Pingtan Experimental Area' (shortly for 'Technical Regulation'), the main contents of short-term construction plan is important infrastructure and public facilities building and keeping a defined sequence. It is feasible for Pingtan to give priority to construct public facilities in land development to improve whole function and quality of life. The other hand, the relationship between master plan and detailed planning can be standardized in the gurantee of local legislation, especially the management of time limit.

Third, the administrative of mainland relies on omnipotent government and planning review and approval are full organized by governments at all levels and departments. Before the 'Pingtan Experimental Area Ordinance' is formally publicized, the major provision of Pingtan is the 'Decisions' which was constituted by Fujian Provincial People's Conference of Representatives. It is presented to explore various managing patterns to improve management efficiency and scientific, especially the breakthrough in administrative system and set up departments according to actual demands. It can be considered to separate parts of technical functions from the administrative commission of Pingtan and establish special departments dealing with planning review in the future directions of reform. This will give full play to involvement of Taiwan and improve management effectiveness.

Finally, Pingtan and Taiwan have similar development conditions in land control, like land resource constraints. As a Remote Island, Pingtan needs to consider about disaster prevention in the urban development. The land use classification in Fujian is far from Taiwan according to basic laws in

mainland; the mode of non-urban land use control of Taiwan is difficult to be copied. But lessons about land use intensively and efficiently can be shifted to land use control of Pingtan under the support of local legislation. According to management methods of non-construction land in ‘Technical Regulation’, refines types of land conservation and special land use area appropriately. It is necessary to enhance the implementation of statutory planning strictly in construction land management and carry out the concept of intensive and efficient development of Pingtan.

## **5. DISCUSSION**

### **5.1 Basic Idea**

Building the sub-regional cooperation framework is mainly based on the differences of urban planning system in Fujian and Taiwan and their ‘possible relationship’ and ‘plasticity’. Fujian’s planning management is combined with central control and local auxiliary through links of the system of laws, planning formulation, review and implementation management. The urban planning system of laws and regulations in Fujian is a national four classes horizontal system which based on ‘Urban and Rural Planning Law’ and guided by local regulations. Planning formulation is using the way from master plan to detailed planning and achieves planning management by the full coverage of regulatory detailed planning. Planning achievements are inspected and reviewed by urban planning departments of government and all projects are implemented according to development permits of ‘One proposal and Two Licenses’. The central government has strong and direct impacts on system building and policy guidance for local governments and management, but also leaving some rooms for special administrative units.

Taiwan takes statutory regional plans as upper guides for local planning and following ‘Urban Planning Law’, ‘Building Act’ and ‘Regional Plan Act’ as bases to build the system that from regions to locals. Planning formulation is using the way of ‘Master Plan---Detail plan’ and guiding area development through the time limit and a set of temporal constraints clearly. Planning achievements are reviewed by urban planning commissions after formulating by departments of government and using the control of land use zoning and development permit to urban and non-urban land respectively. In overall, the urban planning system in Taiwan has many similarities with Fujian but existing differences in contents of special operation because of the social system, local characteristics and stages of development, etc. The development of Pingtan is in the background of Fujian’s planning system. Therefore, integrated differences of planning system in Fujian and Taiwan into Pingtan’s planning system construction appropriately and learn from each other in the operation will provide an enabling environment of joint planning, development and management.

## **5.2 Construction of Cooperation Framework**

### **5.2.1 Improving the Guarantee of Local Laws and Regulations**

Strengthen the legal construction is a necessary means to ensure the joint operation and improve planning effectiveness. The localization of laws is the guarantee for the construction of system of laws and regulations in Pingtan. List related points to clear legal provisions of connecting planning system which including planning formulation, review and administration in the level of local laws by using administration privileges of city granted by state. Pingtan has similar development conditions with Taiwan. It should reflect the importance of intensive development in the process of improving local regulations. By increasing necessary building and land use control into legal aspects to provide mechanism protection of cooperative development in Pingtan.

### **5.2.2 Adjustment of Operation Mechanism**

#### **5.2.2.1 Strengthen the Connection of Planning Formulation**

The planning formulation of Pingtan under the background of sub-regional cooperation should meet needs of regional development based on the connection with in planning system of Taiwan. Fujian can learn some planning means from the way of ‘master plan----detail plan’ in Taiwan under the system of formulation and many mandatory indicators should be emphasized in the preparation of master plan. Meeting requirements of whole functions before formulating detailed planning (especially regulatory detailed planning) to enhance the flexibility of lower plans. For example, increase relevant local regulations about indicators of public facilities in master plan are forced to reach the legal target before detail planning is organized. Strengthen the connections between master plan and detailed planning, like the management of time limit and development stages in regulatory detailed planning that meeting the ways of Taiwan’s planning and improve the efficiency of Pingtan’s construction.

#### **5.2.2.2 Relatively Independent Planning Review**

The process of reviewing and approval after the planning formulation also has significant impacts on improving planning rationality. Taiwan’s planning administrative departments are relatively streamlined which

belongs to linear vertical leadership. But two important sectors of planning formulation and planning review are separated appropriately. Governments set up special urban planning committees for planning review and focus on the diversity of members. It is a way to improve the management effectiveness, but it is difficult to arouse the enthusiasm of local authorities for development. Fujian carries out a multi-sectoral management which regards local governments as the corpus. But there existing opposite results: high enthusiasm of departments but unclear responsibilities and low efficiency. Pingtan needs to consider about setting up special departments for planning review under legal management in administrative cooperation and improve the scientific and social participation of planning formulation and review, especially the full participation of Taiwan's representatives actively.

### **5.2.3 Unified and Strict Land Use Management**

Management system is a key point of planning implementation smoothly and effective management after formulating and review. Due to the land use development mode of planning-central, Fujian easily emerges problems of actual constructions break through existing planning without necessary legal protection. Taiwan implements unified management of urban and rural land. According to regional planning, land resources are divided into urban and non-urban lands and managed by different system. Especially in urban land, all development projects must be conducted in accordance with land use control and whatever goes against expected land use types of existing planning are not allowed. This way is benefit to the urban construction deferred to statutory planning but easily causes the excessive diversity of urban landscape. Therefore, the development management of Pingtan should keep principles of reasonable statutory planning and increases the general formula requirements under the management pattern of case basis appropriately by setting up standards. Implementing management for all kinds of land in a same way to promote overall effective development of Pingtan (*Figure 9*).

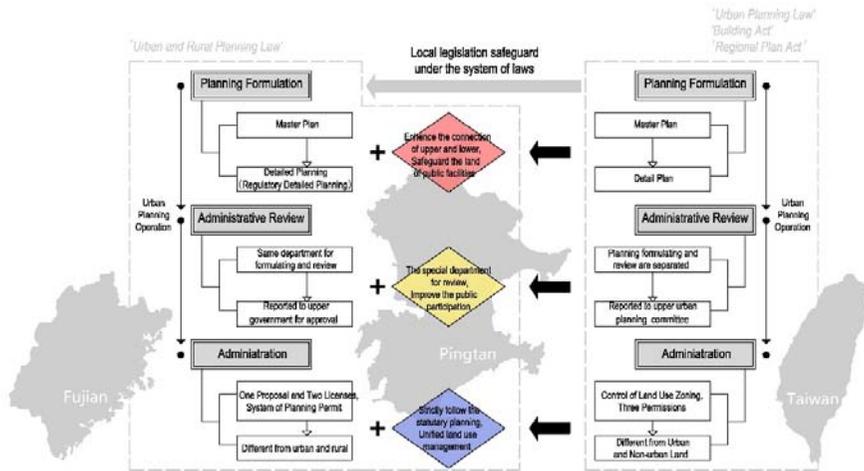


Figure 9. The framework of cooperative development of Pingtan Experimental Area

In addition, Pingtan needs to guarantee the effective operation by deepen following aspects in the guidance of sub-regional cooperation framework. It is necessary to make a combination with Fujian and vast heartland in industrial development on the basis of economic cooperation; inheritance Pingtan’s historical and cultural traditions to achieve the depth of docking of both sides; combine with goals of building smart city in Fujian province and fully embodies the importance of the idea of wisdom in Pingtan; finally protect Pingtan’s great natural environment and put some sustainable development suggestions like economical or intensive into practice when Pingtan is in rapidly construction to realize mutual benefit of new area development on both sides.

## 6. CONCLUSIONS

This paper takes Pingtan as a case study and analyzes the specific circumstances of cross-strait urban planning system. It also conducts beneficial research on the sub-regional cooperation and joint construction of new area which provides the theoretical support to cross-strait joint development in Economic Zone on the West Coast of the Taiwan Strait. The construction of Pingtan should start with urban planning system, especially in the initial stage of development of new area and provide excellent environment and system safeguard for expanding cross-strait cooperation and settling a large number of Taiwanese businessmen. By building the sub-regional cooperation framework which including urban planning system of laws, operation and administration to promote rapid prototyping of regional cooperation and improve the efficient use of regional resources. Finally achieve the sustainable development of Pingtan Experimental Area and Economic Zone on the West Coast of the Taiwan Strait.

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NO.43

## **Building Resilient Cities through Community Empowerment:** *Principles and Strategies for Taiwan Island*

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**Keywords:** Climate change adaptation, resilience, resilient city, community empowerment

**Abstract:** IPCC AR5 notes that since the 1950s, changes in climate systems, ocean, sea levels, icebergs, carbon and other biochemistry have been unprecedented. If the emission rate of greenhouse gases remains constant or increases, then the effects of climate change will become severe. Accordingly, research on vulnerability, mitigation and adaptation of climate change is required. With respect to those considerations, development of the concept of resilience and the construction of resilient cities has become a critical and important task for sustainable urban and regional development.

This study begins by providing a brief introduction of the significant impacts of climate change globally and, in particular, in Taiwan. The second section analyzes concepts related to resilient cities, including vulnerability, adaptation, resilience, governance and community empowerment. The third section proposes principles to govern the construction of resilient cities through community empowerment, based on a literature review and documentary analyses. The final section presents conclusions and suggestions.

## **1. INTRODUCTION**

Climate change has brought new challenges, including uncertainty in climate change and various impacts on everyday life (Andersson-Skold *et al.*, 2015; Archer *et al.*, 2014; IPCC, 2014; The Principles for Sustainable Insurance Global Resilience, 2014; The Royal Society, 2014). In the upcoming decades, the major driver of damage and losses that are caused by associated disasters will be the growth of populations and assets in harm's way, especially in urban areas (IPCC, 2012). Therefore, interest in urban

resilience is growing (Chelleri, 2012; Kernaghan & da Silva, 2014; Lee, 2015; The Royal Society, 2014). Cities, municipalities and counties may also use climate change-related strategies to achieve such objects as sustainable and efficient energy use and renewable energy production, and provide a context within which both relevant behavioral and relevant technical innovations may arise and spread (Burch *et al.*, 2014; Lee, 2015). Cities are centers of innovation, which is a key component of resilience (Kernaghan & da Silva, 2014; Rose, 2014).

Often located along coastlines, in flood plains, or on seismic rifts, cities with their concentrations of assets and people are vulnerable to disasters (Jha *et al.*, 2013). They must adapt to past and future effects of climate change, despite related uncertainty and unknown risks and its local effects (Andersson-Sköld *et al.*, 2015; Archer *et al.*, 2014; IPCC, 2012; Pelling, 2011). Cities must constantly improve their communication and management of risk, early warning systems, emergency contingencies, evacuation plans, and recovery plans. While long-term trends in losses have not yet been attributable to natural or human-made disasters, climate change adds to city planning and management a dimension of additional risk and uncertainty (IPCC, 2012).

Numerous contexts of climate change that have been studied in the literature suggest that a holistic framework is required to address both urban sustainability and urban resilience (Kernaghan & da Silva, 2014; Rose, 2014). The goal of these studies is to elucidate policies and strategies in which flexible and “low-regret” measures can be cost-effective even when risks, of which many must be faced, are uncertain (World Bank, 2012a). Considering the existence of unknown risks and uncertainties, resilience depends on redundancy (Armitage *et al.*, 2009; Marcotullio & Price, 2015). Cities that are facing difficult decisions concerning limited resources and investments must strive for efficiency, and consequently make trade-offs between resilience and redundancy (Montenegro, 2010; Jha, *et al.*, 2013).

Taiwan is located in the Eastern Pacific Region, which is an area that is hit by frequent typhoons and under the influence of many meteorological effects. The presence of short rivers with narrow mouths and ongoing reduction in green open spaces contribute to low water drainage rates and reduced capacity for lands to contain and store water, promoting disasters such as floods and mud landslides. Since the 1980s, the urban population has exceeded the rural population. In 2014, Taoyuan Municipality became the sixth largest municipality in Taiwan by population. Since then, people who live in the six municipalities have come to represent more than 70% of the total population, making Taiwan an urbanized island state. As the massive rural-to-urban migration continues, cities are increasingly becoming the focus of attempts to transition to sustainability (Nevens *et al.*, 2012).

Taiwan is facing a great challenge from climate change and inappropriate land development. Floods and debris flows that are caused by torrential typhoon rains have become increasingly common, resulting in severe loss of land, soil and water resources, and environmental degradation (Council for

Economic Planning and Development, CEPD, 2012). Climate change is also likely to have a large impact on urban populations in Taiwan (Lee, 2014). Therefore, adaption to climate change is a growing concern in Taiwan. In 2012, the government of Taiwan issued the national adaptation plan, *Adaptation Strategy to Climate Change in Taiwan* (CEPD, 2012). In 2014, the National Development Council (NDC) identified three metropolitan areas (Taipei, Taichung and Kaohsiung) as the primary focus for urban climate change adaptation plans and strategies.

In response to increasingly severe impacts of climate change and emerging demand for resilient cities and communities, this study firstly introduces significant impacts of climate change both globally and particularly in Taiwan. The second section analyzes concepts related to resilient cities, including vulnerability, adaptation, resilience, governance and community empowerment. The third section proposes principles, guidelines and strategies for constructing resilient cities by community empowerment, based on a review of the literature, in-depth interviews, focus group discussions and documentary analyses (concerning local climate change adaption plans). The final section draws conclusions and offers suggestions.

## **2. CONCEPTS OF RESILIENT CITY AND RESILIENT COMMUNITY**

Resilience is the ability of a system, community, or society that is exposed to hazards to resist, absorb, accommodate, and recover from the effects of a hazard promptly and efficiently by preserving and restoring essential basic structures and functions (UNISDR, 2011). The IPCC (2014) has defined resilience as “the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.” The Royal Society (2014) has defined resilience as “the capacity of individuals, communities and systems to survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it.”

Resilience can be specific or general (The Royal Society, 2014). General resilience and specific resilience must be consisted together because being highly resilient to one stress or shock can increase vulnerability more generally (Folke *et al.*, 2010). In the context of cities, resilience is evolving as a new paradigm for urbanization and affects our understanding and management of urban hazards, as well as urban planning in general (Jha *et al.*, 2013). A resilient community can respond positively to a stress or shock and thereby retain its basic structures and maintain the provision of services (Resilience Alliance 2002).

The concept of resilience can be applied to any community and any type of disturbance - natural, man-made, or a combination of the two. Examining disaster risk in the context of resilience helps urban planners to elucidate the many impacts of disasters and determine the long-term capacity of communities both to adapt to and to cope with uncertain risks (Jha *et al.*, 2013). Briefly, resilience can be used as an umbrella term that dynamically links existing concepts of risk and sustainability (The Royal Society, 2014).

All levels of government (central, regional and local) have an obligation to protect their citizens. However, since local governments are the first institutions to respond to disasters, they have a particular obligation to reduce risk and build resilience within their communities (UNISDR, 2011). Governments are responsible for managing and communicating risk. Constructing and enforcing the responsibility of city and municipal governments to manage and communicate risk effectively can be challenging, in part because doing so requires a perspective that temporally extends beyond elected terms (Jha *et al.*, 2013).

Policies, planning and construction in all city or municipality districts must take resilience into account to ensure that enhancements in resilience are gained across whole cities or municipalities, rather than in one community at the expense of another (Arup *et al.*, 2014). Resilience goes beyond risk management and mitigation: it increases not just preparedness but also the capacity to respond to disasters and rapidly recover from them. Resilience must be part of everyday urban development, short-, medium- and long-term investment and planning, hazard management, and urban governance (Jha *et al.*, 2013).

Community-based solutions that build social capital can be an important part of generating urban resilience (Revi *et al.*, 2014). Community-based adaptation refers to the participatory identification and implementation of community-based development activities that increase the capacity of local people and community to adapt to climate change, and building on communities' expressed needs and perceptions to address local development concerns that are related to vulnerability (Ayers & Forsyth, 2009). Civil society can have a role in preparing for climate change, both through local non-governmental organizations (NGOs) and local communities, which integrate adaptive governance methods with tools for participatory planning (Archer *et al.*, 2014).

### **3. PRINCIPLES FOR CONSTRUCTING RESILIENT CITIES**

Since urban adaptation to climate change is a relatively new field, and adaptation activities must be context-specific, no standards currently exist for planning and adaptation on the city scale, and various cities have used different approaches to planning and implementing adaptation-related

activities (Anguelovski & Carmin, 2011; Jha *et al.*, 2013; Archer *et al.*, 2014).

Planning for climate change may involve vulnerability analyses, risk assessments and mitigation strategies, including at the community level (Jha *et al.*, 2013). However, significant gaps remain in inclusive approaches to urban adaptation that can only be filled by community-level knowledge and adaptation activities (Archer *et al.*, 2014).

In the field of urban planning, decision makers face a trade-off between adequate preparedness and the potential future costs of response, recovery, and reconstruction after a disaster. The aftermath of a natural disaster frequently provides an opportunity to decision makers to take corrective and even preventive actions. A World Bank report on the economics of natural disasters provides empirical evidence of large returns from preventive measures (World Bank, 2010).

A recent review of the resilience literature distilled ten core characteristics of resilience that pertain to climate change and related disasters, including high diversity; effective governance and institutions; the ability to work with uncertainty and change; community involvement and the appropriation of local knowledge; preparedness and planning for disturbances; high social and economic equity; robust social values and structures, acknowledgement of non equilibrium dynamics, continual and effective learning and the adoption of a multi-scale perspective (Bahadur *et al.*, 2013).

However, technology alone cannot make urban infrastructure resilient, and it will not be at all in the absence of suitable climate for the required investments. Technology can provide benefits only if system operators are equipped to use and act upon the information and controls that it can provide. Changing social, political and economic conventions are as essential to the success of city resilience initiatives as is upgrading physical assets. Based on a review of the literature, local climate change adaptation plans in Taiwan, in-depth interviews and focus group discussions, this work identifies five aspects of city governance and operations that together provide the important “enabling framework” for planning, investment and action to improve urban resilience.

Taiwan is composed of 22 municipalities and counties, of which 20 have issued local climate change adaptation plans and two are drafting such plans. The budget for drafting and issuing these plans was provided by the Council for Economic and Planning Development, started in 2012 after Taiwan’s government published the *Adaptation Strategy to Climate Change in Taiwan* (CEPD, 2012). For this work, three expert workshops were conducted in Northern, Central and Southern Taiwan in 2014. With help from the Community Empowering Society (a national NGO), various in-depth interviews and focus group discussions with governmental organizations, local NGOs and local communities were conducted in four counties (Chiayi, Yunlin, Taitung and Hualien County) to work out principles for building resilient cities.

### **3.1 Integrated urban planning, land use control and urban design**

Policies and strategies related to urban resilience and sustainability must address multiple sectors and dimensions, including land use planning, energy management, ecosystem services, housing and transport, among others (Kernaghan & da Silva, 2014). Integrated policies and strategies for upgrading public infrastructure can increase resilience across sectors and balance the preservation of local identity with the mitigation and management of risks faced by the city. Proper incentives can facilitate actions and investments toward urban resilience goals (Arup *et al.*, 2014). Cities can be made less vulnerable to disasters by the deconcentration of key infrastructure services, the reduction of transportation bottlenecks and the provision of more rapid emergency response systems (Kernaghan & da Silva, 2014; Rose, 2014). Participatory planning resembles the approach toward sustainability because it seeks to integrate social, nonphysical or “soft” dimensions (Lee, 2014). Furthermore, participatory planning and the development capacity of local authorities must be improved to make resilience against the impacts of climate change a main component of local development plans (Khailani & Perera, 2013).

### **3.2 Governance**

Climate has a significant impact on urban areas because they concentrate population, infrastructure, assets and economic activities (Kernaghan & da Silva, 2014; Khailani & Perera, 2013; UNISDR, 2010). Therefore, cities have become critical focuses of governments that are facing climate change (Bulkeley, 2010; Jabareen, 2013; Lee, 2014; The Royal Society, 2014). Governance should take a whole-system approach to city management. Governance structures can support a rapid, accurate and decentralized emergency response (Arup *et al.*, 2014). Coordinating and enabling activities across multiple levels of governance is a critical theme in most city, county and municipality adaptation planning (Bahadur & Tanner, 2014; Leck & Simon 2013; Lee, 2015).

### **3.3 Capacity Building**

Resilience goes beyond risk mitigation to the building of adaptation capacity (Jha *et al.*, 2013). Social systems on various geographical scales must develop their own capacities to respond to the impacts of, and harm caused by, extreme climate change; only by so doing can they build social capacity as part of a long-term adaptation strategy (Lee, 2014). Additionally, improvements in knowledge and capacity can help city stakeholders plan and

design for, and recover from, emergency situations (Arup *et al.*, 2014).

Not every city, county and municipality has the technical capacity to produce a geospatial description of hazards, harms and social vulnerability. States are responsible for providing technical support for mitigation planning, risk analysis and adaptation planning, but many face the same deficiencies of capacity as the cities, counties and municipalities, as they are unable to specify in detail local mitigation strategies, vulnerabilities and adaptation actions (Tate *et al.*, 2011). To solve this problem, bottom-up methods that involve all stakeholders can help to clarify the causes of local patterns of vulnerability (Khan, 2012) and to build urban resilience (Lee, 2014).

### **3.4 Financing Investments**

Appropriate financing mechanisms are required to support investments in, and the maintenance of, resilient urban infrastructure. Project appraisal processes should be utilized to elucidate the lifecycle benefits of investments in urban infrastructure (Arup *et al.*, 2014). Disaster risk financing – the shifting of the economic burden of loss to other sectors, through risk sharing or risk transfer mechanisms such as insurance, should be investigated (The Principles for Sustainable Insurance Global Resilience, 2014). Additionally, the impact of a natural disaster can be felt long after the event: global economic losses due to natural disasters in 2013 amounted to US\$ 131 billion, or almost 2% of global GDP (Swiss Re, 2014). In fact, the World Bank has stated that up to US\$ 100 billion annually in climate adaptation financing will be needed in developing countries alone over the next 40 years (World Economic Forum, 2014). Most guidelines, strategies and plans do not consider funding requirements and sources, but financing remains an uncertain factor in adaptation planning and urban resilience efforts (Lee, 2015).

### **3.5 Stakeholder Participation**

Where local communities are well-informed and able swiftly and effectively to participate in, and shape, local planning processes, they can hold local bodies to account, and their doing so can represent the beginning of a transformative process of social and political change (Archer *et al.*, 2014). Governments should engage widely with experts, scholars, local NGOs and local communities, and increase the likelihood that additional consequences of climate change are identified (The Royal Society, 2014). However, small localized stand-alone initiatives are not enough to respond to these challenges (Reid, 2014; Schipper *et al.*, 2014), and stronger engagement with a wider group of stakeholders, particularly governments, provides more opportunities to move away from isolated pilot projects and to

integrate community-based adaptation into policy and planning to an extent that NGOs cannot (Reid & Huq, 2014). Moreover, participatory planning and the development capacity of local authorities must be improved to make resilience against disaster a main component of local development plans (Khailani & Perera, 2013). In short, top-down priorities must be aligned with local-level needs.

Any attempt to build resilience must consider social factors and use local knowledge as well as community and NGO networks to manage and reduce risk (Jha *et al.*, 2013). Additionally, institutional adjustment and reformation is the critical basis of implementing eco-spatial governance. Issues related to climate change are cross-disciplinary, cross-sectoral and cross-territorial. Therefore, a transformational, multi-sector, multi-scale and collaborative approach must be taken to efficient governance (Archer *et al.*, 2014; Crist *et al.*, 2013; Eversole, 2011; Leck & Simon, 2013; Lee, 2015; World Economic Forum, 2014).

#### **4. CONCLUSIONS AND SUGGESTIONS**

Although the conceptualization and operational definition of resilience vary among disciplines (as discussed in, for example, Taubenbock & Geiß, 2014), the broad underlying concept is overcoming adversity (Buikstra *et al.*, 2010). The literature elucidates three attributes of resilience, which are (a) recovery, which is the capacity to recover from an adverse event and return to the original state; (b) stability, which is the capacity to cope with adverse changes with minimal disruption, and (c) transformability, which is the capacity to adapt to changing conditions (Dhakal, 2013). The third attribute, transformative resilience, is particularly important in organizational systems (Edson, 2012). Transformation can involve a long-term shift or occur swiftly in response to a triggering event. Like adaptation, transformation can be negative (unintended) and positive (proactive). In general, the focal point is on positive adaptation and transformation (The Royal Society, 2014).

Improving resilience involves integrated actions and responsibilities at local, national and international levels, by the public and private sectors, local communities and NGOs (The Royal Society, 2014), which have the potential to restructure economic, social, and political institutions. Briefly, urban climate-focused governance remains an emerging climate change adaptation planning dimension (Archer *et al.*, 2014). Experience has demonstrated that community-based adaptation can remain centered on the priorities and processes that are selected by community without all adaptations' having necessarily to be implemented at the level of the community (Reid & Schipper, 2014).

Although inclusive, integrated and deliberative methods of urban climate governance are preferred, in practice their implementation is

constrained by capacity gaps, power relations, and political struggles, which may limit the transformative potential of such methods in an urban context (Archer et al., 2014). However, coordinating and enabling the actions of multiple stakeholders provides opportunities for effective urban climate governance (Bahadur & Tanner, 2014; Leck & Simon 2013; Lee, 2015). Additionally, a robust top-level policy structure is essential to shaping the mainstreaming of community-based adaptation into local- and national-level planning and design (Archer et al., 2014; CEDP, 2012).

Resilience-building is a relatively new area of activity for cities (Anguelovski & Carmin, 2011; Archer et al., 2014). An ongoing process involves the use of new information and evaluation of existing measures to update regularly resilience-related plans and decisions (The Royal Society, 2014). However, no “one-size-fits-all” solution exists, and relevant action must be context-specific. Planning activities must take into account local priorities, which may not be climate change, and so integrate adaptation into the prevailing development paradigm (Archer et al., 2014). Furthermore, authorities must clearly understand the relationship between the vulnerability of local administrative regions to climate change-induced disasters and the resilience of those areas against such disasters (Jabareen, 2013; Khailani & Perera, 2013; Lee, 2014).

Building adaptive capacity both increases resilience and reduces vulnerability to many hazards (Lee, 2015). Broad responses to climate change in Taiwan, such as those aimed at urban resilience seem to be more open to participation and contributions from numerous stakeholders on various geographical scales. In 2012, the government of Taiwan set the national adaptation policy. Since then, cities, counties and municipalities had drafted plans to adapt locally to climate change. However, no community-based adaptation policies, plans or actions have been proposed. Building a resilient society requires top-down policy guidelines from the government, bottom-up community empowerment and the participation of local communities. In the near future, the focus should be on helping communities to develop the principles that will govern their adaptation strategies and related guidelines, and, further, to implement them. Only by so doing can a resilient society be realized.

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NO.54

## Pottery Housing Transforming after The Earthquake as Adaptation on Tourism Globalization Based on Gender Perspective

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**Key words:** Transforming, Pottery, House, Tourism and Gender

**Abstract:** So far the theory of building or houses which undergo changes as a result of function in development of tourism industry has been sufficient dug by several other researchers . While the effect of the earthquake on the Kasongan village which is one of the tourist village as well as changes in the function of the home after the earthquake has not been widely explored by researchers. In addition to the changes caused by the earthquake the other phenomena that is quite interesting is the change is seen also in the gender perspective , this is due to that the houses were transformed functions are homes that most craftsmen are women . This study aims to gain additional insight into the gender perspective in the functional changes caused by the development of the tourism industry after the earthquake. Architecture research by using a gender perspective is done using phenomenological approach to gain a deep understanding and description . Analysis begins by looking at the change typology houses in the village and neighborhood Kasongan. Selection of the cases set out purposively in order to obtain representative character typology of residential buildings and the environment Results of this study showed that there are some changes in the pattern of the earthquake as an adaptation of the tourist industry in Kasongan. Changes caused by the development of economic activity occurs not only in Bangunjiwo Kasongan main road but also spilling on the second tier in the three hamlets, The shape of these changes are 1) changes induced economic activity ; 2) changes that occur due to kinship and 3) changes that occur due to the increase in space requirements. Meanwhile, if viewed from a gender perspective, the changes that occur due to the desire of all of these women are also have the contribution to the family income by working at home (samben).



NO.56

## **Comparing The Cultural Landscape's Concept Case Study: Managing data for A Smart City in Indonesia**

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**Key words:** cultural, landscape, cities, smart city

**Abstract:** *Exploring* urban cultural landscape is a significant factor to understand the value of the city. The cultural landscape is about the interaction between human and environment that supported by the culture. One of the first men who explain about cultural landscape was Carl Sauer that based on geography field. But in the process, not only geographer who interest with it, but also the other field. Many countries explored so many urban and rural cities to identify the local knowledge to get the concept of cultural landscape. Based on the nature and culture, included the history, they described the significance of the concepts. Description of cultural landscape will guide to manage and set up the good city planning. Urban city should be reminding the nature that has been set up the urban city and the culture and human as to support of it. Nature is one of the cultural landscape's elements that have a circle process with human and cultural.

But, the problem in many areas is about managing the information about cultural landscape's concepts that based on potency and the integration all of the data. When cultural landscape's concepts had been explored and the information about it had been managing digital, it will be simple and efficient to create the city and the people. There is no negative effect of technology, because based on the cultural landscape, the development of the city had been based on the local potency.

In this paper, it will be shown many cities, especially in Indonesia and describing the pattern of them that can be argued as a part of the strategy to get the smart of the city. It's believed that the good management and good exploring the concept of cultural landscape can take the urban and rural city to be a smart city which support from IT, and the product can show about nature, culture and development.

## **1. INTRODUCTION**

Management of urban planning and urban design is a significant aspect to create the good city smart city, intelligent city. Today, every time we always discuss how to make smart city, city with quality life, city management for the citizen and the government that supported by public private partnership. So, it's not only a sustainable city, ecology city and green city, but also an effective and innovative city. The important aspect is about how to manage the city with technology to make effective and innovative in creating a better quality life. We know that a good city is not only containing the physical elements, but also the absurd elements, likely management of the society and stakeholder.

Madanipour (1996 and 2007) wrote that to make good city we have to understand of cultural diversity and promote of socio-spatial enclaves, the possibility of change and exchange needs to be appreciated. He stressed too about the vision of the shape of good city needs to be constantly under development. As a product that always process, a city have been created and have been growing up (Longstreth, 2008; Morris, 1979; Rossi, 1982; Dantzig and Saaty, 1973; Burn and Carol, 1954). Physically, the city will change with its building, the region and its structure of it. But, the primary of changing is about the mind of the citizen. How we cannot say if there are many changing buildings and area in the city because there are some changing in the mind of the community when the civilization occurring. Rapoport (1969) said that people change the nature because of the value of nature and remind the culture as the background knowledge. Adding by Asworth (1991), the changing of space, culture and action is very unique with full meaning.

Based on cultural landscape theories, we know that there are interaction between the city and the people. Cultural landscape shows the life evolution of the human that, can we say it's about process of nature, human and cultural (Saver, 1995; Bernd von Droste, 1995; Egan, 2003; Farina, 2000; Fowler, 2000; Hough, 1990; Konold, 2007; Longstreth, 2008). Platcher and Rossler (1994) said the nature is used as an inspiration that happened because of people act based on the nature. According to the cultural landscape theory, that we know all of elements must be considered in the process of the city, we can assume that cultural landscape concepts can be support and create a smart city with all elements. A cultural landscape that combining and balancing between culture and demand can create the best quality of life to make good city.

Good city for people is closed with smart city, where we have put it balance between physical aspect and non-physical aspect. The difference both of it is about technology demand for documentation and analisisation. A smart city can be defined by an integrated system by technology information that take over all of the information about the potential of the

area. Smart city is related with digitalize all about cultural landscape concepts to manage the daily activity.

## **2. METHOD**

To combining cultural landscape's concept for smart city, in this small research was used content analysis. Content analysis is one of methods to explain the phenomenon which use some literature and supported any empiric as a text. Much text had been read as a data that can explore from the books, journal, and empiric data on the field. Bungin (2007) and Berg (2001) explain about content analysis that it can describe and explore the message of phenomenon to get the information "who says what, to whom, why and what effect" (Babbie, 2008). Many Indonesia's data were used to analyze from newspaper, journal, article, etc. Data's were analyzed to generate the application of smart city and also to know the cultural landscape exploring which they had been afflicted. How is The cultural landscape's concept in some cities which can create the smart city by government, citizen and stakeholder. There are many cities in Indonesia will be described, likely Makasar, Bogor, Bandung, Jakarta, Magelang, Yogyakarta, Medan etc. The main purpose of this paper to see the condition with different scale and different problem to create a smart city.

## **3. LITERATURE REVIEW**

### **3.1 Based Cultural Landscape in Smart City**

Nature, people (human) and culture were mentioned when we discussed about cultural landscape. There are many books that explain it, such as Platcher and Rossler (1994) and UNESCO (1994) that defined cultural landscape is about human and nature reflect the interaction between people and their nature over space and time as the manifestation of space, time and activity; Hough (1990) supposed that cultural landscape is supported by the power of the physical of the nature, culture and the unique history over space and time and it related to human activity-ecology, social economy and its culture (Bernd von Droste, 1995; Egan, 2003; Farina, 2000; Fowler, 2000; Hough, 1990; Konold, 2007; Longstreth, 2008; Akagawa dan Sirisrisak, 2008).

The cultural landscape has always concerned about changing of nature (environmental) and culture that influence by people as citizen, authority and government (Utami, 2013). Cultural landscape describes the life evolution of the human, process of nature, human and culture. Sauver (1995) said cultural landscape is formulated by a set of belief with culture as an agent to

support the interaction. Jackson as the follower of Sauser that was written by Wilson and Groth (2003) argue cultural landscape is about nature and people with its culture that related each other. In architecture and planning which connecting the theory about form, space and place, cultural landscape was concern on nature to change the nature and their action is done because of its belief to the condition, both of nature and culture. In this process, there is a changing of action because of mind process of the people. All of that can be shown in the process of culture and action with changing nature. Relation of nature – human – culture process creates the uniqueness of action (Utami, 2013). In addition, the main point of the cultural landscape is not only about the relationship between nature, people and culture, but also about how to manage three aspects to get the quality changing and quality life. So it can say that in urban design and urban planning, cultural landscape will talk about a comprehensive approach to create the better condition.

Boyd Cohen (2012) said that in 2012 based on ranking, there are ten city that can be defined as a smart city : Vienna, Toronto, Paris, New York, London, Tokyo, Berlin, Copenhagen, Hongkong and Barcelona. Smart city is assumed by the books, journals and paperwork's as a comprehensive approach to get the quality life for the citizen. Townsend (2013) wrote smart cities need to be efficient, but also preserve opportunities for spontaneity, serendipity and sociability. Dameri and Rosenthal (2014) said that the smarter city is the one that has the larger cultural capital and is able to use its knowledge to choose the better solutions for the further development of the city, quality and the city should use its awareness to promote sustainable development, equal economic growth and environmental quality in the urban areas. Harrison and Donnelly (2011) with their journal "A Theory of Smart Cities" mention that smart cities are a new approaches to planning, design, finance, construction, governance and operation of urban infrastructure and services. Anthopoulos and Vakali (2011) said that a smart city is about the analysis of planning's dimensions that show various meeting points for some aspect. We can say that a smart city is about how to make better quality service and product of space. Papa et al (2013) said that a smart city is generally means as a city capable if joining "competitiveness" and "sustainability" to support the quality of life of the communities. A smart city will be a city that community has learned to learn, adapt and innovate (Coe et al, 2001 in Nijkamp, 2009).

Anthopoulos and Vakali (2011), Harrison and Donnelly (2011) and Dameri and Rosenthal (2014) said that all of item in the process has the main goal mainly a quality of service. The term smart city is not used in a holistic way describing a city with certain attributes, but is used for various aspects which range from smart city as an IT product and concern "smart people", "smart environment", "smart economy", "smart governance"; smart mobility" and at a total "smart living" (Giffinger, 2007 and [www.boydcohen.com/smartcities.html](http://www.boydcohen.com/smartcities.html)). The main of smart city is about sharing system (Trisciuglio and Yu, 2014; Anthopoulos and Vakali, 2011; Harrison and Donnelly, 2011 and Dameri and Rosenthal, 2014) and smart

living (Anthopoulos and Vakali, 2011). Budde in Rossla and Pardalos (2014) mentioned that a smart city is built on three pillars: (1) to make quality of life an excellence hub, to deliver services tailored to the citizen; (2) to promote sustainable development through harmonized management of public services, which will increase productivity and generate saving on energy; (3) to work, on economic development, so that the city remains an essential lever in the development of new services and the creation of innovative businesses and activities. There are three fundamental factors in smart cities had been mentioned by Papa et al (2013) , (1) technology (infrastructure of hardware and software); (2) people (creativity, diversity and education) and (3) institution (government and policy). The concept of smart cities is much more related to the role of human capital, social and relational capital using ICT<sub>s</sub>, a growing attention to the role of the users and how they utilize communication infrastructure (Papa et al, 2013).

Dameri and Rosenthal (2014) consider on three main aspects of a smart city, effectiveness, environment consideration and innovation. **Effectiveness** suggest that a smart city is not smart for itself, but if it creates public value for people, which means the capacity of a city to supply effective public and private service to several subjects, such as citizens, companies, not for profit organizations and in detail to different categories of citizens, and also stakeholders. **Environmental** suggest consideration regards the increasing impact that large cities have on the environmental quality of urban areas which concern on reducing all energy consumption to preserve the environmental quality, environmental degradation. **Innovation** is about technology that a smart city should use all the new and higher available technologies to improve the quality of its core component to create a better service but reduce its environmental impacts.

There are some various benefits of smart city that assumed such us reducing resource consumption (energy and water), improving the utilization of existing infrastructure capacity for quality of life, making new services available to citizens and commuters which correlation with how best to exploit multiple transportation modalities, improving commercial enterprises through the publication of real time data on the operation of city services and revealing how demands for energy, water and transportation peak at a city scale by city managers (Harrison and Donnelly, 2011 that modified from NYC, 2007; Stockholm, 2006; Singapore, 2011; Peterborough, 2011). Thwaites, et al (2007) mentioned about integrating transportation for a good transit, walkability and cycling facilities that can help to create sustainable city and in this paper, we can say about smart city if it can be supported by IT, because sustainable is talk about the balancing of product too.

From Scientific American, 2014 in *Designing The Urban Future, Smart Cities* mentioned that there are three concepts of smart cities; (1) cities of the future; (2) technology, sustainable, cooperative, wired and efficient and (3) smart cities encourage economic development and promote a high quality of life.

When we concern of two concepts, cultural landscape and smart cities, it is explained that information technology (IT) product that explain and describe the cultural landscape concept can set up the cities comprehensively and can create the smart city. The main key is about balancing nature and innovation. The universal value which suggests by UNESCO and WHC can be explored step by step that connect with IT service. It argues too by Flower (2003) that the documentation is very important for cultural landscape exploration. Smart city is about how to create space as human life to be a better place which, integrated in each aspect, not only a physical aspect but also the socio-politico-culture aspect. The regulation can be used as a tool to set up it. The main key is about balancing nature and innovation.

### **3.2 Between Cultural Landscape and Smart City**

The main concept of cultural landscape is about changing people 'consideration for their environment, in other hand the main concepts of smart city is about quality life that support by integrated system and innovation. Harrison and Donnelly (2011) in their paper mentioned that natural environment, infrastructure, resources, service and social system are the aspect that must be strengthened in smart city. It's also said by Dameri and Rosenthal (2014) that the smart city's infrastructures have to conform to planning rules and not to charge the local environment or the local protected areas, while planning has to uniformly develop smart cities across the regions for coherent development. In this context, the *infrastructure* layer meets all planning dimensions. Addition by Budde in Rassla and Pardalos (2014) that smart cities will be created included smart and renewal energy, next generation networks, smart building, smart transport, extremely important and smart government.

Trisciuglio and Yu (2014) which explained with the urban planning approach, said that the perception of different spatial is simulated by interdisciplinary application and can be defined in technology, philosophy and physical science for the integration of space, time and territory. In addition Trisciuglio and Yu (2014) pressed that the smart cities are concerned many require their perception about reality (and landscape) through IT device, that can compare the landscape change with pre-digital era; the concept of landscape has extended beyond the concepts of merely telling, describing, talking still or motion image. Smart cities are using technology to improve the quality of life in urban space and to reduce pollution and energy consumption (Dameri and Sabroux in Dameri and Sabroux, 2014 with paper Smart Cities and Value Creation). Frank Duty with his paper *A Time and A Place for Everything* in Rossla and Pardalos (2014) said that looking back the wider lessons from this local incident are that (1) it is far more ecologically sound to work with nature than against it (2) that technology develops rapidly, but not always in a benign direction (3) that

energy resources are by no means unlimited (4) that more intelligent design and technology solutions depends upon user education and behavioral change and (6) by no means all contextual, politic, economic, social and technology developments can be anticipated.

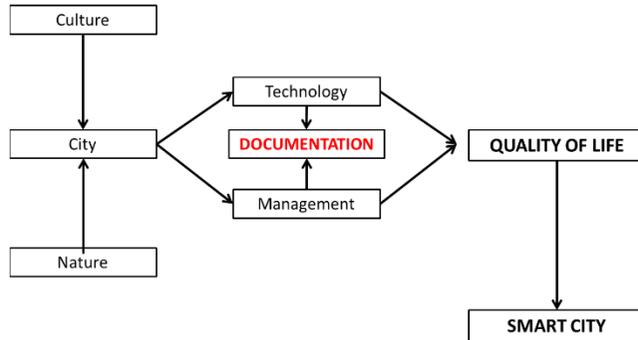


Figure 1. Scheme of Smart City based on Cultural Landscape

We can say that space is a manifestation of the interaction between human and nature with its living culture (Utami, 2013). Nature, culture and belief (human) can change in overtime rapidly or slowly. One of the results in economic and politic paradigm or culture paradigm. Robertson and Richards (2003) explain about the changing of the process and the product of community related the culture as the reconstruction of the culture. Ellsworth (1991) expressed the changing of mind that influence at nature is normal and have to be a part of life. The changing is a process in the past and recently that can influence the cultural landscape and the community creates the new paradigm to create the action (Taylor, 2003). But Asworth (1991) highlighted that we have to know the value of the city or area to prevent the specific character of urban cultural landscape heritage. The value or the meaning of the city must be considered by all of the people included the government and stakeholder.

In other hand, in figure 1, we can say cultural landscape concepts (contain environment such us city, culture and nature) which is supported by technology and management of all the aspects (social, politic, culture, economic etc.) Will can create a smart city to get the best quality life. Policy of the government, the action of stakeholders and the action of the community are an aspect of changing the environmental with its nature and culture and when the government has a new policy and it can change the setting of the city or area must be always documented to get the much information. Or the others words we can say that all of the data about the potency of the city must be applied in mobile information for the effective application for every one.

Why should be we applied all of the data of the city ? The main aspect of it is about effectivitas and integrated information for the user. Every one

can know every thing from mobile information and all of the information had been connecting each other, one service for all.

#### **4. CULTURAL LANDSCAPE'S CONCEPTS: SMART CITY FOR CITIES IN INDONESIA**

Indonesia as an island country has several big islands (Papua, Kalimantan, Jawa, Sumatera, Bali etc) and so many small islands (Nias, Nusa Kambangan, Seribu, etc.). Today's, with a large area and manual data in each area, Indonesia has a big problem about documentation, especially technology documentation. Why it's a big problem? Because of the lack of information which based on technology, there is some conflict to manage the specific area. All of the changing area is one system that can explain the interaction between nature, human and culture cannot define with a holistic approach. In other hand, there are so many unique nature that can be explored and can be support as a city's potency, such as Yogyakarta city cannot be separated from philosophical ax and imaginary ax that explain the palace and the city as a part of cosmologies; Istanbul city grows as a sacred city in the hill between Bosphorus and Marmara Sea (Hough, 1990); Wachau, valley city, grows with the big river and settlement in the hill with grape farming; Kyoto grows with five mountains and its rivers and Magelang city is influenced by the rivers (Utami, 2001) and mountains (Utami, 2012).

Since 2014 and today's 2015, Indonesia have been applying the scheme of smart city. Based on collaborate with PPP (Public Private Partnership), many cities had been signed as a part of smart city's scheme and program. Makasar, Bogor and Surabaya are a part of cities in Indonesia, which started to be a smart city.

A city could be categorized as a smart city when IT had been developed to the point that the administration could sense, understand and control every resource to serve its people and sustain development in the city.

Besides smart, a city should also be able to respond quickly to all problems that emerge in its jurisdiction. This can be helped through smartphone technology that allows residents to make complaints. (Suhono Harso Supangat Statement, in Jakarta Post March, 2015 (<http://www.thejakartapost.com/news/2015/03/25/smart-city-index-coming-indonesia.html>)).

Makasar has become the first city to launch a smart city and followed by Jakarta. One of the program's rafts is to introduce a system that residents had been integrated with a single card containing the civil registry data, tax number and social security number. By other hand, Jakarta as a capital city of Indonesia launched two srtpohone apps: clue for residents for lodging complaints and crop for city leaders to respond the complain (<http://www.thejakartapost.com/news/2015/03/25/smart-city-index-coming-indonesia>).

html). According to Telkom website, Makasar had been getting an Indonesia Digital Society Award 2014 from Telkom that have five (5) application for smart city in government and people services and become a pilot project for the other cities in Indonesia (<http://www.telkom.co.id/telkom-targetkan-smart-city-di-20-kota-besar.html>).

Many cities in Indonesia had been created each city as smart city, but it sets based on e-government for the service. It had been not a potency of the city which can support for the whole activity and service. In other hand, cities in Indonesia have a unique character that can support the meaning and value of Indonesia. Based on cultural landscape data's, eventually there are many information can be integrated with e government for service. Everything about cities can be digitized and connected for some services. Not only for services like e-government product, but also how to design an area to create something or how to go to somewhere which have a beautiful location.

Magelang city is one of the smallest cities in Indonesia, which has a conflict among its surrounding area to develop. Magelang is located among the district of Magelang regency, two rivers to be a separate line between city and regency. Conflict in the area have been occurring because each other never think about integrated management. Borobudur as a world heritage is a magnet for Magelang regency, but for Magelang city is not a potency. This condition is supported by manual data that always done for them. Both of them consider that they just think it self area. Both of them make many policy integrated program, likely ringroad for each area, commercial area in each enclave. In other hand Magelang city where is circled by district of Magelang regency has a good connection with nature that located in Magelang regency. The impact of conflict each other, there are many meeting points that show about unmanagement, such as economic district, tourism planning, socio-culture, planning etc. Gap of innovation to manage Magelang regency and Magelang city had been some conflict each other until now. Exactly, if Magelang regency and Magelang city can integrate their program, it will be good result because there will many programs that can combine both of the city's program. Based on technology of data, Magelang should develop together with its surrounding area that explore the potency. Every one can access everything from online likely smartphone when they want to get something. In other hand, someone can delay the visiting based on e-information if there is any problem with that date.

Same case with Magelang for Medan city, where is located in Sumatera Island with specific nature. If Magelang is surrounded by 7 mountains (Utami, 2013) and district area for Magelang regency, Medan is closed with the headboard, beach and other district that have specific character. Until now, Medan city always looks for the good management for it, but merely only some program shows up the integrated management that connected with other area comprehensively. In this recent time, there is a railway with good management and quality, but only connecting two areas because of the airport location. The innovation for it show the good integrated system. The decision maker should be sitting together to solve the problem that

related to each other, but must be considered with one solution and one result. The integrated transportation is still a problem with it, except for airport connecting. Until now, Indonesia has a national development strategy, but it just describes the potency without how to make potency together. Each planning for Medan and surrounding it is still unintegrated, included information which can connected the other area, likely some tourism information of surrounding area, Toba Lake, Nias Island, Padang activity etc.

Yogyakarta is a holistic area between its city and regency. Bantul, Sleman, Gunung Kidul and Kulonprogo area a regency and there are Yogyakarta city that all of them are a system. Actually, based on it, Yogyakarta grew as a cultural city that always remind the axis of the city. Until now, when government will develop the area of the city, they always think about the existence of the mountain and sea that occurring used for a long time and it has a specific value. There is a regulation which holds the government policy which number 1 in 2013 that regulate the ordinary of Yogyakarta. The regulation connecting the value of a region with a specific meaning that the main of it is about the relation of nature, God as the creator of the nature, the authority and the community with the balancing between each other. Area and building must be layout or designed with their concepts, imaginary line and philosophy axis. System of that area is not showing because of administration, but also connecting with long history. Until now, design of area is integrated but only spot by spot. There is no integrated system in whole areas, in addition, there is no accumulating data for them that supported by information system technology or by technology innovation such as geographic information system (GIS) among the area.

## **5. CONCLUSION**

Indonesia for smart cities is the good goal for development planning. Without innovation, a smart city is only a dream. Cultural landscape, city can be created by the interaction between human and nature that expressed by the unique character of nature in specific places, geography and specific meaning of nature (mountain, river, hill, valley, slope of mountain, sea, etc.) And contain some administration area that can combine for the management with technology method like GIS. But over time, there is a dangerous aspect that can destroy the meaning of the nature because of lacks for date information. Collaboration between government as the authority and community as the human/people must be wrapped well. Without a good collaboration between it, the conflict among each other will be created. When we get good collaboration between each government as the authority that supported by automatic data and integrated data, we can go to smart city for a better living. It is supported by Anthopoulos and Vakali (2011) and Dameri

and Rosenthal (2014)'s statement that explain smart city by smart living and the aspects, effectiveness, environmental consideration and innovation.

Smart city is not only how to make simple for service because of technology of data, but also about how a great the data which can get it one. Cultural landscape is a multilayer field, that have a big data related the whole area. If all of the data of cultural landscape in Indonesia can be integrated based on each character location and culture, so we can say that Indonesia can be seen in one chip/data or in one hand. Every people can get the best information to life in and the tourism/visitor can get the suitable information from all of Indonesia.

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NO.58

## Spatial Network and Crime Occurrence

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**Keywords:** Crime Prevention, Space Syntax, Street Network, Safe City

**Abstract:** A lot of social problems regarding the environment, traffic, safety, and so on are occurring in the process of urbanization. In particular, the anxiety of citizens is growing due to the continual occurrence of crime threatening our valuable lives, and assets. Therefore, the measures to prevent crimes are keenly required. In the meantime, various approaches for the prevention of crimes have been made across the world. However, this study attempts to approach crimes in terms of urban planning. It analyzed the relationship between the urban space and crime occurrence to explore ways to create safe urban spaces. Meanwhile, in view of the fact that crimes are frequently occurring on the road, this study focuses on the relationship between the street networks and the crime. J city which has 340,000 populations was selected as a case study. J city is a typical medium-sized provincial city in Korea and holds stable urban characteristics without major social and urban morphological changes. For the analysis of the street networks, this study adopted space syntax theory as an analysis method. The crime data of J city was collected for two years; 2008 and 2011. To analyze crime spatial data, their attributes were converted to Geographic Information System (GIS). Subsequently, three space syntax parameters were calculated; 'Connectivity' which measures how each street segment is connected to all the other segments, 'Control' which shows the probability of passing through a certain street to reach another street, and 'Integration' which identifies how easily get access from a specific street segment to other street segments. Then, we collected the crime cases happened along with the individual road and investigated the relationships between crimes with the three space syntax parameters by regression analysis. The study results demonstrate that 'Connectivity' would have the most significant positive effect on crimes. This reveals that the crime rate is higher in the street where street networks are well-established. In terms of the 'Integration' and 'Control', they both have a positive correlation with crime occurrence too. However, 'Control' measure has a weak correlation with crime. Street networks also had an effect on crime occurrence in the five most common types of crime; violence, theft, robbery, rape, and murder. Violence and thefts mainly

occurred on the streets where connectivity, control, and integration measures were higher, while, robbery and rape usually occurred in the small road where connectivity, control, and integration measures were lower in J City. The analytical approach to the murder was not conducted due to the absence of the case. The findings above suggest that the creation of a safer city from crimes would be realized depending on the careful design and development of street networks. Therefore, it is required to develop a planning and design guidelines on street network, going beyond the urban planning or design which is mainly focusing on traffic management.



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## A Study on Promotion Strategies and Framework of Smart City in the Taiwan National Spatial Planning

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**Keywords:** Smart city, Strategies and Framework, Intelligent Urbanism.

**Abstract:** At present, the construction of smart city has become the important choice of urban innovation and development in urban planning. In addition, intelligent urbanism that wants to achieve a convivial purpose must offer institutional choices to support a life of action and technologies that serve individuals themselves. This paper summarizes the definition and main content of the smart city, then from Benninger's Principles of Intelligent Urbanism (PIU) theory of environmental sustainability, appropriate technology, heritage conservation, infrastructure efficiency, social access, place making, transit oriented development, regional integration, institutional integrity, human scale, constructs a set of strategies and framework of smart city in the national spatial planning , with the characteristics of objectivity, clear orientation and justifiability, to provide a useful reference for the convivial and rapid development of smart cities.

### 1. PREFACE

With the fast-pace development of the global economy, the population is highly concentrated in the cities. Based on the statistics in 1900, only 13% of the world's populations reside in the cities; however, by 2050, that number will increase to 70%. Every year, there will be 7 cities will be born, which are equivalent to the size of New Year City. In the next 20 years, 500 new cities will be generated; the importance of cities is becoming increasing important. However, the problems of energy, water source, transportation, disaster prevention, security, health, education, medical care and other issues would also surfaced (IBM, 2015). These urban problems stimulated the cities to use the advancement of information technology, to strive for more updated observation and analysis on the planning, design, finance, build, governance of infrastructure facilities, and service, in more intelligent manner.

Therefore, the theory and idea of smart city, from the work of *How Smart Growth Can Stop Sprawl* by Bollier (1998) advocates that old perspectives should be abandoned, and apply new policy for urban planning. This is being put into practice by city of Portland in the United States, during the late 1990s of 20th century. Since 2005, the term “Smart City” is being widely used by the world’s largest information technology companies (such as Siemens, 2004; Cisco, 2005; IBM, 2009). Complex information systems were built to integrate buildings, transportation, public facilities and other systems in the cities. Gradually, it this evolved into technology-based innovation activities for urban planning, development and management.

Most literatures in the past emphasize on the development backgrounds and definitions of smart cities, along with evaluating the literatures that talk about degree of intelligence for cities around the world; however, very few literatures talk about theoretical foundations with clear structures, and workable smart city assessment indicator system and strategies. On the other hand, various local governments within the Taiwan domain also take smart city as an important policy to be implemented. However, due to the fact that central government doesn’t have clear guidance on development strategy, and the resource system that assist the local governments, therefore, this research thinks that as Taiwan move towards smart cities, an objective assessment indicator structure should be established, to ensure the smart city strategies under the homeland coordination plan, will be put into action. Furthermore, the assessment indicator structure can also measure the degree of urban intelligence, as a reference for smart homeland policy and resource injected into local regions to construct smart cities, which are established by the central government.

## **2. SMART CITY**

### **2.1 Definitions**

There are dynamic definitions to a smart city. Starting from the information technology layer, it uses various types of information communication software technology tools completely maximize city operation efficiency to the maximum level, and minimize energy consumption. Taking consumer goods administration service business and commerce operation, energy usage and other activities as well as internal and external resources, then efficiently integrate them.

This includes using technical skills to increase the cities' public infrastructure, such as transportation, public business, along with private residence and working environment (Institute for Information MIC, 2012). An example can be drawn for having sustainable cities, using information

technology skill in the urban system in order to establish regenerated energy circulation using carbon balance transportation system (Girardet, 1999). Jia Hua LI (2012) used European countries' smart city plan to discuss the direction of developing smart city within the Taiwan domain. Besides focusing on the application of ICT, the widely describe innovative energy are one of the primary factors to increase urban competitiveness. Li thinks that at the same time Taipei develops into smart city, power of innovation from various industries must also be strengthened, increase power of being an international city, and move forward to being an international smart city. Therefore this entire research has consolidated the narrow and broad definition of a smart city. See Table 1.

*Table 1.* Consolidation of Definition on Smart City

Style	Definition	Source
Narrow definition	A city control and combine various infrastructure project resources, such as: road, bridges, tunnels, railroad subway airport, port, communication water electricity. This enable optimization and protection of the safety of resources also provide the maximum amount of service to the citizens.	Hall, 2000
	A smart city creates advancement for a city or region, through information and communication technologies.	Odendaal, 2003
	Utilizing ICT skills as primary infrastructure to serve the city. The services include: urban management, education, medical care, public safety, real estate, transportation and public business; all of which connect in more intelligent, interactive, and efficient manner.	Washburn and Sindhu (2009)
	In a smart city, contact various unites through the Internet; the technologies and database can continue to gather, and utilize information to analyze city data and optimize operation efficiency. This is to strive for urban competitiveness and sustainable development. In addition, integration of information, share and passing on communication, would resolve compound urban problem.	Copenhagen Cleantech Cluster (2012)
	Smart city is a hardware facility that combines quality of knowledge communication and the society.	Batty et al., 2012
	The city is seen as an integrative system, containing nerve system, intelligent ability to respond, and ability to optimize every layer.	MIT (2013)
	Utilizing the internet to manage a city, provide civic service based on highly efficient stability and ICT technical facility with high mobility.	Lee et al., 2013
Broader definition	Smart city is about investing in human beings and social capitals. Utilizing traditional and modern communication facilities, as well as management of intelligent natural resources, participatory governance, to stimulate sustainable economic development, and high quality living style.	Caragliu, Del Bo and Nijkamp (2009)
	Smart city is a service using message communication technical skills to strengthen freedom of speech and proximity, to reveal information.	Anthopoulos and Fitsilis (2010)
	The Smart City policy requires innovative ways to interact with stakeholders, manage resources, and provide services	Nam and Pardo (2011)

in transportation, public safety, energy, education, medical care sectors and so on.	
The development formats of any smart cities, must focus on cultivating smartness of people, community, and create qualities of life that are relevant to the people. At the same time, dissimilarity and conflicts will also occur during this process.	Haque (2012)
Smart City combines a variety of techniques to reduce the environmental impact and provide a better quality of life for the people. This is not only a technical challenge, but it's also crucial for the government, innovative providers, scholars, and civil society organizations.	Smart Cities and Communities (2013)

As an overview of the above literatures, this research define smart city as: “Utilizing ICT technical tools, to enable city economy, transportation, and environment develop in sustainable manner, while the ultimate goal is still to allow the public enjoy quality life in the city”. The city itself is an ecosystem, complied by the subsystems of its people, materials, transportation, energy, commerce, and communications. The city utilizes means of information technical skills, and connects regularly with its subsystems in humane, intelligent, popularized manners. The city and its subsystems stimulate and influence one another’s ecosphere (Jing Hua XU, 2012). Therefore, at the same time of building the smart city, monitoring for land that are environmentally sensitive, improve the quality of civic intelligence, governance effectiveness and efficient use of resources can be developed towards the goal of smart homeland.

## 2.2 Research Summary of Smart City Assessment Indicator

In 2007, the research team led by Professor Rudolf Giffinger from the Vienna University of Technology started from 6 layers: smart people, smart economy, smart governance, smart transportation, smart environment, smart living, and established European smart cities assessment system, including 31 second degree indicators, 74 third degree indicators. After proceeding with standardized transformation and totaling the indicator system, assessed, 70 mid-sized European smart cities were placed into ranking, based on the levels its development. Finally, the results showed that levels of city intelligence are higher for Sweden, Finland, other Nordic countries, as well as Netherlands, Belgium, Luxembourg, and Austria. Based on this research, it’s evident that smart economy, smart transportation, smart environment, and smart living, are the results of the implementing smart city. The importance of smart people, is the quality of manpower assets, and executes decision of urban development through smart governance. However, the selection process, and the assessment selection for systematical, societal,

cultural and environmental assessment indicators in this research are far from comprehensive.

Moreover, Boyd Cohen (2012) used such concept, and created Smart City Wheel (see chart 1), indicating the relationship between goals and assessment indicators of smart city. In addition, achieve the goal of smart city through three key steps: “people’s participation in creating urban vision”, “benchmarking, setting goals and select indicators”, and “Go Lean”.

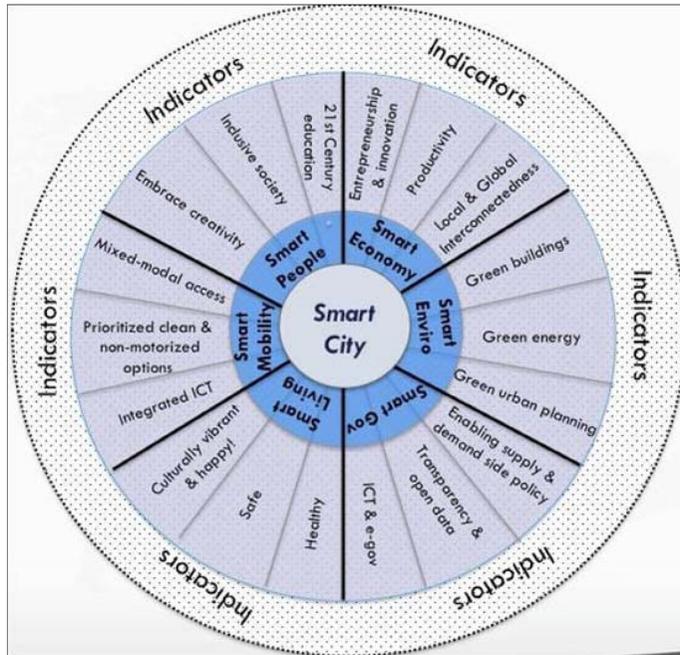


Chart 1. Smart City Wheel (Boyd Cohen,2012)

IBM Corporation released the “Smart City is in China” white paper in August 2009, to define smart city as being able to utilize information and communication technology method to a full extent, for sensing, analyzing, and integrating the key information of the city operation’s core system. This would make intelligent responses for people, environmental protection, public safety, city services, industrial and commercial activities. Ultimately, create a better city life for mankind. Therefore, six core systems were proposed, for the smart city construction to be built based on people (public safety, medical education and quality of life), commercial (business plan, open to external parties, investment, labor protection, products on the market, etc.), transportation, public transport networks, sea and air freight), communications (electronic communications infrastructure, such as telephone, broadband and wireless internet), water supply and cleaning) as well as energy (production, transportation and waste disposal system). Furthermore, the white paper pointed out that the effectiveness, efficiency

and safety of these systems, decide how should a city operate, and achieve goals.

As a think tank that observe the development of smart city on long-term basis, the Intelligent Community Forum conduct research on smart city with construction of smart community as its core center, and seek for the best practices of smart city to promote sustainable development of cities. The ICF mainly asses the level of development for smart community from five aspects: broadband connection, knowledge-based workforce, innovation, digital tolerance, and community marketing. ICF announced “The World's Top Seven Smart Community”. Amongst the list of winners, Taiwan made it into the ranking since 2004 with City of Taipei, Taichung in 2012, Taoyuan County in 2013, along with New Taipei City and City of Hsinchu in 2014, have been assessed as smart cities. Therefore, major cities in Taiwan will also march towards the goal of becoming smart city as primary governance objective. On the other hand, due to different regional conditions, the focus of development will also be different. This research summarizes and consolidates the topics of promoting Smart Taiwan and governmental smart cities developments in five municipalities.

## **2.3 Overview on the development of smart cities in Taiwan**

### **2.3.1 Intelligence Taiwan**

In terms of promoting the development of smart city within the Taiwan domain, the Council for Economic Planning and Development, Executive Yuan (now known as National Development Council) passed the “New Century Phase III National Development Plan (2009 - 2012)” in December 2008. Amongst the primary policy of national development, the 5th category is “Smart Taiwan”. The content includes 6 major development strategies: Wireless Broadband & Convergence Network, Cultural and Creative Industries, Superior e-Government, Demand-Driven Applications, Opportunity Equivalence, and Manpower Cultivation. Focuses were placed on these 6 categories for construction of wireless broadband and digital streaming networks, develop cultural and creative industries, use ICT skills to integrate innovative government services, create smart environment, as well as promoting smart transportation related services and applications. In 2015, NDC proposed the drafted bill of “Internet Intelligence—New Taiwan Government Policy White Paper”, building an intelligent Taiwan from 5 aspects: basic environment, transparent governance, smart living, the Internet economy, and smart homeland. When we look at the background on promoting the overall smart environment, from web government service, on

specific locations, mobilized M-Taiwan in 2005, until the I-Taiwan with smart services, it's clear that Taiwan has proceed from passively provide specific device for particular groups of people to use, until incorporating these aspects into the daily life of general public, so that the public can enjoy convenient civic service anytime, and anywhere, through smart terminal equipments.

### **2.3.2 City of Taipei**

Taipei City Government take the Taipei City Government Information Office as the primary force of promotion. There are three phases to the promotion plan. The first phase (1999 - 2002), the "Network Metropolis" plan, with core concept: "more use of Internet, less use of road", and construct web city government, in order to provide 24 hours year-round city government service for the general public. Second phase (2003 - 2006) is "Digital city, mobile Taipei" as vision for the development process. This means eagerly constructed public wireless LAN area and campus wireless network, enhance digital life applications for the general public, as part of strengthen e-government services. By 2006, complete 90% of population coverage, the first of Taiwan, and provide the most convenient Internet life and online municipal services for the general public and visitors.

The third phase, change urban development strategies, placing three sectors as starting point: needs of the people, community involvement, and government's efficiency, in order to introduce "Smart City Construction Outline Plan" (2007 - 2014). The plan will also take "smart city, quality life" as its vision, and promote information technology infrastructure, common information platform, internet-based communities, individual service window, and 70 sub-plans, hoping to build U-style Taipei City (U refers to Ubiquitous, meaning omnipresent). Therefore, in addition to the main focus of infrastructure construction, optimize public service, which is being continually promoted, public release of government information plan and cloud applications has also been added into the path of developing Taipei, to help the city move towards the goal of smart city reconstruction.

### **2.3.3 New Taipei City**

The New Taipei City Government Research, Development, and Evaluation Commission works with Information Center, taking 3O (Open Government, One Government, Government On-Hand), 3T (Service Tech., Cloud Tech., Mobile Tech.), 3I (I-Government, I-City, I-Citizen) as core of constructing smart city, and develop an open government, cloud technology and smart public services.

New Taipei City uses cloud technology to integrate administrative processes, and break the restrictions amongst regions and institutions, so that the public can enjoy convenient civic service anytime, and anywhere. In addition, in order to face and resolve old problems that people have been complaining repeatedly, New Taipei City uses big data to analyze municipal services. The case analyses were conducted based on patterns, hot spots of the cases that received the most response, and gathered the relevant offices to review the processes and policies. In 2012, New Taipei City Government worked with IBM to enhance on technology security and defense, to build smart security city, and was elected as the IBM 2012 Global Participating Units for “Smarter Cities Challenge”. This include using web power to detect, in order to compensate for the lack of police power, and using big data analysis to improve the efficiency for criminal investigation and prevention.

#### **2.3.4 City of Taichung**

The strategy to develop smart city from the Taichung City Government Information Center, is to emphasize on creating a comprehensive information technology infrastructure, and set the primary goals: to build an international city and promote smart living. Amongst the plan, broadband connection, digital content, knowledge work power, innovation and marketing promotion, are set as five indicators for Taichung Smart City. In terms of the broadband connection indicators, through the collaboration with Chunghwa Telecom and Vee Telecom, the city has devoted into wireless broadband network infrastructure, audio visual multimedia’s add-value services, and variety types of web service provided by fiber-optic broadband network. This has created a complete infrastructure construction, and diverse electronic services. As for the other four indicators, under the support of broadband infrastructure, specific contents can be achieved, such as: personnel training in incubation center of universities shorten the digital gap of Digital Opportunity Center, construct smart driving record check, engineering data banks and other innovative services, in order to create business opportunities.

#### **2.3.5 City of Tainan**

Starting in 2011, Tainan City Government Research, Development, and Evaluation Commission proposed the Smart City Plan—Greater Tainan. Using various issues faced by local environment, the goal is to make City of Tainan to become a smart city that connects with the world. The plan include promoting smart and convenient transportation system, community health care smart add-value plan for urban and countryside health center, smart

sightseeing tourism service plan, cultural industry guidance smart service system, community smart security surveillance system for urban and countryside, and geographic information system integration plan. Starting 2012, “Smart Greater Tainan City” flagship strategic coordination plan has been promoted for, along with promoting add-value application for smart electric vehicles, application for smart grid, mobile sightseeing service system, and relevant smart marketing business for agricultural countryside. These plans are being promoted in hopes to resolve local problems, create local opportunities, building low carbon, technology-based, smart industrial city.

### **2.3.6 City of Kaohsiung**

City of Kaohsiung promotes smart city strategy, with wireless city plan as the primary force; continue with promoting smart transportation plans. , using GIS geographic information on long-term basis, for add-value application, building a safe, healthy, and ecological smart city. In the future, establishment for the corridor of the three primary smart transportation in Kaohsiung Science Park, Da-Fa Industrial District, and Linyuan Industrial Park will continue to be promoted, in order to upgrade traffic quality and safety (Qin Rong LIN, 2013), as well as to promote the city bicycle rental service, coping with hardware and information technology facilities renovation, and information add-value application service measures, shaping the public transportation towards a sustainable city. In 2014, Kaohsiung City Government work jointly with Taiwan Mobile, to construct 4G smart broadband applications city, and provide 4G related innovative application service to be implemented at Kaohsiung. The contents include; smart commercial zone, smart education, smart transportation, smart entertainment, and smart health.

Through urban design method, smart environment will be put into practice. Urban Development Bureau, Kaohsiung City Government provides reward incentives for fiber construction (community) development reward, in order to attract innovative corporations and vendors to investment. Newly developed architectural projects are capable to cope with Kaohsiung City Government to promote digital development policy, to introduce and build fiber-optic broadband network architectures (community). After Committee of the Consideration of Urban Design, City of Kaohsiung, came to an agreement, except for the original legal floor area ratio, reward for floor area ratio can be added. Therefore, the government encourages smart buildings architecture, constructing smart community, through urban design awards. In addition, create omnipresent smart living environment through transformation of urban public space, and create new urban aesthetics.

In summary, in terms of the experience to promote for smart city within the Taiwan domain, there are different goals for developments, most of them are: application of new ICT software, hardware technology tools, manage and monitor industrial, transportation, and civic life activities. However, integration of various environment resources, coordination and cooperation of various departments' participants, are still lacking. This research combines the problems of promoting smart city within the Taiwan domain:

1. Smart cities have streamed into new information of smart homeland, benefiting the planning of homeland space. However, as of now, Taiwan has not yet developed governance strategies for smart homeland space, in order to guide the developments of city intelligence.
2. Besides the absence of evidential policy guidance of smart homeland space development, and implement legalized criterion, but also lacking the methods to asses urban intelligence, as the reference to assist the city in developing resource distribution.
3. Local districts lack institutions that dedicate to promoting institutional smart city, as smart city involve broad range, and require joint implementations from Department of Transportation, Urban Development Department, and Police Department of respective local districts. The research found that local governments have only IT departments that operates on its own, and lacking the integration of dedicated organization.
4. As the local governments develop smart city, there were heavy reliance on providing IT (information technology)-oriented technology via top-down vertical manner, but ignored the mechanism involved in the demands of participating and planning from the bottom-up users, resulting in general public and industries unable to actually feel the convenience of broadband network construction, as well as the lack of acknowledgement for the smart cities' relevant innovative services.

### **3. INTELLIGENT URBANISM**

In terms of the trends of contemporary urban planning, it develops land use pattern, from the concepts of public transportation, and New Urbanism, as the mainstream of urban space planning. The trend advocates compact city and mixed land use to decrease occurrence of trips, in order to prevent outward expansion of urban development, promote environmental-friendly mode, and protect pedestrian space or security, to correspond with ICT technical skills and improve the overall quality, service of the city. In continuation of the trend described previously, Intelligent Urbanism was introduced in Benninger (2001), stressing that with the appropriate

technology and creates a suitable urban life, overlap and compliments one another. The idea contains theoretical principles of urban planning and urban design, and melt in participatory planning, to establish the basic structure of smart city, based on the values of general public. Intelligent Urbanism is made by 10 principles: environmental sustainability, heritage preservation (conservation), appropriate technology techniques (appropriate technology), social interaction network (conviviality), infrastructure efficiency, humane (human scale), create opportunities (opportunity matrix), regional integration, smooth transportation (balanced movement), and system integrity (institutional integrity). The goal is to coordinate and manage diverse urban problems; therefore, this research uses such diverse and comprehensive concept, as the theoretical basis of smart city development strategy, under homeland construction.

### **3.1 Environment Sustainability**

The goal of this principle is to achieve balanced developments between urban and natural environments, through stressing habitat protection, density control, land use planning and open space design and other ways to protect the environments, avoid deforestation, soil erosion, groundwater depletion, floods and other disasters caused by excessive urban developments. In addition, this principle also analyzes and controls the energy consumption and waste emissions during the life cycles of buildings.

### **3.2 Historical Heritage Preservation**

This principle aims to achieve balance developments between urban and traditional culture, preservation of historical sites and buildings, base on the search for traditional intelligence through distribution of residence, architectural plans in procedural manners, lifestyles in the past, symbols, features, and historical developments. In addition, this principle also respect the traditions, customs, styles and sense of community, while utilize local knowledge and cognitive systems, the integration of cultural assets, positioning and construction of urban development plans.

### **3.3 Appropriate Technology Skills**

The appropriate technologies use the perspective of “petite and beautiful”, to strive on the technical acceleration of architectural materials, construction craftsmanship, infrastructure and operational management. These technologies must be consistent with the local population,

geographical climate, local resources, and capital investment; advancement in technology enables urban and service range expansion, and let interactions of information become more transparent amongst people.

### **3.4 Social Interaction Networks**

Coordinators proceed with social interaction through public areas, and the space can be separated into different social levels: individual, friendships, residents, neighborhood, communities, and the entire city domain. Each level will have its corresponding physical space in the residence structure. Through the development of urban design, establish pleasant, harmonic community and living space that belongs to people, to enable a normal operation of social relations.

### **3.5 Efficiency**

The principle advocates comfortable, safe, achievable, efficient, and sanitation goals, with efficient use of energy, time and financial resources, avoid excessive consumption. In addition, encourages compact and high-density development method for land use. Moreover, this principle promotes providing service to every residents of each community unit, with smaller cost, effective allocation of public land, roads, infrastructure, and provide public services network.

### **3.6 Humane**

The idea of smart urbanism promotes pedestrian-oriented urban design pattern, shape people-friendly street corridors with mix usage, provide open space through the reduction of the architectural mass, or use arcade and park as buffers amongst the compacted architectural and transportation mass, in order to achieve coordination with more humane concepts.

### **3.7 Create Opportunities**

This principle assumed the city as a medium between personal, social and economic development. Through the use of assorted organizations, services, facilities, and information, provided various opportunities for employment, education and entertainment or leisure, and allow the general public to participate and debate. In addition, provide wide space (zone, districts, precincts, etc.) to stimulate economical investment and interactive

activities through urban facilities, such as: basic health care, communications, drinkable or usable water, waste disposal, and sanitation establishments.

### **3.8 Regional Integration**

Assuming the urban area is a society within the greater environment, or an organic body of economic and cultural geographic system. Urban population would, eventually expand to neighborhood area; increase the needs of urban employment, shopping, entertainment, health care and education. Therefore, urban planning needs to predict the scenarios of incorporating and close interactions between the city and neighborhood area.

### **3.9 Intergrated Transportation**

In this section, public transportation is stressed, to proceed towards land use format, integrate transportation system, including: pedestrian walks, bicycle lanes, public buses designated lanes, light rail, sky trains, subways, and channel transportation. This is to allow smooth connections with different means of transportation, linking the urban connection points that are both high density and mixed use of pedestrian access.

### **3.10 System Integrity**

This principle emphasizes establishing complete database for citizen rights and responsibilities, transparent and responsible local participation, as well as governance mechanisms, in order to achieve smart city.

Benninger (2002) uses Intelligent Urbanism to assist Bhutan's capital, Thimphu setting urban outline plan, using the 10 principles from Intelligent Urbanism, and construct 10 basic strategies, 22 topics for coordination. The plan clearly assumes, specifies, and provide appropriate assessment plan, along with an alternative to the conservation of natural resources, allowing the city and environment to develop in balanced manner. The plan of execution establishes the improvement areas for the environment, through the National Open Space System. The Open Space System and improvement areas for the environment include the walking pedestrian system, such as stairs and footbridges.

In addition, the plan emphasizes the importance of heritage preservation, such as: pagodas, temples or traditional villages and implement protection and maintenance measures. Furthermore, the plan recommended the use of

open space, urban corridors, primary routes, to connect circulatory network such as roads and pedestrian trails, with dedicated religious areas, allowing the general public to get closer to historic buildings, and increase their experience with heritage culture. Unlike the western urban planning, the Thimphu Outline Plan considers the life style of Bhutan, and apply a mixture of both plans. After a detailed daily life survey and analysis, the Thimphu Outline Plan coordinate more than 20 designated sections as resident areas, commercial exchange facilities, and combine with religious functions, allowing the people to reside in compact, and walking distance communities. The plan also includes social service space and facilities, so that the residents have access to basic health care, education, drinkable and usable water, and electricity and communication networks.

As an overview analysis of the above literatures and theories, conclusions can be drawn: spaces in the smart city are “creating life with high-tech, environmental sustainability, humane”, using the design model that is user-centered, and allow general public to participate and planning process, while dealing with difficult urban issues. This would allow the general public to accept the solutions provided by the smart city, on a more in-depth level. Just as Oscar Wilde (1891) stated, “It is a competition between machine and mankind. Under appropriate conditions, the machine will serve human beings”. Such appropriate conditions, by definition, is placing people are priority, creating services based on technology and respecting environmental ethics.

#### **4. STRUCTURES OF SMART CITY DEVELOPMENT STRATEGIES**

This research cuts in from the generalized smart city angle, combined with the Intelligent Urbanism philosophy, categorized that smart city not only emphasize information and communications technology stimulate the city to develop in efficient manner, but also focus on conservation of natural environment, and preservation of cultural assets. Moreover, the idea also stresses on governments’, general publics’, and relevant individuals’ participations in the interactive planning, in order to shape a more humane urban space.

Therefore, this research adopted “High-tech information infrastructure, enhance quality of life and sustainable development” as vision of developing smart city. This research also applied European cities’ smart indicator structure in 2007, by Rudolf Giffinger, along with European Smart City Plan in 2014. The research is based on the theoretical concepts of Intelligent Urbanism, from the 6 goals: Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living.

In addition, the research is combined with Intelligent Urbanism planning principles, to look into 6 primary goals, 10 underlying categories, and 25 criteria for the smart city development structure (see chart 2). This would allow the structure to become more comprehensive, in terms of selecting the city's principle, social, cultural, and environmental assessment index, as evaluating urban smartness, building the foundations of smart city development strategies. Summary of 6 objectives are outlined as follow:

#### **4.1 Smart Economy**

Smart economy, meaning to increase productivity and creativity for e-commerce, having advanced ICT manufacturing techniques to provide new services and business models, efficient usage of energy, time and financial resources, avoid excessive consumption, in order to achieve industries with knowledge and innovation as primary foundations.

#### **4.2 Smart Transportation**

Utilize ICT technology skills from smart transportation, and support, integrate transportation and logistics systems. For example: integrate trams, public buses, trains, subways, cars, bicycles, pedestrians and other traffic patterns, to enable safer and sustainable usage. Smart transportation puts environmental-friendly and non-motorized vehicles as priority. In addition, revealing relevant public transport information in open manners can cut down commuting time, lower cost, and reduce carbon dioxide emissions. Furthermore, improve service quality and provide channels for general public's feedback, user's actual commuting time and relevant information, would be helpful for coordinating transportation in the future.

#### **4.3 Smart Environment**

In terms of the smart geographical environments, including using renewable energy and alternative energy, as well as using ICT technology to protect regions that are environmentally fragile, provide measuring, pollution control and monitoring, density control, to utilize resources more efficiently. Applying smart environment to urban services, such as upgrade buildings and facilities, environmental-friendly architectures, and environmental-friendly urban planning, waste management, monitoring water resource system, in order to reduce pollution and improve quality of water. Moreover, regarding humanistic environment, historical sites and

buildings are being preserved, while respecting tradition, customs, unique style and sense of community.

#### **4.4 Smart People**

Refers to how people are able to work while using ICT technology skill (e-skills), have the opportunities to receive education, and conduct human resource management in an understanding, and innovative society. These specific features allow people and communities to build database that are humane-oriented, based on their own needs and method of usage. Examples can be drawn from using the appropriate data analysis tools and control panel to make decisions and provide services.

#### **4.5 Smart Living**

Indicate the living style, behavior, and consumption in patterns of ICT. Smart living is also included in city that contains multicultural aspects and high quality residence. The city has a high level of social cohesion and social capital. In addition, interactions occur amongst humane community and civic living space.

#### **4.6 Smart Governance**

Refers to the integration of internal and external governance of the city, including the integration of management and interaction of public, private, civic, and community organizations; this allow the organism of the city to function effectively. This process is achieved through the operation of ICT infrastructure and database. The links amongst countries, domestic cities, or city's internal sectors are crucial. Therefore, urban planning must predict the integration and close interactions between a specific city and its neighborhood regions or environment. In addition, public and private sector stakeholders work in joint hands to strive for the goal of being smart city. The goal include: the use of ICT technical skills, and e-government, to allow transparency of database, encourage shared decision-making process, and create web-based services, such as applications of APP. Using the APP provide assorted employment, education and entertainment opportunities, enable the general public to be more independent and intelligent. Smart governance can also be integrated and coordinated with features from other smart cities, and is the key to constructing smart city ([Belissent, 2011](#)). This allows establishing a complete database for citizenship rights and

responsibilities, and using transparent, responsible local participatory governance mechanism, to achieve being a smart city.

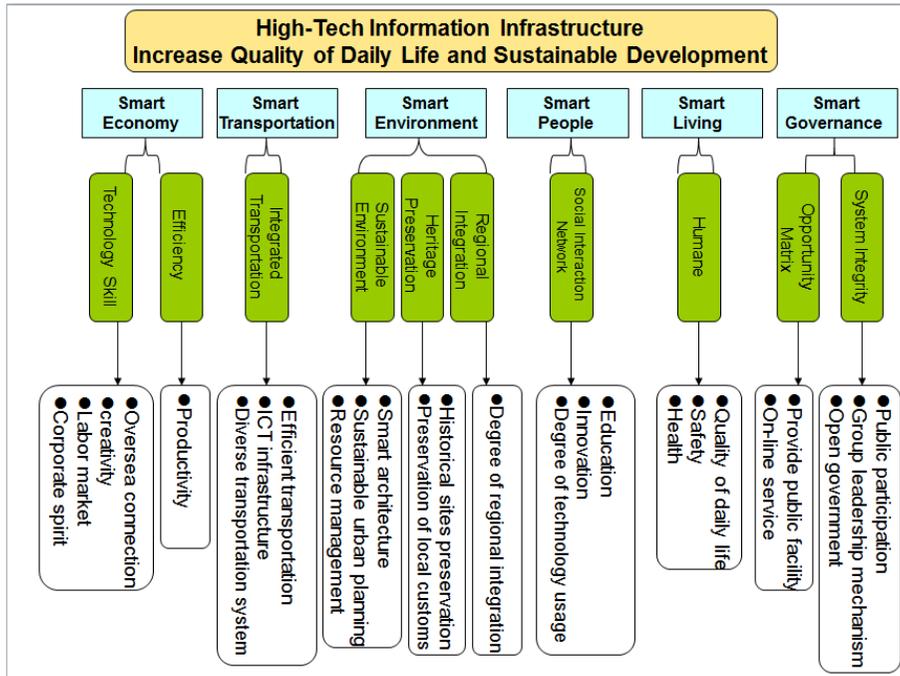


Chart 2. Diagram of Smart City Development Strategy Structure

## 5. CONCLUSION AND follow-up RESEARCH

Smart city is a combination of space and ICT (information communication technology), as well as new ideas of urban economic growth. It's not a single long-term plan, but a plan that is made by continual short-term plans, achieving visions and goals in progressive manners. In other words, smart, is multi-scale, diverse level concept. The city use information technology to create a city environment mode that is suitable for people to live in. With such, the country will be able to manage developments on regional or city-basis, through a platform, and move towards the goal of smart homeland.

Until today, the major cities within the Taiwan domain are moving towards becoming smart cities, as development milestones, and gradually gained international recognition. However, based on the European "Smart City Plan" and review of the literature for cognition and structural elements on smart city, there are still spaces for improvements for developing diverse applications for smart city within the Taiwan domain. This is mainly due to heavy reliance on technology hardware constructions, but without

comprehensive software service applied onto environment, daily life, economic, civic and governance. On the other hand, Taiwan also lack smart homeland development plans for national, counties (cities) level , that is capable to guide, integrate, and connect the urban policies, as well as resources.

Therefore, the smart city development strategy structures that were initially drafted, including the visions of: “high-tech”, “environmental sustainability”, and “humane”, along with the 6 goals, 10 underlying categories, and 25 criterions should be fully developed, to enhance value of the city through science and implement the categories of: city environment, economy, transportation, daily life, people, and governance. This is so that the urban development would proceed under an intelligent constrained framework. Follow-up researches are as follows:

1. Continuing from the previously described smart city strategies structures, and establish indicator system; using Entropy values to calculate the equivalent weigh of criterion, and pair with multiple criteria decision making (MCDM) analysis method, to provide objective, and the best intelligent urbanized proposal for coordinator.
2. Choose the cities that are promoting smart city within the Taiwan domain, and place the smart cities’ development level in specific space by combining the statistical method and Geographic Information System (GIS) based on the indicator system of this research. One can then check to see if positive benefits exist, based on the promoted smart city policies, and draft countermeasures of urban development issues.
3. Develop homeland planning strategies based on the smart city concept, in order to use utilize Information and Communication Technology (ICT) to assist the developments of cities and townships, along with monitoring for land that are environmentally sensitive. This would enhance the effectiveness of governance and using resources in more efficient manners.

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NO.61

## The Contribution of the Mixed-use Space to Sustainable Communities

— Case Study of Huaqingjiayuan Community in Beijing

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**Key words:** mixed-use space, sustainable development, building scale, urban community, community vitality

**Abstract:** Function partition and mixed-use have been hot issues in urban planning and design. With rapid development of science and technology, more and more successful mixed-use cases come up with different urban scales in pursuing sustainable cities, leading to a more detailed research demand in community and single building scale where people live. This paper firstly systematically summarizes the progress of mixed-use residential community in China, then selects Huaqingjiayuan Community in Beijing as a typical study case, which featuring a spontaneously mixed-use condition of residence and commercial in buildings and the community. By mass interviewing, questionnaire surveying and a comparison with other successful mixed-use community which were designed to be mixed-use originally, some results are given including how the mixed-use condition forms, the data of ratio and types of various function, the spatial characteristic and lifestyle of residents there. It further leads to some design approaches to increase community vitality and sustainability such as the location, targeted groups, the relationship with central city, etc. Finally it concludes several ways in achieving sustainable community in the context of continuous urban regeneration and development.

### 1. INTRODUCTION

In 1920s, mass residential districts were constructed under the modernism theory. The early urban planning sought to enhance safety and efficiency by putting distance and buffers between activities and space, which gated community could achieve to some extent. Meanwhile it brought some problems like traffic stress, boring landscape and long distance from work, etc. In 1930s, the theory of urban function division in Athens Charter used to throw a light on urban problems. As the era of information coming up, the

idea of function division have been weakened with new industries emerging and the lifestyle changing. The mix-use development in various spatial scales is becoming a hot issue in sustainable planning.

Sustainability has emerged as a popular concept (Jabareen, Y. (2004)) Scholars and practitioners have been seeking forms or design ways for a better human settlement to achieve sustainable development. The approaches can be found in different spatial levels, including the regional level (Wheeler, Stephen. M. (2000).), the city level (Jenks, M., Williams, K., & Burton, E. (1996).), the community level (Van der Ryn, S., and Calthorpe, P. (2008).) and the building level (Woolley, T., Kimmins, S., Harrison, R., & Harrison, P. (2002).) Mixed use as a key concept related to sustainable urban forms (Jabareen, Y., (2004).), which was put plenty of emphasis from 1960s (Jacobs, J. (1961).) to New Urbanism in 1990s.

## **2. DEVELOPMENT OF MIXED-USE COMMUNITY IN CHINA**

### **2.1 Background of Mixed-Use Community Emerging**

The previous community with single residential use in China were planned by the government and constructed and managed by the big state owned enterprises. With the increasingly development of society and the change of the lifestyle, the planned residential district can change into a more sustainable community by a spontaneous approach as part of urban regeneration.

#### **2.1.1 Changes under the Information Era**

As the information network rapidly developing and being generally applied, industries that mainly based on information production, circulation and application are taking a bigger part in urban economics, leading to a great transformation in people's communication, work and daily life, etc. For example, advertising will no longer be restricted to a certain space, due to the changes in how people receiving advertisement, so that retail store can be located in a more private place.

In terms of the changes in urban space, mixed-use spaces show up due to the innovation in lifestyle and communication, making it more flexible for a multi-functional layout of various functions like residential and office. In the context of urban planning, the land use greatly changes according to mixed-use space and functions.

### **2.1.2 Flexibility in Housing Location and Investment in Real Estate**

The residence commercializing policy makes it possible for the differentiation of residential spaces, so that people can have more flexible choices for housing location and no longer be restricted to a fixed public housing location. People can choose wherever they prefer to live.

Meanwhile, the real estate investment has become a hot issue, leading to an active market of renting and second-hand house trading, which, to some extent, weakens the phenomena of class stratification and promotes mixed-use and mixed-class.

### **2.1.3 Demand of Promoting Community Vitality**

The mode of residential district takes a great percentage in residential area in China. An increasing number of problems emerge in large-scale residential districts, including single function, large-scale road system and scarce open spaces, etc. It further leads to deterioration in urban fabric and loss of community vitality, which gradually decrease the sustainability in communities. Meanwhile, there is a higher demand of community vitality since it's the exact scale where residence can perceive.

## **2.2 The Evolution in Mixed-Use Residential Community Form**

New urbanism was then widely be advocated in community development. It puts an emphasis on blocks as the basic unit in cities. Compared to western experience, China got a late start on the community development theory. At the moment, there is a coexistence of open and gated community, as well as a coexistence of large scale residential district and small scale ones (Wang, 2012) in existing community regeneration and new community development. Several main stages are as followed.

### **2.2.1 Traditional Residential Districts**

There has been a mass construction of modern residential districts in 1980s in China. However, most of them tended to be large-scale with single pattern so that the traditional neighborhood fabric was destroyed. Then many scholars tried to adjust it by means of allocation of public facility. Although some supporting business and service had been added, they still failed to solve the problem of broken urban fabric. At present, such old planned residential districts still account for quite a large proportion.

### **2.2.2 Flexibility in Housing Location and Investment in Real Estate**

Since the 1970s, the concept of mixed community has been gradually accepted, which has been widely used in the planning practice of urban renewal and newly construction area. Vanke (a Chinese developer company) firstly started the exploration on open-gated residential districts, emphasizing the interaction between residential areas and cities. The earliest exploration is the project of Shanghai Vanke City Garden in 1992, in the form of "open road network, no-gated residential area", which has been a great success at that time. In this stage, however, the open space and service facilities inside the residential district are for internal residents. Although some commercials were introduced inside, it mainly relied on residential.

### **2.2.3 Demand of Promoting the Community Vitality**

Residential community developed after the Vanke pattern and further reflected the mixed use concept. There is a great difference between the pattern of "residential community" and open blocks proposed by Vanke, community-type one stands for open road network and community arrangement including mixed use. It emphasizes multi-functional mix, which means residence, commercial, office and other functions can mix and permeate in each residential unit to insert a diversified living space and urban landscape. This pattern has been widely used in western developed countries while just at the initial stage of development in China, which has begun to be used in metropolitan cities like Guangzhou, Beijing, Shanghai (Wang W.H. (2012)).

## **2.3 Summary**

During the exploration of urban function penetrating into the community spatial level, residential communities have become a well-recognized pattern in this stage. It emphasizes the diversification of the residence, open space, urban landscape and residents, in order to stimulate the vitality through the approach of mixed-use.

Some gated communities are transforming to mixed-use communities. Among current research on mixed-use communities, there is a deficiency in the market feedback throughout the transformation period. A detailed mixed-use case is analyzed in this paper based on a community and building spatial scale, where all the citizens can easily observe and perceive their life.

Huaqingjiayuan Community (H Community) in Beijing is in a spontaneous transition stage from a planned gated residential district to

mixed-use community. Driven by spontaneously inserting commercial, the public space is shared by the surrounding residents. It is a typical case of spontaneous mixed-use sustainable community.

### 3. CASE ANALYSIS

#### 3.1 The Development History and the Current Surrounding Environment

H Community was developed by the developer Huayuan Enterprise in 1995 and was constructed in 1999. It was positioned as a middle-grade residential district with the gross floor plan of 308,000 square meters. The Community was designed without branch roads connected to the city, which made it a gated community that time.

It is located closely next to Wudaokou Metro Station and many bus stations, surrounded by many colleges and universities, with great commercial atmosphere including shopping mall and supermarket, while the urban function continuously permeating into the residential area throughout years.



Figure 2. The location of Huaqingjiayuan Community



Figure 2. The aerial view of H Community (Source: Baidu pictures)

### 3.2 The Current Internal Condition

There are 17 buildings for residential in total and three other separate buildings for urban function including one kindergarten, two office buildings. The area for residential and service facility is 256,000 and 52,220 square meters respectively. The landscape ratio is about 30%. The total number of households living there is 2364, with a population of 9456. The service facilities include a primary school, a kindergarten, fitness stores, tennis courts, supermarkets, and a garage with the capacity of 1052 parking lots, etc.

However a spontaneous vertical mixed-use can be observed in these residential buildings within these years, which permeates the urban function and greatly contributes to the community vitality.

Table 1. Construction index of the H Community

Name	Data
Total area	126,700 sq.m.
Gross floor plan	308,000 sq.m.
Area for residential use	256,000 sq.m.
Area for service facilities	52,220 sq.m.
Landscaping ratio	30%
No. of householders	2364
No. of Parking lots	1052

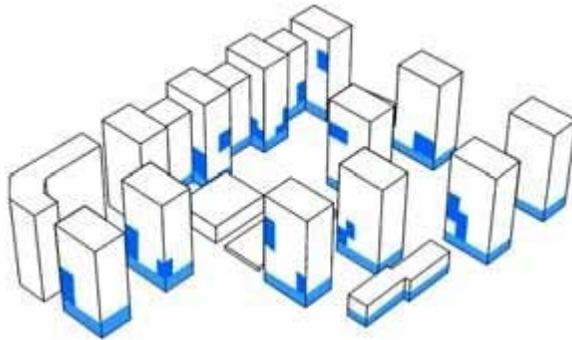


Figure 3. Diagram of vertical mixed-use in Huaqingjiayuan Community (Source: Zhu, 2006)



Figure 4. the scene of residential units changed into commercial

### 3.3 Analysis from the Survey and Interviews

A survey and questionnaire interview were conducted in H Community in order to find out the mixed-use condition and feedback of the market-oriented spontaneous mixture.

#### 3.3.1 Target Groups

Some of the residents here are householders while other are tenants. The age of the residents are between 25 and 40. Their working fields include IT industry, university researching, the finance industry, etc. The population composition in this community is changing with the society development and greatly matches the target group of retail stores inside gradually, which keeps attracting more urban functions inserting into the community.

These inserted stores, studios, etc. are mainly distributed on the edge buildings adjacent to the city. The Types of inserting commercials are as

followed according to the survey. There are 17 spa shops and 17 education organizations, accounting for 25% respectively of the whole inserting commercial households. The number of retail stores are 8 accounting for 12%. The number of recreation and medical stores are 5 and 3, respectively. Other types of commercial include bakery, tattoo, housekeeping services, etc. The target group of these stores are residents in this community and around.



Figure 5. The scene of the inserting stores inside the residential buildings

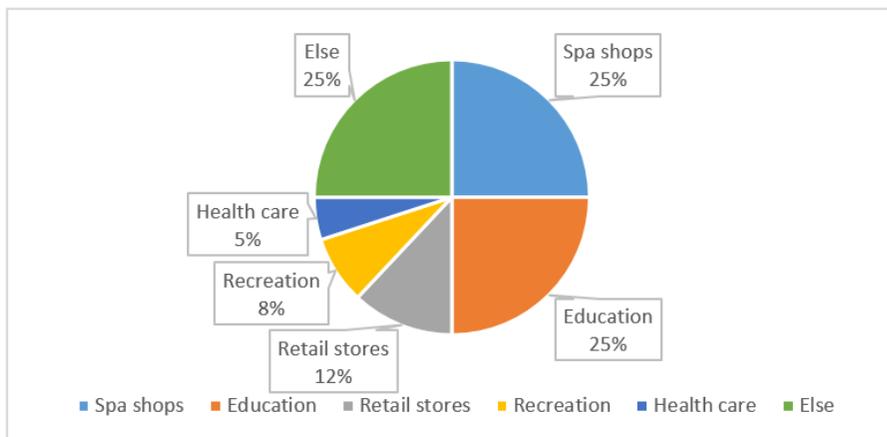


Figure 6. The percentage of different types of commercial inside buildings

### 3.3.2 Reasons for the Commercial Inserting

Questionnaires for store owners mainly were designed to find out the motivation for inserting commercial. Questions included advertising methods, reasons for choosing this community, advantages for locating here as well as monthly rent.

Attracting clients continuously is the key factor for stores to operate in residential buildings. Most of stores have their own advertising posters on their windows. However, it is not the main method. More advertising approaches through the internet are applied, which is preferred by youngsters nearby compared to traditional ways.

The surrounding commercial atmosphere also contributes to this dynamic inserting commercial in turn. Locating stores in residential buildings here is reasonable for its cheaper rent compared to surrounding shops.

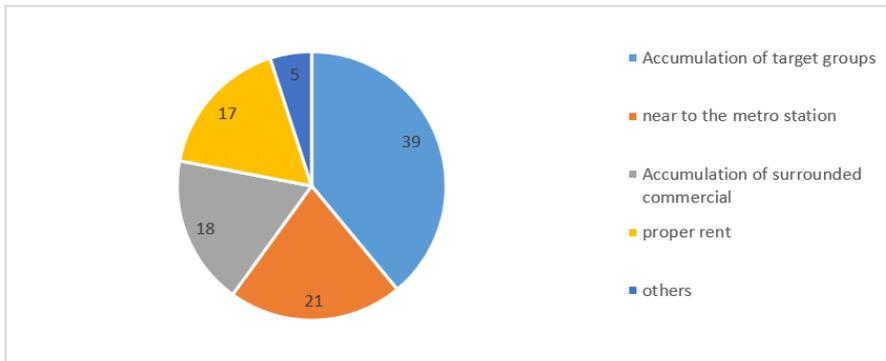


Figure 7. Reasons for being located in Huaqingjiayuan Community

### 3.3.3 Feedbacks from Residents

Seen from the interviews with the residents here, although a few people concerned about the safety after plenty of stores move in, quite a number of people thought shops had little disturb on their daily life but contributing greatly to the convenient life and the community vitality.

## 3.4 Summary

The mixed-use of space in H Community residential buildings is a result from the demand of people living there, as it fulfill the needs of people's changing lifestyle. A large number of customers are formed naturally due to

their different needs since it located in the typical commercial area Wudaokou, adjacent to a group of colleges and universities, Tsinghua Science Park, and Zhongguancun Park. Consequently, it leads to a form of a residential-commercial mixed function area, meeting the demand of residents here, and also contributing to unique mixed-use residential buildings. It has become a new phenomenon for the sustainable development of H Community.

## **4. RELATIVE CASES AND STRATEGIES FOR THE DESIGN OF MIXED-USE COMMUNITY**

### **4.1 Precedent Cases**

This section concerns with two successful mixed-use communities: Dangdai MOMA and Jianwai SOHO. Different from the spontaneity of H Community, they introduced the concept of mixed-use consciously at the beginning.

#### **4.1.1 Dangdai MOMA**

Dangdai MOMA is designed by Steven Hall and his team. It sits by the North-east Second Ring of Beijing, surrounded by commercial and cultural centers like Dongzhimen Commercial Zone and International Exhibition Center. It also has a convenient public transportation network. Dangdai MOMA is composed of 9 buildings, taking up 3 ha with a building area of 220,000 m<sup>2</sup>. 8 of them are residential and are connected by bridges high above, while the other is a hotel. In the design of Dangdai MOMA, Steven Hall used Beijing Linked Hybrid as the concept and proposed many strategies to promote the mixture of function within the community.

In Dangdai MOMA, a three dimensional (3-D) multi-functional network combining residence and urban functions replaces the traditional 2-D function layout. Urban functions are distributed in three spatial levels, covering the needs of different ages: on the ground level are stores, restaurants and independent hotel, school and cinema; on the middle level are semi-public parks, holding quiet activities; on the bridge level are swimming pool, gym, library, gallery and salon, which require more communication.

#### **4.1.2 Jianwai SOHO**

Jianwai SOHO is designed by Japanese architect Riken Yamamoto. It is located at the CBD of Beijing, south-west to the cross of Guomao Bridge. Public and private transportation is convenient. It contains 18 high-rise apartments, 2 office buildings and 4 villas, taking up 16.9 ha with a building area of 700,000 m<sup>2</sup>.

It also distributes various functions to different height level. To reduce traffic congestion around the Guomao CBD, it introduces two city roads to the community and forms a park in the center, merging itself to the city. The boundary is vague since there is no wall around it. Three avenues and one street divide Jianwai SOHO into 5 small-scaled blocks. Thus residents can have a better sense of recognition.

### **4.2 Strategies for Mixed-Use Communities**

Based on case study of H Community, Dangdai MOMA and Jianwai SOHO, some concepts in common can be concluded and used in future designs of mixed-use communities.

#### **4.2.1 A Good Location**

H Community is surrounded by Tsinghua Science Park and universities including Tsinghua, Beijing Forestry University and Beijing Language University. Dangdai MOMA is near to Dongzhimen Commercial Zone and International Exhibition Center. And Jianwai SOHO is close to Guomao CBD. Also, vicinity to public transportation stations, especially subway stations, makes it convenient for people to get to the three communities. Prosperous economic development and high concentration of people in surrounding areas promote the vitality and liveliness of such mixed-use communities.

#### **4.2.2 Clear Target Groups**

It is crucial to have clear target groups in order to decide what types of functions the community should hold. H Community aims at students, foreigners and young people working around; Dangdai MOMA focuses on family units with high income; Jianwai SOHO targets at business and SOHO people. Correspondently, they have different emphases on functions. For example, the demand for language training and collective entertainment is greater in H Community than the other two; primary school and children activity center, which are important in Dangdai MOMA, seem useless in Jianwai SOHO.

### **4.2.3 A Three Dimensional Multi-Function Layout**

H Community, Dangdai MOMA and Jianwai SOHO challenge traditional pattern of combining residence and commerce, which allocates stores on the ground floor along a road. In communities of traditional pattern, types of stores are limited to small shops, lacking of necessary public activities and communication. Thus, the utilization ratio of commerce is rather low. On the contrary, the three mixed-use communities enrich types of functions and distribute various functions to different height levels. Although the function distribution is irregular in H Community because of its spontaneity, Dangdai MOMA and Jianwai SOHO have clear principles to allocate functions according to their publicity and privacy. The bridges in Dangdai MOMA even weave a closer network to enhance the utilization of facilities.

### **4.2.4 Openness to the City**

Opening to the city can introduce more people to communities, increasing the utilization ratio and operation income of facilities and enhancing the vitality of residents. Since mixed-use develops without the support of property management company in H Community, people need access cards to get in. It brings a lot of trouble to visitors and damages the vitality of H to some extent. In contrast, Dangdai MOMA and Jianwai SOHO open themselves to the fullest by cancelling the walls and increasing the number of entrances.

### **4.2.5 Distinctive Spatial Features**

Dangdai MOMA and Jianwai SOHO both concern about the creation of distinctive spatial experience for visitors. Dangdai MOMA uses the layout of courtyard. Jianwai SOHO introduces small-scaled allies, sunken parks and platforms to create abundant spatial levels. Distinctive features help residents and visitors better recognize the community and form a sense of belonging.

## **5. CONCLUSION**

As can be seen from the analysis above, mixed-use space in single buildings and communities can promote the economic vitality, social equity and environment quality, thus greatly contributes to the sustainability. Many

approaches of design strategies can be applied to achieve a better community in pursuing sustainability.

Meanwhile, in the context of the urban regeneration, a number of residential districts are strongly affected by the complex urban life and transforming to a more diversified community. Thus mixed-use spaces can formed spontaneously and greatly adds to diversification and vitality in communities.

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## **A Comparative Study on the Present Government Procurement Act and Act for Promotion of Private Participation in Infrastructure Projects in Taiwan**

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**Key words:** 1. Government Procurement Act  
2. Act for Promotion of Private Participation in Infrastructure Projects  
3. Promote what is beneficial and abolish what is harmful

**Abstract:** In Taiwan, national infrastructure development is undertaken in accordance with the 1998 Government Procurement Act and the 2000 Act for Promotion of Private Participation in Infrastructure Projects. Before the Act for Promotion of Private Participation in Infrastructure Projects was enacted, public-private partnerships in infrastructure development were conducted in accordance with Article 99 of the Government Procurement Act, which states that companies (i.e., suppliers) who are qualified to develop infrastructure related to transportation, energy, environmental protection, and tourism shall be selected by the competent authority in accordance with this article, unless provided for by other regulations. Accordingly, determining which act should be applied when commissioning infrastructure developments is debatable. Governmental staff, judicial officers, and private business owners have often mistakenly applied the Government Procurement Act for the Act for Promotion of Private Participation in Infrastructure Projects. Furthermore, the Act for Promotion of Private Participation in Infrastructure Projects has frequently been confused with the Government Procurement Act, and the spirit of these laws has frequently been misused. Article 2 of the Act for Promotion of Private Participation in Infrastructure Projects states that this act prevails regarding promoting private sector participation in infrastructure projects. Therefore, the government must evaluate which act their plans should be implemented in accordance with; the government should clearly define their plans in order to promote public interest and prevent fraud.

## **1. RESEARCH BACKGROUND AND PURPOSES**

When formulating national infrastructure plans, the government must consider how to prevent fraud and promote public interest. If fraud prevention measures are strict, then civil servants tend to perform their duties rigorously and are likely to take on fewer tasks in order to avoid making mistakes; however, infrastructure developments may be delayed and the use of public space may become inefficient. By contrast, if promoting public interest is the main focus, then risk management is disregarded and the social benefits of infrastructure development are not maximized. Therefore, developing a system for promoting public interest and preventing fraud is crucial to the promotion of national infrastructure development.

In Taiwan, despite previous governments allocating large budgets to developing national infrastructure, they were ineffective in supervising procurement, bidding, and compliance procedures, resulting in low-quality public works. Some civil servants have been subjected to judicial investigations and prosecutions because of conflicting interests. Therefore, to establish an open and fair procurement procedure and to enhance procurement efficiency, the Executive Yuan promulgated the Government Procurement Act in 1998, in which procurement regulations were stipulated (including regulations for bid rigging and bid collusion) to prevent corruption, minimize poor budgetary spending, and improve the quality of public works.

Infrastructure developments are typically undertaken to stimulate economic growth. Although the government is responsible for such developments, private funds can be acquired and professional technologies can be introduced by adopting a user-pay system to facilitate infrastructure development and to ease governmental financial pressure. Therefore, to enhance the quality of public services and to stimulate socioeconomic development, the Act for Promotion of Private Participation in Infrastructure Projects was enacted in 2000. Through private participation in public infrastructure operation, private institutions are independently liable effectively responsible for the performance of such operation and share their profits with the government to improve people's quality of life, achieving a beneficial outcome for the government, business owners, and the public.

In Taiwan, national infrastructure development is undertaken in accordance with the 1998 Government Procurement Act and the 2000 Act for Promotion of Private Participation in Infrastructure Projects. Before the Act for Promotion of Private Participation in Infrastructure Projects was enacted, public-private partnerships in infrastructure development were conducted in accordance with Article 99 of the Government Procurement Act, which states that companies (i.e., suppliers) who are qualified to

develop infrastructure related to transportation, energy, environmental protection, and tourism shall be selected by the competent authority in accordance with this article, unless provided for by other regulations. Accordingly, determining which act should be applied when commissioning infrastructure developments is debatable. Governmental staff, judicial officers, and private business owners have often mistakenly applied the Government Procurement Act for the Act for Promotion of Private Participation in Infrastructure Projects. Furthermore, the Act for Promotion of Private Participation in Infrastructure Projects has frequently been confused with the Government Procurement Act, and the spirit of these laws has frequently been misused (Division for Promotion of Private Participation, Ministry of Finance, 2006b; Public Construction Commission, 2007; Section for Promotion of Private Participation at Public Construction Commission, 2010).

Article 2 of the Act for Promotion of Private Participation in Infrastructure Projects states that this act prevails regarding promoting private sector participation in infrastructure projects. Therefore, the government must evaluate which act their plans should be implemented in accordance with; the government should clearly define their plans in order to promote public interest and prevent fraud.

## **2. RESEARCH METHODS**

This study examined the literature review and conducted a comparative analysis of the legislation processes related to the Act for Promotion of Private Participation in Infrastructure Projects and the Government Procurement Act. The differences between these two acts as well as the government's promotion of private participation in infrastructure projects were explored by investigating the spirit of the laws, open procedures, security measures, private sector participation, and measures that promote public interest and prevent fraud.

## **3. EVOLUTION OF THE GOVERNMENT PROCUREMENT ACT**

Before the Government Procurement Act was enacted, procurement for public works was performed in accordance with the Enforcement Rules of the Audit Act, the Ordinance Concerning Inspection Procedure Governing Construction Work, Procurement and Disposal of Properties by Government Agencies (hereafter referred to as "the Inspection Ordinance," which was based on Article 59 of the Audit Act), and/or Guidelines for Invitations to Tender for Public Construction Works Drafted by the Executive Yuan. (The

Legislative Yuan of Republic of China, 1994) Therefore, in Taiwan, the government developed public works in accordance with the Audit Act. The Inspection Ordinance, which contained only 24 regulations, was enacted in 1950 and abolished in 1999 after being in effect for 49 years.

The Inspection Ordinance was abolished in response to countries worldwide removing trade and tariff barriers in order to promote free trade, including the drafting of the 1947 Agreement on Government Tax and Trade (GATT); in 1995, the World Trade Organization (WTO) was established. To address the challenges of globalization, in 1990 Taiwan applied for participation in the GATT forum and became the 144<sup>th</sup> WTO member in 2002. Among the various WTO agreements, the current Agreement on Government Procurement, which was concluded in Uruguay in 1993 (Liao, 2003), is most directly relevant to public works. When Taiwan applied for accession into the WTO, other countries requested that Taiwan first open its government-procurement market in order to conform to the Agreement on Government Procurement. Accordingly, the Government Procurement Act was enacted in 1998 in accordance with the agreement and relevant regulations.

#### **4. LEGISLATION PROCESS FOR THE ACT FOR THE PROMOTION OF PRIVATE PARTICIPATION IN INFRASTRUCTURE PROJECTS**

Enactment of the Act for the Promotion of Private Participation in Infrastructure Projects was preceded by the 1929 Privately Owned Public Utilities Supervisory Act and then the 1953 Statute of Privatization of Government-Owned Enterprises, which was not passed by the Legislative Yuan until 1991. In 1993, consensus was reached on a review report regarding a 6-year national development plan, and Taiwan began promoting private participation in infrastructure projects (Li, 2015). Subsequently, the Statute for Encouragement of Private Participation in Transportation Infrastructure Projects was enacted in 1994 (The Legislative Yuan of Republic of China, 1994).

In 1995, the National Development Council in the Executive Yuan adopted a build-operate-transfer model in managing 22 projects aimed at promoting national infrastructure development, including the north-south high-speed railway. In 1996, the National development Council held a conference on national development, which culminated in the implementation of the Statute for Encouragement of Private Participation in Transportation Infrastructure Projects. The conference was aimed at modifying the range of legal applicability, as well as to form a legal basis for promoting private participation in infrastructure projects. Accordingly,

the Act for Promotion of Private Participation in Infrastructure Projects was enacted in 2000 (Division for Promotion of Private Participation, Ministry of Finance, 2006a ; The Legislative Yuan of Republic of China. 1998). In addition, the Statute for Encouragement of Private Participation in Transportation Infrastructure Projects applied to investment contracts related to private participation until the statute was replaced with the Act for Promotion of Private Participation in Infrastructure Projects, which was deemed advantageous to private institutions. Subsequently, the statute was no longer valid under law.

## **5. ISSUES WITH THE GOVERNMENT PROCUREMENT ACT AND THE ACT FOR PROMOTION OF PRIVATE PARTICIPATION IN INFRASTRUCTURE PROJECTS**

### **5.1 The Constitution of the Republic of China Does Not Clearly Distinguish the Differences Between Service Provision and Gaining Illegal Profits, Which Leads to the Possibility of Law-Abiding Civil Servants Being Subject to Prosecution.**

In 2005, at the 995<sup>th</sup> ministry meeting, the Minister of Justice proposed relaxing the Act for the Promotion of Private Participation in Infrastructure Projects, and that concessions be made to encourage private participation in infrastructure projects. This act is a special law because it prevails over other related laws, and is thus critical for law enforcement officers investigating cases relating to illegal profits. An offense involving illegal profit obtainment is judged on the basis of whether the involved persons have deliberately violated any law. “Deliberately violating a law” is a crucial element in a case for which the law related to inviting investors has been infringed upon. Regarding the procurement of evidence, according to Item 3 of Article 6 of the Government Procurement Act, the competent authority shall assist or provide counsel to the Judicial Yuan or Control Yuan when investigating, accusing, impeaching, or censuring procurement agencies or staffs (Ministry of Justice, 2005). If questions arise regarding whether cases are related to the Act for Promotion of Private Participation in Infrastructure Projects, the regulations in this act stipulate when the competent authority shall assist or provide counsel to determine which act shall prevail in order to prevent incidents of misjudgment.

## **5.2 Issues on How the Government Promotes Private Participation in Infrastructure Projects**

### **5.2.1 Problems Concerning the System of the Act For the Promotion of Private Participation in Infrastructure Projects**

The Institute of Transportation (of the Ministry of Transportation and Communications) (2009) examined cases in which the Act for the Promotion of Private Participation in Infrastructure Projects (referred to as “the act” in this section) has been enforced and identified the following issues:

1. Real estate securitization: Public works cannot yield profits, which hinder business operations through public facilities; therefore, real-estate securitization and land trust cannot be implemented.
2. Ambiguity between private and public investment contracts: The act is unclear about whether investment contracts are considered private or public contracts.
3. Entitlement premiums and rebates: To prevent conflicts of interests created by personnel involved in the act, high entitlement premiums are offered; however, this hinders number of services offered and improvements in service quality.
4. Low awareness of how public works benefit the general public and the protection of the disadvantaged groups: Discussions about public interest have been insufficient. For example, media coverage on subsidies for disadvantaged groups and environmental protection are not objective, which generate negative publicity about the act.

### **5.2.2 Factors Contributing to Conflicts of Interests in the Act**

In 2010, the Public Construction Commission, Executive Yuan, 53.8% of the difficulties that government agencies have encountered related to the promotion of private participation in infrastructure projects were inexperience, poor advice, low professionalism among project executives, and disputes with private enterprises who are eyeing on the profits. Consequently, government agencies are hesitant about promoting private participation in infrastructure projects or are overly conservative when undertaking such projects.

### **5.2.3 Problems Related to the Promotion of Private Participation in Infrastructure Projects**

In 2007, the Public Construction Commission, Executive Yuan, an independent agency of the Executive Yuan, indicated that government agencies have encountered the following problems with the promotion of private participation in infrastructure projects: Unfamiliarity with the Act for Promotion of Private Participation in Infrastructure Projects: Government agencies mistakenly adopting the Government Procurement Act in cases where the Act for Promotion of Private Participation in Infrastructure Projects should be applied (and vice versa).

### **5.3 Government Staff (accountants, auditors, accounting and statistics officers, ethics officials, and prosecution and investigation officers) Are Unfamiliar with the Act for Promotion of Private Participation in Infrastructure Projects**

The Ministry of Finance (2014) hosted a forum to discuss issues about promoting private participation in infrastructure projects. The representative for the northern region of Taiwan argued that many civil servants lack experience and professional knowledge in promoting private participation in infrastructure projects; consequently, in the event of problems, the project manager is held accountable. In addition, civil servants are not encouraged to promote private participation in infrastructure projects, and the Ministry of Finance lacks comprehensive guidelines and provides inadequate assistance to help project managers in solving problems. Furthermore, information presented at a seminar on political morality and government procurement erroneously referred to cases related to the Act for Promotion of Private Participation in Infrastructure Projects as being related to the Government Procurement Act.<sup>1</sup> Similar problems have been encountered by both infrastructure project managers as well as staff in accounting, auditing, statistics, political morality, and prosecution divisions.

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<sup>1</sup> For example, when discussing government procurement ethics and transparency measures in a seminar materials about political morality and government procurement at Taipei Veterans General Hospital, Gao-Yue Guan erroneously referred to cases related to promoting private participation in infrastructure projects as being related to government procurement.  
<http://homepage.vghtpe.gov.tw/~ged/left1.htm>

## 6. COMPARISON BETWEEN THE GOVERNMENT PROCUREMENT ACT AND THE ACT FOR PROMOTION OF PRIVATE PARTICIPATION IN INFRASTRUCTURE PROJECTS

This study compared the Government Procurement Act and the Act for Promotion of Private Participation in Infrastructure Projects for two reasons: to assist government agencies in determining whether they should adopt the Government Procurement Act (when budgeting for public works) or the Act for Promotion of Private Participation in Infrastructure Projects (when obtaining private funds), and to ensure that infrastructure developments satisfy public interest.

*Table 1. Comparisons between the two acts*

Project	Comparisons between the two acts
Laws related to government procurement	<ol style="list-style-type: none"> <li>1. Act for Promotion of Private Participation in Infrastructure Projects: Cites the Statute for Encouragement of Private Participation in Transportation Infrastructure Projects;</li> <li>2. Government Procurement Act: Cites the Government Procurement Agreement and the Inspection Ordinance.</li> </ol>
Drafting of legislation	<ol style="list-style-type: none"> <li>1. The Act for Promotion of Private Participation in Infrastructure Projects was introduced to broaden the scope of the Statute for Encouragement of Private Participation in Transportation Infrastructure Projects, to ensure that due diligence is exercised when promoting private participation in infrastructure projects, and to promote public interest;</li> <li>2. The Government Procurement Act was enacted to establish an open, transparent, fair, competitive, efficient, trustworthy government procurement system in accordance with the Inspection Ordinance and WTO Agreement on Government Procurement.</li> </ol>
Purpose of legislation	<ol style="list-style-type: none"> <li>1. The Act for Promotion of Private Participation in Infrastructure Projects was introduced to enhance the quality of public services, promote private participation in infrastructure projects, and to stimulate economic development;</li> <li>2. The Government Procurement Act was introduced to establish a fair procurement procedure.</li> </ol>
Application of legal regulations	According to the Executive Yuan (Tai 89 Jiao Zi no. 12117, 2010), government agencies shall promote private participation in infrastructure projects in accordance with the Act for Promotion of Private Participation in Infrastructure Projects.
Characteristics of legal regulations	<ol style="list-style-type: none"> <li>1. The Act for Promotion of Private Participation in Infrastructure Projects contains two chapters pertaining to promoting public interest (i.e., Land Acquisition and Development; Financing and Tax Benefits);</li> <li>2. The Government Procurement Act contains two chapters pertaining to fraud prevention (i.e., Dispute Settlement, Protest, and Complaint; and Penal Provisions).</li> </ol>
Implementation procedures	1. Act for Promotion of Private Participation in Infrastructure Projects: The government shall provide land and buildings; private investors shall provide funding; the procedure for land development or inviting investors shall be conducted openly and fairly, emphasizing the importance of cooperation;

Project	Comparisons between the two acts
	2. Government Procurement Act: The government shall provide funding; and suppliers shall provide construction technology, labor, and company property. Throughout the procurement, the government shall provide funding and maintain control of the procedure; private investors shall provide assistance if necessary.
Scope of application	The Act for Promotion of Private Participation in Infrastructure Projects and the Government Procurement Act differ in their defined scope of application.
Relevant agencies	Cases in which the Act for Promotion of Private Participation in Infrastructure Projects is applicable: The authority in charge, authorized institutions, and commissioned agencies; Cases in which the Government Procurement Act is applicable: Government agencies, public schools, government-owned enterprises, entrusted corporations or groups, and other agencies of professional capacity.
Private participation in infrastructure projects	1. The Act for Promotion of Private Participation in Infrastructure Projects contains two procedures pertaining to announcements made by the government and planning undertaken by private institutions. 2. The Government Procurement Act states that the government shall control the implementation procedure; suppliers cannot plan their level of participation. In addition, the Act for Promotion of Private Participation in Infrastructure Projects applies to cases involving private participation in public construction.
Public procedure for inviting public participation	1. Act for Promotion of Private Participation in Infrastructure Projects: The government shall invite investors and cooperate with private institutions openly and transparently. 2. Government Procurement Act: Regarding a fair procurement procedure, the government shall announce information on invitations to tender in the Government Procurement Gazette and online. Thus, the Act for Promotion of Private Participation in Infrastructure Projects is more open and transparent compared with the Government Procurement Act.
Confidentiality provisions	1. Act for Promotion of Private Participation in Infrastructure Projects: Except for the negotiation process and review content, other procedures related to inviting investors shall be conducted openly and transparently. 2. Government Procurement Act: Tender documentation shall remain confidential before the documents are published; the reserve price as well as the list and number of suppliers that have submitted tenders shall not be revealed before the opening of tenders.
Confidentiality provisions	1. Act for Promotion of Private Participation in Infrastructure Projects: Except for the negotiation process and review content, other procedures related to inviting investors shall be conducted openly and transparently. 2. Government Procurement Act: Tender documentation shall remain confidential before the documents are published; the reserve price as well as the list and number of suppliers that have submitted tenders shall not be revealed before the opening of tenders.
Negotiation mechanisms	1. Act for Promotion of Private Participation in Infrastructure Projects: Documents related to inviting investors state that negotiations may be undertaken to facilitate selecting the best applicant; 2. Government Procurement Act: When the awarding of a contract cannot be decided, the contract may be awarded through negotiations, but only after the entity was received approval from the superior entity and after

Project	Comparisons between the two acts announcing such intentions in the tender documentation.
Selection and review procedures	1. Selection Committee members: In accordance with the Act for Promotion of Private Participation in Infrastructure Projects, the list of Selection Committee members may be announced in tender documentation provided that all Selection Committee members agree unanimously; in accordance with the Government Procurement Act, the list of Procurement Evaluation Committee members shall remain confidential; 2. Chairperson: In accordance with the Act for Promotion of Private Participation in Infrastructure Projects, the chairperson of the Selection Committee shall be elected by the Selection Committee; in accordance with the Government Procurement Act, the chairperson shall be a senior member of the agencies.
Bid selection and contract signing procedure	1. Act for Promotion of Private Participation in Infrastructure Projects: Negotiation and execution of concession agreements; 2. Government Procurement Act: Negotiation and comparison of procurement tenders followed by the execution of concession agreements.
Bid bond and security deposit	1. Act for Promotion of Private Participation in Infrastructure Projects: No regulations are stipulated regarding the confiscation of the security deposit in order to encourage the cooperation between the government and private institutions. 2. Government Procurement Act: The bid bond is not returned and security deposit is confiscated.
Nature of contract	1. Act for Promotion of Private Participation in Infrastructure Projects: Civil law may be applied if no contractual laws govern the investment contracts. This act removes the power possessed by the government for administrative contracts and promotes cooperation between the government and private institutions on the basis of the equality. Government Procurement Act: The government determines how to formulate procurement contracts.

*Table 2. Rules for promoting public interest and preventing fraud*

Act for Promotion of Private Participation in Infrastructure Projects	Government Procurement Act
Measures for promoting public interest	Measures for preventing fraud
<b>(1) Relaxation of legal limitations</b>	<b>(1) General rules</b>
1. No regulatory restriction on foreign investment;	1. Procurement rules::
2. Relaxation of the business term for private institutions;	(a) Private organizations shall be treated equally;
3. Relaxation of contract term for lease contracts;	(b) Procurement staff shall not infringe this act;
4. Relaxation of rules regarding leases, superficies, trusts, premiums, or rents;	(c) Judicial, control, or other government agencies may request assistance or counsel from the authority in charge when investigating, prosecuting, judging, impeaching, or censuring procurement agencies or staff;
5. Sale of sporadic public lands;	2. Supervision by the superior entity;
6. Land expropriation	3. Operations in procurement agencies;
(a) Limitation of control over price negotiations;	4. Limitations of procurement operations;
(b) Land expropriation plan may stipulate the terms of land development, business cooperation, land lease, creation of superficies, trusts, or land premium, and rent contribution;	5. The principle of avoiding conflicts of interest shall be followed;

Act for Promotion of Private Participation in Infrastructure Projects	Government Procurement Act
<p>(c) The use of expropriated lands for infrastructure projects by private organizations is not limited by Article 25 of the Land Act, Article 28 of the National Property Act, or legal regulations stipulated by local government agencies responsible for managing public land;</p>	<p>6. Managing conflicts of interest.</p>
<p>(d) Leasing expropriated lands and creating superficies;</p>	<p><b>(2) Invitation to tender</b></p>
<p>7. Development of public lands;</p> <p>8. Infrastructure passing above, under, or through public or private land;</p> <p>9. Expropriation of part of private land for infrastructure projects;</p> <p>10. Announcements restricting construction and advertisements.</p>	<p>1. Open tendering procedures;</p> <p>2. Suppliers are given equal opportunity to be invited;</p> <p>3. Principle of joint bidding;</p> <p>4. Technical specifications may not be limited;</p> <p>5. Announcement of invitations to tender;</p> <p>6. Waiting time for tendering;</p> <p>7. Bid bond and security deposit;</p> <p>8. Confidentiality principle;</p> <p>9. Qualifications of suppliers may not be used as reason of rejection without adequate explanation;</p> <p>10. Political parties and their affiliated enterprises may not submit tenders;</p> <p>11. Suppliers with political affiliations may not submit a tender.</p>
<p><b>(2) Financing and tax benefits</b></p>	<p><b>(3) Awarding of contracts</b></p>
<p>Chapter 3 of the Act for Promotion of Private Participation in Infrastructure Projects:</p>	<p>1. Tenders shall not be opened until the bid is awarded;</p>
<p>1. Subsidies: the authority in charge may, on the part of the inadequate self-financing portion, subsidize part of the interest accrued from the loan needed by the private institution or, invest in part of the construction;</p> <p>2. Long-term loans;</p> <p>3. Relaxation of credit limits;</p> <p>4. Foreign financial institutions jointly provide loans to private organizations;</p> <p>5. Publicly issuing new stocks;</p> <p>6. Issuing purpose-designated corporate bonds ;</p> <p>7. Tax relief: business income tax, tariffs, land tax, property tax, and deed tax;</p> <p>8. Investment tax credits.</p>	<p>2. No opening or submission of tenders for private organizations;</p> <p>3. Announcements of the awarding of contracts;</p> <p>4. Tenderers are information about the awarding of contracts.</p>
<p><b>(3) Rent concessions</b></p>	<p><b>(4) Compliance management</b></p>
<p>1. Public land: According to Items 1 and 2 of Article 15 of the Act for Promotion of Private Participation in Infrastructure Projects, after using public lands, the authority in charge may lease the land and provide rent concessions;</p> <p>2. According to Item 1 of Article 18 of the Act for Promotion of Private Participation in Infrastructure Projects, when the space above or under public or private land is leased to private institutions.</p>	<p>1. Essential elements of contracts;</p> <p>2. Guidelines on violations of subcontracting restrictions;</p> <p>3. Suppliers are accountable for defective works;</p> <p>4. Construction quality control measures;</p> <p>5. Rules for construction inspection panels.</p>
<p><b>(4) Administrative rules</b></p>	<p><b>(5) Penal provisions</b></p>
<p>1. Rules pertaining to rent concessions for leasing public land and creating superficies are aimed at promoting private participation in infrastructure projects;</p> <p>2. Award rules for encouraging agencies to</p>	<p>1. Penalties related to suppliers operating on self-interest;</p> <p>2. Penalties related for procurement staff who reveal confidential documents;</p> <p>3. Penalties related to procurement decisions that deviate from the original plan;</p> <p>4. Penalties related to forcing procurement staff to reveal confidential documents;</p>
	<p><b>(6) Additional rules</b></p>
	<p>1. Competent authorities may investigate progress;</p>

Act for Promotion of Private Participation in Infrastructure Projects	Government Procurement Act
promote private participation in infrastructure projects; 3. Rules for awarding the golden prize for construction to encourage private participation in infrastructure projects;	2. Suppliers shall be notified about how they have violated a law and the infringement shall be announced in the government gazette;
Measures for preventing fraud	Measures for promoting public interest
1. Supervision and management; 2. Selection Committee members may not be influenced illegally or recommend themselves as committee members; 3. Selection Committee members shall remain impartial throughout the selection procedure. For example, they may not receive bribes, kickbacks, gifts, or concessions; 4. Selection Committee members shall avoid conflicts of interest.	(1) According to Article 44 of the Government Procurement Act, because of price difference, Taiwanese suppliers are given preference in being awarded a contract. (2) Priority on the procurement of green products. (3) Government agencies shall help small and medium-sized enterprises to implement a government procurement contract or subcontract.
Comparisons between the two acts	1. Act for Promotion of Private Participation in Infrastructure Projects: Positively framed regulations for promoting public interest; Government Procurement Act: Negatively framed regulations for preventing fraud.

## **7. THE ACT FOR PROMOTION OF PRIVATE PARTICIPATION IN INFRASTRUCTURE PROJECTS IS NOT FOR PROCUREMENT BUT FOR ATTRACTING INVESTORS**

The essential elements of procurement behavior are as follows: (1) implementing a contract, (2) whether a “quid pro quo” (consideration) relationship exists, (3) control power (Liao, 2003), and (4) buyers and sellers. Whether the Act for Promotion of Private Participation in Infrastructure Projects is in accordance with the meaning of procurement behavior is discussed as follows.

## 7.1 Subjectivity and Objectivity: Procurement Requires Buyer and A Seller.

1. *Figure 1* depicts the government procurement process: the government is the buyer and the private organization is the seller.

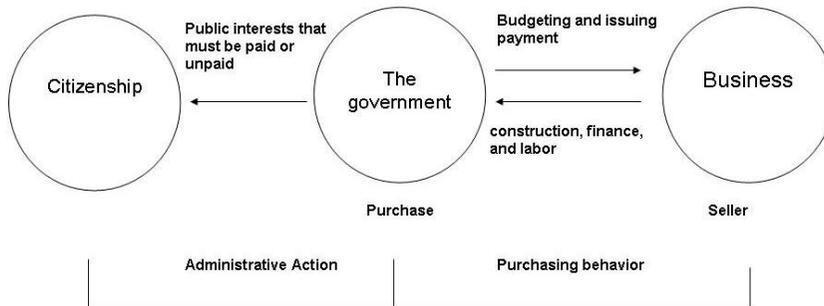


Figure 1 Procurement

Source of data: compiled by this study

2. *Figure 2* depicts the government’s process for inviting investors and promoting private participation in infrastructure projects: The public is the buyer and the private organizations are the sellers; the government cooperates with the private organizations.

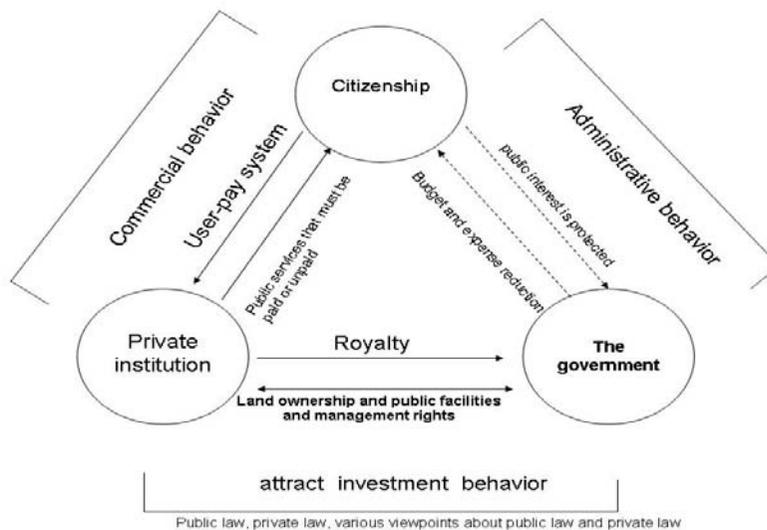


Figure 2 Attracting Investor

Source of data: compiled by this study

According to the figure shown previously, the subject and object of the Act for Promotion of Private Participation in Infrastructure Projects cannot be easily defined in terms of buyers and sellers.

## **7.2 Contract Implementation**

Contracts can be implemented according to the Act for Promotion of Private Participation in Infrastructure Projects.

## **7.3 A quid pro quo relationship**

This type of relationship is explored from the perspectives of “payment” and “procurement.”

### **7.3.1 Payment**

Whether the government issues payment is the basis for determining whether a quid pro quo relationship exists and which regulations should be applied.

1. According to Article 4 of the Act for Promotion of Private Participation in Infrastructure Projects, for the government or a government-owned enterprise to invest in a private organization, the investment shall not exceed 20% of the total assets of the private organization. The Act for Promotion of Private Participation in Infrastructure Projects limits the government’s shareholding in private organizations to avoid hidden expenditure.
2. According to Article 29 of the Act for Promotion of Private Participation in Infrastructure Projects, “the authority in charge may, on the part of the inadequate self-financing portion, subsidize part of the interest accrued from the loan needed by the private institution or, invest in part of the construction”; Regarding the limitation of non-self-liquidation, the Selection Committee shall evaluate hidden expenditure. According to Article 33 of the Act for Promotion of Private Participation in Infrastructure Projects, construction projects operated by private institutions must be inspected by the authority in charge; after the authority in charge issues payment for the construction project and acquires the property rights, the authority may allow the private institution to use the construction. According to the Selection Committee, the authority in charge shall issue a certain amount of payment.

3. The cost of expenditure is measured by the value of land and time. When a concession contract expires, the government reobtains the land ownership of lands, ownership of public facilities, and relevant management rights. Objectively estimating the land value and time during the operation period is difficult.

### **7.3.2 Procurement**

In addition to obtaining premiums, the government retrieves the ownership of lands and all public facilities and related management rights following expiry of a concession contract. A portion of the value of the land and public facilities is related to public interest. Estimating the value of public interest is difficult.

In summary, the value of expenditure and procurement in cases related to promoting private participation in infrastructure projects is difficult to estimate; therefore, a quid pro quo relationship does not exist.

## **7.4 Control Power**

The government maintains control in overseeing the procurement process. The Act for Promotion of Private Participation in Infrastructure Projects does not render the government absolute control power. The reasons are provided as follows: According to Article 22 of the Enforcement Rules of the Act for Promotion of Private Participation in Infrastructure Projects, private institutions taking the initiative to and independently planning to apply for participation in infrastructure projects must receive approval from the authority in charge within a certain period. Private institutions are afforded the right to apply for participation in infrastructure projects. Therefore, private participation in infrastructure projects in no way reveals confidential information; the government also does not control how private organizations apply for participation in infrastructure projects.

## **7.5 Summary**

Cases related to promoting private participation in infrastructure projects do not possess the three elements of procurement behavior (i.e., subject and object, quid pro quo relationship, and control power). Therefore, cases related to promoting private participation in infrastructure projects are investment-attracting cases but not procurement cases.

## **8. CONCLUSION**

1. In this study, the Act for Promotion of Private Participation in Infrastructure Projects and the Government Procurement Act were reviewed and compared. Because the historical background, legislative purpose, implementation procedures, transparency, and confidentiality regulations are fundamentally different between the two acts, they should not be compared. Executives should avoid erroneously misapplying laws.
2. The Government Procurement Act contains more regulations related to preventing fraud compared with the Act for Promotion of Private Participation in Infrastructure Projects. The rules on confidentiality are as follows: the content of tender documentation and the reserve prices shall remain confidential until the winning applicant is announced. Through the principle of confidentiality and a fair procurement mechanism, the quality of procured products can be assured. The Act for Promotion of Private Participation in Infrastructure Projects covers more concession regulations than does the Government Procurement Act. Providing an open and transparent mechanism facilitates the acquisition of private investors. Through implementing such a mechanism, government agencies can improve investor confidence.
3. The elements of procurement are subjectivity and objectivity, contract implementation, quid pro quo relationship, and control power. Actions performed in accordance with the Government Procurement Act are procurement behaviors; actions performed in accordance with the Act for Promotion of Private Participation in Infrastructure Projects are aimed at attracting investors. The government encourages private institutions to invest in infrastructure projects; therefore, the government exhibit investment-attracting behaviors and private institutions exhibit investment behaviors. Because users are required to pay for using such infrastructures, they thus exhibit purchase behaviors.

## **9. RECOMMENDATIONS**

Currently, regarding implementing the Act for Promotion of Private Participation in Infrastructure Projects, the differences between service provision and gaining illegal profits cannot be distinguished; therefore, civil servants are reluctant to take on additional responsibility in fear of being held accountable. Based on the findings of this study, the following recommendations are proposed to provide a reference for government agencies to promote private participation in infrastructure projects.

1. Because of the zero premium and rebates, public construction does not benefit public interest. In an investment contract, unusually high operating profits should be reported and premiums and rebates should be increased.
2. The amount of funding that private institutions can acquire from banks should be limited in order to reduce the level of risk exerted on the government when private institutions fail to operate as contracted.
3. The Act for Promotion of Private Participation in Infrastructure Projects should be clearly defined to facilitate mutual trust and cooperation between the government and suppliers in order to promote private participation in infrastructure projects.
4. Executives at government agencies should receive adequate trained to ensure that they possessed the required professional skills and knowledge to facilitate the establishment of specialized consultancies.
5. Government employees, including judicial officials, accounting and statistics officers, auditors, investigators, and ethics officials, should be invited to seminars to achieve consensus about the Act for Promotion of Private Participation in Infrastructure Projects and raise awareness on the Act for Promotion of Private Participation in Infrastructure Projects and the Government Procurement Act.
6. The Act for Promotion of Private Participation in Infrastructure Projects should be amended to include regulations requiring government agencies to seek counsel or counsel from competent agencies when investigating, prosecuting, judging, impeaching, and censuring agencies or people who are responsible for promoting private participation in infrastructure projects.
7. Because prosecutors and judges are subject to human errors, a professional advisory committee, specialized court, or jury system should be established to handle cases related to promoting private participation in infrastructure projects in order to prevent judges with inadequate knowledge, job experience, or empathy from making misjudgments, which can make civil servants become conservative in developing national infrastructure and utilizing public assets.

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## Dilemma and Key Crack Field of the Urbanization in Central China

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**Key words:** central region, urbanization dilemma, crack fields.

**Abstract:** Central China has good resource conditions and geographical advantages, playing a pivotal role in the development process of urbanization. In the process of urbanization in China to vigorously promote the construction of the central region, the features are: large population base, weak total economy, uneven development of cities. In this paper, analysis is made according to the central region of urbanization and realistic environment that in the process of promoting the new urbanization in central region, implementing and promoting the pattern of urbanization that matches the regional geographical environment, the urbanization dynamic mechanism that adapts to the diverse stages of development and the leading organizational unit of urbanization which combining with the regional towns rating scale will be the key issue to crack the dilemma of the central region urbanization.

ACCORDING to April 2006, "the CPC Central Committee, State Council on promoting the rise of the central region,"(in the [2006] No. 10), the central regions located in the hinterland of China, including six provinces :Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan.Apparently, from the geographical point of view, the central region has good traffic location conditions, being an ideal hub and channels for factors of production resources to China's west, north, south, east. It is the country's important agricultural base, energy base, industrial raw material base and the major industrial base. However, this does not mean that the central region is clearly developing into an ideal state, in fact, the central region is largely "marginalized, being hollowed out," The problems the development facing can not be ignored.

## **1. THE DEVELOPMENT OF URBANIZATION IN CENTRAL CHINA SINCE 1980**

After 1980, the central region urbanization development entered a new historical period, in summary, it can be divided into four stages :

### **1.1 The Urbanization Comprehensive Recovery Period (1979-1983)**

In 1980, the State Council formulated the development policy which pointed "strictly control city development scale, rational develop secondary cities, and actively develop small cities", the central region proposed priority development of small towns coping strategies. In this stage, the blossoming of township enterprises scattered layout patterns, urban construction has not been attention, the urbanization level is limited. According to related statistics, by 1983, the central region urbanization level is about 17.3%.

### **1.2 Transformation of Urbanization Development Stage (1983-1992)**

In 1984, the state introduced a new household registration management system, allowing farmers to migrant business, adjusting the township establishment standards, and making a rapid increase in the number of cities and towns. But institutionally, the household contract responsibility system does not promote rural urbanization town, the pace of urbanization development is slow.

### **1.3 The Acceleration of Urbanization Development Stage (1992-2004)**

Beginning from the 1990s, the central China's vast rural areas have risen a rural industrialization and urbanization wave, a large number of construction and rapid development of township enterprises has greatly facilitated the process of industrialization and urbanization. Urbanization rate increased rapidly to over 30%.

## **1.4 Rapid Urbanization Development Stage (2004-2007 Currently)**

In 2004, experts proposed strategy of central China, in the 2009 it official became a national strategy, at this stage, the central region gained a new opportunities for development, the central provinces has built urban agglomerations, urban zone to undertake coastal industrial transformation, and promoted urbanization institutional innovation, most of the central region urbanization rate in 2012 have been nearly 50%, Hubei Province has reached 53.5%.

## **2. THE DEVELOPMENT OF CENTRAL CHINA NOWADAYS**

### **2.1 The Large Rural Population, Relatively Weak Economic Foundation**

According to the statistics department information displays, the total population of the six central provinces is 361 million, accounting for 28 percent of the country population, which accounts for nearly one-third of the rural population. From the vertical comparison, although the central region has developed rapidly since reform and opening up, there is still a significant gap on the total economy, level of development, pace of development ,urbanization process, changes in the structure and other aspects comparing to the overall level or national average level, particularly to the eastern coastal areas. Data shows that in 20 years from 1980 to 2003 , the eastern region in the proportion of the total national economy, increased from 58.86% to 50.2%, especially after the 1990s, surged 7 percent. The position of the central region in the country showed a declining trend. Reflected on the level of per capita GDP, per capita GDP in the central region in 1980 is equivalent to 88% of the national average, in 1990 dropped to 83%, and merely equivalent to the only 75% of national average by 2003. GDP difference between the central region and the eastern region expanded more than six times. 1990 income of urban residents in Hunan, Hubei, Jiangxi, Henan, Anhui five major grain-producing provinces, is 2.07 times the income of the rural population, this figure is only to 2002 then expanded to 2.82 times ,the pressure of local farmers to earn rich, social conflicts caused by the widening gap has become a heavy burden of central China.

*Table 1*

ALL PREVIOUS CENSUS PERMANENT POPULATION IN EASTERN, CENTRAL AND WESTERN REGIONS AND GDP ACCOUNTED FOR THE PROPORTION OF CHANGE IN THE COUNTRY

Category	Year	1982	1990	2000	2010
The resident population(per)	The eastern region	41.2	41.4	41.7	44.1
	The central region	28.4	28.0	28.3	26.8
	In the western region	30.5	30.0	30.0	29.7
The proportion of GDP(per)	The eastern region	52.6	54.1	59.4	59.5
	The central region	22.5	21.8	20.4	19.7
	In the western region	24.9	24.1	20.2	20.8

## **2.2 The Traditional Industry Shrink, Outflow of Production Factors**

Obviously, from the perspective of national policy, central China was in the "collapse" situation in the eastern and western great opening "cracks". During the "Eleventh Five-Year"(2006-2010), the status of the central region in the national development pattern of the decline into the rise, "V" shaped reversal of the trend has been formed, it was also said that the development process of China's central region is continuous marginalization of the development process, namely in economic activities ,the importance of the role of regional development decline, the decline in the state, and its essence is a steady outflow of factors which led to the lagging of economic development.

Traditional industries shrink. Central region has always been China's major heavy manufacturing base and agricultural base, due to the reform and opening up, China's economy gradually adjusts the industrial structure, and subjecting to the market adjustments, the light industry of eastern develops rapidly, however due to the aging equipment ,large investment, unobvious competitive advantage, the heavy manufacturing of the central region rapidly shrinking, and also makes the economic development of the central region lost industrial industry support. Meanwhile, the agricultural industry itself is low industry, coupled with its reforms, the persistence of agricultural and industrial scissors, the central agricultural industry is difficult to support the economic development.

**TABLE II**  
*THE SIX PROVINCES IN CENTRAL INDUSTRIAL STRUCTURE COMPARED WITH THE NATIONAL AVERAGE*

Category	In 1990	In 2000	In 2010
Anhui	40.5:40.5:19.0	241:42.7:33.2	14.0:52.1:33.9
Jiangxi	41.9:31.8:26.3	24.2:35.0:40.8	12.8:54.2:33.0
Henan	36.4:37.0:26.6	22.6:47.0:30.4	14.1:57.3:28.6
Shanxi	20.3:52.8:27.4	10.9:50.3:38.7	6.0:56.9:37.1
Hubei	36.6:39.6:23.8	15.5:49.7:34.9	13.5:48.6:37.9
Hunan	39.7:35.6:24.7	21.3:39.6:39.1	14.5:45.8:39.7
The average of the central region	36.6:38.9:24.5	20.2:44.6:35.2	13.0:52.4:34.6
The national average	27.1:41.6:31.3	15.9:50.9:33.2	10.1:46.8:43.1

After the development of the eastern region of China, the central region's human capital and resources quickly gather to the east, forming a hollow resources element development. In contrast, due to the space distance element, the cost of information search, deal, transportation etc is high, so that the more distant from the eastern the more difficult elements of the western region flows to the east, central faces more unfavorable elements loss situation than the central and it gradually intensified. According to 2010 data, regional labor and factors of production moved the most concentrated into the coastal and Tibet, Xinjiang, Yunnan, and move out of places focus on the northeastern and central regions. In addition, the policy is also an important factor in economic development, from the view of national macro-regional economic development strategy, China's imbalanced development strategy achieves the opening up and development of coastal -western development- revitalization of the northeast old industrial base, and finally the implementation strategy of central China, timing, there is a certain marginalized on the policy of the central region.

### **2.3 Urban Cluster Effect Is Obvious, Megacities, Two-Way Development of Small Towns**

According to the general characteristics of the city, in recent years, the central region has been initially formed in Wuhan city circle, urban agglomeration, Xiangtan city group, Wanjiang City circle, Poyang Lake City Group and Taiyuan City Circle six urban agglomerations oriented development pattern, the tendency of industry and population gathering to towns is obvious, the leading role of the regional center of the city increases, the phenomenon of urban agglomeration in the geographical space is obvious, links between the towns continues to strengthen. However, there are also the dominant position of outstanding medium-sized cities, the lack

of national significance megacities problems of urban municipal districts according to population, the current central region has eight mega-cities, 21 cities, 44 medium-sized cities and 16 small cities, in which the proportion of medium-sized cities up to 50%, the dominant position of the whole medium-sized cities are more prominent. But at the same time, on the one hand, Wuhan makes efforts to build central city in China, but in fact the central region has not yet to form a central city of national significance, the city has not been enough to lead the development of an entire central region, play a regional economic development The "leading" role; on the other hand, most of the town township scale less than 5,000 people, small towns are generally weak, showing a scattered (scattered geographical distribution), small (small scale), weak (economic strength and infrastructure Horizontal weak), the difference (the difference between adsorption) characteristics, can not achieve a "transit station" and "reservoir" effect, can not form a reasonable space hierarchical structure, urban-rural gap significantly.

### **3. THE CENTRAL REGION URBANIZATION PROBLEMS**

#### **3.1 The Development of Urbanization And Industrialization Is Not Coordinated, Sustainable Development of Towns' Carrying Capacity Is Not Strong**

From the horizontal comparison of recent statistics, the county urbanization in central region since 2000 have nearly ten years of slow development speed, which belongs to the slow urbanization area, behind of the high-speed development of the second industry, the level of urbanization cannot provide sufficient human security for accelerated industrialization. The development of County town is the focus of the new urbanization development, the central region below the county level urban most of the population of the towns below counties accounted for 30% of the province, the role of the "transition zone" and "reservoir" played not enough. The echelon structure, is not conducive to the realization of the distribution of the large-scale industry gathering areas, but is easy to form the industry gathered "depressions formed a few big city benefit" at few cities.

At the same time, the presence of the economic structure in urban—rural areas hampers the equal exchange of production factors and products between urban and rural areas, restricts the non-agricultural industries and cities to absorb rural surplus labor, accounts for the decline of agricultural

comparative labor productivity, and the slow development of the rural economy has weakened the ability of coordinate development between industrialization and urbanization. At the same time, along with the process of urbanization in Central China to speed up, some resources and environmental problems continue to emerge, the urban sustainable development is facing the pressure of resources and environment. Relatively rapid urbanization and extensive development pattern has aggravated the supply and demand contradiction of resources such as water and land energy resources, the towns that ecological environment has been severely damaged, is facing serious sustainable development challenges.

TABLE III  
2010 CENTRAL AND NATIONAL GDP AND EMPLOYMENT

Regionl	Primary industry proportion	The second industry proportion	The proportion of the tertiary industry
The central region	13.0	52.4	34.6
The national	9.3	50.4	40.4
The central region	40.7	27.5	31.7
The national	36.7	28.7	34.6

### 3.2 Obvious Contradiction Between The Development of Small And Medium Towns

Currently, the counties of the central region have prominent urbanization problems widespread including the lack of gathering capacity of central cities, the low level equilibrium of inner counties, the weakness of most towns, the small number of the labor-intensive industries, the lack of absorbing labor capacity,the low level of modern service industry, difficulties to fully absorb the population in the local employment, the low average value of Economic Development Zone and the outstanding issues of extensive mode of development ,ect.

**TABLE IV**  
**2009 PARTS OF PROVINCE TOWN SCALE (EXCLUDING THE COUNTY)**

Provinces	Township average population (ten thousand people)	The average area of town(h m <sup>2</sup> )	Per square kilometer to accommodate people (people)	Township size less than 10000 people(per)	
Anhui	0.74	290	2552	78.9	
Jiangxi	0.46	241	1587	16.2	
Henan	0.87	349	2986	71.9	
Shanxi	0.66	263	2269	84.4	
The central region	Hubei	1.02	370	3515	62.6
	Hunan	0.43	132	1468	96.0
	Average six provinces in central	0.69	274	2396	68.4
	Shandong	1.59	436	5489	48.9
	Jiangsu	1.13	547	3897	68.4
The eastern region	Zhejiang	1.89	672	6501	66.7
	The eastern provinces on average	1.54	552	5296	61.3

Take Suizhou city , which is the typical region of Hubei province as an example,its non-agricultural rate in 2010 was19.06%,and the rate of zengdu area 、Guangshui city and county Sui were34.90%,18.22% and 7.46%.The urbanization development pattern of weak-strong-weak from north to south,plains being strong while mountains being weak has a strong coupling with the ecological pattern of moutains,forests at north while plains and farmlands at middle region.



Fig. 2 Draws three division of urbanization in Suizhou

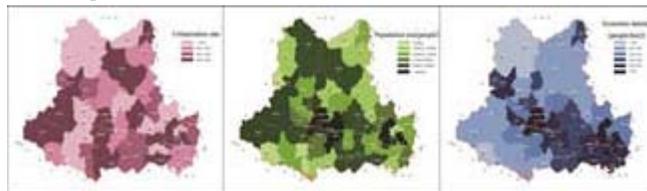


Fig. 3 Suizhou urbanization analysis diagram

### 3.3 The Serious Problem of Outflow of Population And The Obviously Remote Urbanization Phenomenon

Since the majority of provinces's industries in central region emphasis on the heavy style and heavy chemical for a long time, the majority of which belongs to the non labor intensive industry, along with the technological transformation efforts increasing, the labor productivity gradually improving, the current situation of employment ability weak has been formed. The development of labor-intensive industries ,taking the high-tech industry as the representative is relatively insufficient ,and the advantages of processing industry of agricultural products is not enough, large employment population outflows, causes the formation of rural urbanization, which is also incompletely urbanization.

**TABLE V**  
*IN 2000 AND 2010, THE POPULATION OF PERMANENT RESIDENTS IN EASTERN, CENTRAL AND WESTERN REGIONS CHANGE (TEN THOUSAND)*

Region	The 2000 census data	The 2010 census data	2000—2010 Increase the number of population	2000—2010 The growth rate(per)
The eastern region	53622	59595	5973	11.1
The central region	35147	35673	5261	1.5
In the western region	37459	38010	551	1.5

Although a considerable portion of migrant workers were included in the urban population, but have restricted employment by housing, social security and education for children in many aspects and concerns about the future of uncertainty, it is difficult to quickly improve their income level, and their consumption ability is restrained. At the same time, the differences of social security between urban and rural areas which depends on the household registration system such as education, medical insurance and others has seriously restricted the thoroughness of the rural labor force transfer to the city, resulting in the flow of rural labor like migratory birds, go round and begin again, so that the growing population into the edge of the urban people. Accompanied by a large number of migrant workers and migrant workers, obviously will also bring a series of social problems, the more prominent is the left behind elderly and left-behind children problem.

**TABLE VI**  
*SIX PROVINCES IN CENTRAL 2010 POPULATION (TEN THOUSAND PEOPLE)*

Region	The registered population	The population of permanent residents	A net outflow of population	A net outflow of population census register population(per)
Hubei	6176	5724	452	7.3
Hunan	7090	6568	521	7.4

Anhui	6827	5950	877	12.8
Henan	10663	9042	1261	11.8
Shanxi	3463	3571	-108	-
Jiangxi	4633	4457	177	3.8
The central region in total	38852	35673	3179	8.2

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#### **4. THE KEY FIELDS OF THE NEW URBANIZATION DEPTH INTERPRETATION OF THE CENTRAL REGION**

##### **4.1 Geographical Area That Matches The Pattern of Urbanization**

In research of urban space layout, differencing from the global urbanization, continuous urbanization pattern son relatively open, flat rivers impact plains of eastern coast region, the complex topography characteristic of central plains region, mountains decided nodes plains on urbanization and urbanization clustering features is more obvious, in this pattern, the influence of urban space and spatial development of urbanization is more significant. In the urbanization process, urban space expansion issue that involves two important evaluation aspects, that are the hierarchical structure of urban space and urban space expansion of the central city. Among them, to the central region, the major contradiction is big cities not being big, medium-sized cities not being strong, small cities being low-level equilibrium in the hierarchical structure of urban space. The most important thing is the rapid development of urbanization not only brings the rapid increase of urban population and urban population, and let the urban construction land expansion sharply as well. However, the rapid growth of urban land in the short term is not reflected in the economical use of urban land intensive, but is a disorderly, large-scale expansion, some extent, has been out of control. Therefore, there is significant practical significance to research the spatial organization、land use and other "space" elements of central region urbanization.

## 4.2 The Dynamic Mechanism of Urbanization Which Adapt To The Diversified Development Phases

According to the development experience of the world urbanization and the "urbanization curve" put forward by American cities scholar Northam (Ray.M.Northam), the current urbanization rate of moderately developed countries and regions, basically reached 85 percent, many urban areas at the east coast of our country are also close to the urbanization of moderately developed countries, while to the central region, the current level of urbanization in most regions is at the early stages (table 3-19),and is in an important period of accelerated across, in accordance with reasonable the policy ,for some time, the central region urbanization level will rise from about 50% to 70%, from quantitative to qualitative change, basically realize the process of urbanization. Obviously, the focus of the regional urbanization development in our country in the future must be in the Midwest.

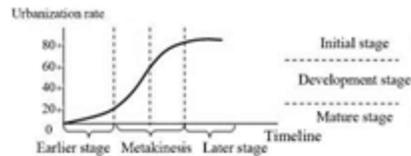


Fig. 4 The Northam curve of urbanization development

TABLE VII  
IN CENTRAL PROVINCE URBANIZATION LEVEL CHANGE (1982-2010)

Region	1982	1990	2000	2010	Twice census during urbanization growth		
					1982—1990	1990—2000	2000-2010
Shanxi	21.3	30.1	35.1	48.0	8.8	5.0	13.0
	0%	0%	0%	0%			
Anhui	14.5	19.6	28.0	43.0	5.1	8.4	15.1
	0%	0%	0%	0%			
Jiangxi	19.6	23.2	27.8	44.1	3.5	4.6	16.3
	0%	0%	0%	0%			
Henan	14.3	17.8	23.3	38.8	3.5	5.5	15.5
	0%	0%	0%	0%			

Hubei	17.8	29.4	40.5	49.7	11.6	11.1	9.2
	0%	0%	0%	0%			
Hunan	14.7	20.7	29.9	43.3	6.0	9.2	13.4
	0%	0%	0%	0%			
The nationa l	20.3	26.7	36.2	49.7	6.1	9.5	13.8
	6%	0%	0%	0%			

From a research perspective we believe that the completion of this historic process, mainly determined by three factors, namely, the existing scientific urbanization, the future development of continuous power and the bearing capacity of the ecological environment. Focus to solve the problems that must be faced in next stage, such as where the dominant driving force of the development of the urbanization is, how to organize the power form reasonable, how much potential the urbanization development has, and how to coordinate urbanization development and natural ecological environment. These, all need to evaluate the dynamic factors of urbanization, also happens to be currently measure and measure elements in weak areas of concern.

### **4.3 Urbanization Leading Organizational Unit Which Combined With Regional Towns Rating Scale**

For the problem of big cities in central China being not strong and two-way shortage problems of small towns' weakness, it is obvious that there is need to find a reasonable "leverage" and "joint axis", this problem, and the country urbanization process are homogeneous. The new requirements from the point of view of urbanization, hoping to focus on the town and the county as an important carrier. This has both political and economic reasons, and also has scientific basis.

Economically, the country's population, land and resources are mainly concentrated in the county administrative divisions, but due to various reasons, for a long time, the degree of the development of county economy in China and possession of resources, population, are unmatched. Relevant information shows, about 65 percent of the country's population, 90 percent of the land, and a lot of forest, mineral resources are concentrated in the county administrative divisions, but the creation of the county's GDP accounted for only 51% of the country, fiscal revenue accounted for four one points. For the central region, counties in the total economy is not strong, at the same time the problem of unbalanced

economic structure is more out-standing, as for the industrial pattern, in the most areas of the central region, county economy is dominated by agriculture, secondary and tertiary industries are not developed, resulting in many areas the county finance more difficult, cannot effectively promote the urbanization process, obviously, the county has become the significant and difficult point of promoting the new urbanization.

From an academic aspect, the premise of the construction of new urbanization is to significantly improve productivity in rural areas, and enhancing rural productivity depends on the scale economies that rural land circulation products, the best idea to solve is to give full play to the role of the county unit, make key towns to be development priorities, Enhance the key towns' industrial absorptive capacity and the level of public services, and in situ urbanization, these can speed up the transfer of rural land, effectively enhance the productivity and income of farmers in rural areas, thus successfully promoting urbanization.

## **5. CONCLUSION**

From the urban development pattern, the way in dealing with the relationship between urban and rural areas, the scale of the urban structure, the urban space layout, the implementation mechanisms and other aspects summary, in the past for a long time, the central region is on an urbanization way where urbanization is behind industrialization, development of big cities is strictly limited, in favor of urban on the relationship between urban and rural areas and spatial distribution of urban scale structure is basically proper, launched and promoted by the government, market and civil forces are ignored and urban construction and management is lag. On the motivation and implementation mechanism of urbanization, the core idea is transferring from arranged by the government, promoted on purpose to guided by government promoted by market, pay attention to the role of the civil power. From a development perspective, the next period of time, the expansion of urban space spread obviously can not meet the needs of the situation, in the process of urbanization and the form of urbanization pattern choice, the realization of the city's network, looking for the best urban scale, the implementation of the rural "in situ urbanization" and the urbanization balanced state of optimizing of industrial space, promoting of the industrial upgrading is the development direction in the process of urbanization of the central region, and it has an important role in promoting healthy urbanization, effective development. The key point of urban development and urban planning will transfer from physical space to social space, from functional space to social space, and from economic production service from individual life service, becoming a balanced urbanization pattern which is dominated by coordinating urban and rural spatial structure,

continues to promote low carbon development, promote social improvement, improve quality of life.

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NO.97

## The Effective Utilization as Parks of Abandoned Railway Sites in Korea

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**Key words:** Regeneration, Abandoned Railway Sites, Industrial Heritage, Parks

**Abstract:** The purpose of this paper is to examine the utilization and characteristics of Korea's abandoned railway sites that lost their traffic functions due to the development of automobile traffic. The history of railway in Korea has started in 1899 under the Japanese colonial rule when the Gyeongin line between Noryangjin and Chemulpo opened 33.2km long. And then The railways, such as Gyeongbu Line, Gyeongui Line, Gunsan Line and Honam Line were constructed continuously. Since a five-year plan for economic development began in 1960's, railways played a significant role as a center for transporting human resources and goods. However, after the Seoul-Incheon highway in 1968 and Gyeongbu Expressway in 1970 were opened to traffic, the leadership of terrestrial transportation transferred from railway to road. Railway industry entered a period of recession and got mired in deficit. For normalization of railway business, the government enacted the Railway Industry Development Act and tried to pump-priming policies for several times. However, they were to hit the limit.

An abandoned railway means abolished routes which are no longer running in the whole or some parts of routes. An abandoned railway site means the a physical space existed for the operation of the abandoned railway. Abandoned railway sites are caused by the aging, moving curved lines, declining sales, changing policies, and establishing new routes. In addition, abandoned railways sites are occurred, because of accidents, submergence, political issues, and diplomatic situations, such as division of Korean peninsula. Interests for the utilization of abandoned railway sites are rising today, because these types of a site have unlimited possibilities. Characteristics of utilizing abandoned railway sites in Korea can be summarized as follows:

First, abandoned railway sites within the city area is an important ways of securing green spaces. Due to industrialization and urbanization, a city green decreased, and this situation brings about significant economic, socio-cultural, and environmental problems. With increasing the interests in environmental issues today, there is a growing desire for creating green spaces. A renewable green space using abandoned railway sites can be a good solution for this desire. Abandoned railway sites of a city by composed with

this desire are designed to change rail, bridges, tunnels to walking trails and parks.

Second, in the cases of non-urban areas, they tend to utilize railway stations and additional facilities changing into commercial and cultural spaces by taking advantages of beautiful natural sceneries. They are utilized as tourist attractions changing its characteristics as a theme park to adopt experiential elements, such as locomotives, rail bikes which cannot be experienced in a city. This type of utilization draws attentions to the rural areas, and takes advantages of potentialities of abandoned railway sites as industrial heritage.



NO.104

## Smart Mobility Society and Cities – Health, Inclusion and Assisted Living: Analysis and challenges

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**Key words:** Smart mobility, society, cities, health, challenges

**Abstract:** Application The world's population is aging, while it is getting sicker at the same time. By 2050, the number of people in the 60+ category will reach 2 billion, while half of the developed world is projected to become chronically ill. A recent study revealed that local hospitals and access to healthcare facilities were cited among the most important features for city inhabitants, [ while ICT plays an instrumental role in bringing unique responses to these needs. Many existing and potential technologies under development for the maintenance and/or supervision of health and wellbeing offer a great promise, ranging from health monitoring services and falls detection to "lifestyle monitoring" (detecting changes in behavior patterns). Within this realm, research in ICT platforms for elderly and people with chronic diseases test ideas of generic health monitoring platforms, addressing people with chronic conditions, and assistive mobile devices, among others. Smart Cities need to incorporate these aspects into their overall structure and roadmap. Current trends in personal health systems, enabled by the advances in ICT, biomedical engineering, healthcare technologies, and micro- and nano-technologies, can greatly contribute to the need for better health care and wellbeing solutions. Personal health systems offer pervasive solutions for health status monitoring, through vital signs measurements performed by bio-sensors, which will be exploited for the prevention and/or early diagnosis of harmful situations. Furthermore, efforts to support independent living encompasses social and medical assistance in the home or at an institution, in the form of face-to-face contact or assistance via tele-care services, in the shape of assistive technologies, personal monitoring, etc. Inclusion is concerned with minimizing all barriers to learning and participation, whoever experiences them and wherever they are located in Smart Cities. Applications include: improving quality of life of users with digital content, taking multilingualism and cultural diversity into account; ensuring seamless access to ICT-based services, and establishing appropriate framework conditions for the rapid, appropriate, and effective convergence of digital communications and services; monitoring Smart Cities, through data collection and analysis of the development, availability, and use of digital communications services. Furthermore, the needs of people with physical impairments have also to be

taken into account, and the way ICT will be used in Smart Cities must consider these needs. Increased use of ICT among elderly people, the technologies used to be elderly friendly, and encourage elderly people to use the services, are also among the needs in this area. The main problems ageing people are facing when living independently are reduced physical abilities and isolation. Ageing well is also about independent life, and continued active and satisfying participation in social life and work. Independent living is the ability for elderly people to manage their life style in their preferred environment, maintaining a high degree of independence and autonomy, enhancing their mobility and quality of life, improving their access to age-friendly ICT, and personalized, social integrated, and health care services. A social problem is the creation of an economically sustainable model for the assistance of elderly people, and for their physical and psychological independence and wellbeing. Local ecosystems that accelerate social innovation: the activation of a tracking network in a local area generates a sort of “augmented neighborhood”, in which the traditional channels of social interactions are backed up by virtual channels of communications supported by the new services; on this ground, new groups, new forms of association and new local events can be created. In this context, the provision of healthcare services using immediate applicable innovative ICT is seen to be one of the elements helping the containment of healthcare delivery costs, while maintaining the expected levels of quality of care and safety. The impact on Smart Cities is undisputable. The challenges can be summarized into three different categories: Social, Market and Business, and Technical. The grand social challenges include: social communication, access to public and private services, healthcare assistance, policy and ethics, and safety of people living independently; use of ICT as the basis for increasing elderly people’s socialization opportunities; informal help exchange or a local exchange trade system. Market and business opportunities address: a revolutionary value chain to show relations within the ecosystem; new business opportunities, also for private companies and service providers; a Go to Market plan, which has to include product distribution chain/channel; economic and financial aspects, such as the pricing strategy, product life cycle, public demo together with a launch venue, beta customers, early field trail, and attracting venture capital for scaling-up.

## **1. INTRODUCTION**

The global trend of aging gradually raises the senior service into a critical issue world widely. Senior service is a complicated, dynamic, systematic social problem, significantly subject to population growth, socio-economic institution, economy, regional infrastructure, culture and value, and service management. The senior service system is composed of a large number of autonomous stakeholders (service supplier, elderly persons, policy maker, etc.) who play fundamental role within the system, and interact with each other in a dynamic urban environment.

The sixth census, conducted in 2010, demonstrated that the population above 60 years old had reached 178 million, accounting for 13.3% of the total population. It was predicted that by 2030, the figure will double (CPC

Central Committee and State Council, 2011). Due to the reduced fertility rate and increasing life expectancies over the last few decades, China is experiencing rapid demographic change. Since aging overlays with the industrialization, urbanization, and social-economic transformation (Peng, 2011), elderly service issue in China is more typical, has to face more challenges, such as aging before getting rich, huge population of disabled senior, old elderly and “empty-nest” seniors, traditional role of families decreasing. At present, the most acute and fundamental contradiction of senior service is structural imbalance between the demand and provision.

To resolve this problem, three of the most important factors to be adequately addressed are demographic transitions, senior’s diversification, and policy reform. One-child policy has played a key role in this demographic transition, and greatly reduced the number of children available to support ageing parents. The deep hesitation whether to enter the facility which is departs from tradition, or to rely on the care of single-child, who is extremely busy and stressful, is very common feeling of urban seniors. After the policy of reform and opening up, social-economic differentiation (e.g., income, hukou status) has emerged significantly in China. It makes a big difference in terms of senior service demand between elderly people with different characteristics. The utility levels of senior care services remarkably varied, for the senior’s social-economic diversification. The health care reform, social security system reform, and household registration system are conducted recently and a series of policy related to senior service will be formulated in future. All of the policies will have important implications for the viability of future senior service strategies.

Most of the existing study on senior service need is multi-disciplinary, because it is difficult to clarify this problem with investigation and analysis method of one single discipline. According to the behavioral model in gerontology and sociology, three sets of variables can account for difference in health service use among elderly. These are predisposing variables (e.g. age, sex, and education), enabling variables (e.g. family income, finance ability of elderly and their accessibility to service) and need variables (e.g. symptoms of health and illness, functional health problem, and perceived need for health care) (Andersen, 1995). From sociology and psychology, the health belief model focuses on the role of individual’s perceptions in seeking the health services, not on the role of demographic and social conditions (Hooyman & Kiyak, 1988). It suggests that senior’s belief about health problem, perceived benefits of action and barriers to action and the self-efficacy trigger the health service utilization (Janz & Marshall, 1984). The P-E fit model, conducted by the environmental gerontologists, was presented that the integration of elder persons with their physical and social environments hugely impact the health service demand ( Lawton & Simon, 1968; Longino, Perzynski, & Stoller, 2002; Rowles & Bernard, 2013). Studies on public health, present that China has experienced an

epidemiologic transition in the leading causes of death, from infectious disease and acute illness to chronic disease and degenerative illness (Gong et al., 2012). The changes lead to an ageing society with the changing health and disease patterns, and the different health service expenditure form (Levit et al., 2003).

To address the issues of mismatch between demand and supply of elderly care service, abundant research shows the importance of different factors, such as the various statuses and life courses of elder people, the relationship between elderly and urban living environment, the facility's attributes (e.g. location, care service), and the policy effect (Barnes, 2002; Gao, 2013; Gao, Yan, & Ji, 2012; Golant, 1979; Moos & Lemke, 1979; Shapiro & Tate, 1985; Yan & Gao, 2014). Nevertheless, the statistic method, social approach, and traditional spatial analysis, are too macroscopic, aggregate, and static to solve this problem. They are disadvantaged to respond to the elder individuals' behaviors and the individual facility's operation in the diversifying society, and to understand the concrete challenges in this comprehensive, systematic, and integrated problem.

Multi-Agent System (MAS) has remarkable advantage to simulate the complex, dynamic system from microscope (e.g., simulate the urban land use, and urban transportation changes ), by modeling the interacting, autonomous 'agents' in a dynamic environment (Batty, 2011; Ligtenberg et al., 2004; Shen et al., 2011; Suryanarayanan, Theodoropoulos, & Lees, 2013). Agents have behaviors, often described by simple rules, and have interactions with other agents, which in turn influence their behaviors and the whole system (Macal, & North, 2010). In urban development simulation, the most important topics are the selection of agents, definition of behavior rules, expression of interactions between agents, extraction and import of environment variables (Chen & Gao, 2013). Not all the numerous stakeholders should be considered as the agents. The confirmation of the agent's behavior is prior knowledge-based and impacted by the research target, involving an interdisciplinary study, in which need to coordinate the theoretical conflict. The circular interaction within the agents is simultaneous, difficult to model. And the interface of environment contains the urban social, economic, nature environment, culture and policies variables which are the essential input of the simulation and needs to be quantified.

Therefore, we use MAS to construct the ECSS (elderly caring service supply) model to reasonably address provision of elderly care services dynamically, and to expand the application of MAS to model the urban complex system.

Based on the gerontology, sociology, urban geography, etc., we select the essential agents, (e.g., the elderly, facility), confirm the agent's evolution laws and the behavior rules, design the agent behavior modules. According to the interaction between various agents, we integrate the agents' behavior,

frame out the affecting mechanism of different agents' modules, simulate the urban elderly care services demand-supply system in micro scale and find out the macro evolution law. Consequently, based on the forecasting outcomes of micro behaviors of elder individuals and facilities, we can conclude the macro laws in the whole demand-supply system of elderly care services. According to this, we can provide the intellectual support more reasonably and predictably, to the planning and provision of elderly care service. Moreover, in the complicated environment, the microscopic simulation and scenario analysis will bring a brand new perspective to the regional and urban planning, and significantly influence in the distribution and allocation planning of infrastructures, public service facilities.

## **2. FRAMEWORK AND AGENT-BASED SIMULATION**

### **2.1 General Framework of the Simulation**

The ECSS Model aims at developing, testing, and applying a new type of integrated urban old people services supply model, simulates the interaction between elderly and environment (Figure 1) in a whole system, under the rapid aging and urbanization process.

Firstly, the characteristic of elder people in the urban region will be defined, such as age, healthy status, income, education, and etc. Then, creates their demands for spatial interaction, such as shopping, leisure travel, activity participation, receiving care, etc. Meanwhile, several elderly need more care for the declining health and loss of independence. These daily activity or specific treatment/health care of old people occurs in the different areas with different level of the accessibility, service convenience, and that will trigger their reaction (e.g. their morale, mood, well-being, of life satisfaction) consequently. Secondly, adjustment of living arrangement as a deliberate behavior of senior, significantly influence the senior care services demand further. Then, urban senior services system will provide the services accordingly, and improve the elderly life quality. In the whole process, there is a remarkable need to consider the different dimensions of environment such as personal space, buildings, neighbourhoods, facility, and etc. Their locational and physical attributes should be taken into account in the interaction between the physical environment and the elder population.

And there are two most important feedbacks in this systemic model: 1) subjective feedback. Based on the existing senior service and urban living environment, elderly will conduct the evaluation of the wellbeing which will influences their future decisions of living arrangement; 2) objective feedback. The allocation of elderly care services facility will impact urban

living arrangement mode of urban senior in turn. Meanwhile, the provision of urban senior service system would be restricted by the government policy significantly.

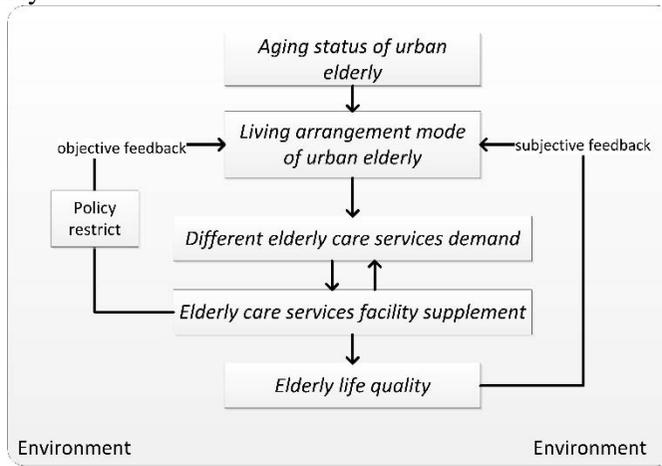


Fig. 1 ECSS model framework

This theoretical framework recognizes the elderly diversity, complexity of senior service system and the uncertainty of developing background. It can be used for predicting the growth of elderly population and the demand of senior services in future, and assessing to which extent these urban environment can effectively meet the needs of elder people for senior services, evaluating the efficiency and impact of potentially social senior services system policies.

## 2.2 Selection of Agent and Module Relationship

According to the multi-agent system, we firstly select the essential agents, and then confirm their behavior rules, and the interactions between agents, agents and environments through various simulation modules.

The ECSS Model is microscopic, including 3 types of agents, 1) elderly agent, 2) residential aged care facility agent, 3) day care center agent. As to elderly agent, which is the kernel agent of this simulation, all healthy, economic status and social support changes, life course, living arrangement mode, elderly care choosing will be modeled by multi-agent based simulation. For residential aged care facility agent and day care center agent, the profit or non-profit, location, capacity for visitors, content of services, and business cycle can be simulated by individual facility. The interactions between elderly care service demand (e.g. home-based services, community-based services and care service from aged care facility) and facility supply (e.g. residential aged care facility, day care center, hospitals) are modeled at the level of individuals. Within simulation environment,

urban policies like senior service facilities plan will be inputted to the simulation environment. Meanwhile, urban governor will be simulated to manage, restrict, and supervise the provision of elderly service system, and also select the urban development strategy, regulate the urban environment construction (e.g., hospital, leisure space, transport facility, etc.). While, the urban aging process, urbanization, and other developing macro background of this model is essential factors to the simulation, impacting the behavior of different related agents, should be represented and inputted as well.

According to characteristics of different types of agents, the elementary behavior and decision-making process are encoded to basic computer programmers unit as different running modules. The ECSS Model is consist of 9 modules, e.g. 5 modules conducted by elderly agent (i.e., life cycle module, care pattern shift module, living arrangement and care pattern choice module, relocation module and facility choice module) , and 4 modules execute by day-care center, residential aged care facility(RACF ) agents ( i.e., day-care center business cycle module, day-care center's location module, RACF business cycle module, RACF's location module).

The simulation modules of ECSS Model interact in various ways with each other. Interactions between the modules and agents-environment are operated by a coordinating program. Figure 2 show that the main interactions which is complicated and enormous, and would be even larger if also indirect impacts were taken into account. Among the relationships of modules and agents-environment, there are three types of influences. 1) The impacts from the same agent are demonstrated by arrow with dotted line (e.g., elderly agent's life cycle module will influence care pattern shift module). 2) The effects from different agents or the interaction of agents-environment are shown by arrow with solid black line (e.g., urban environment will affect the elderly location module). And 3), the interactions between several modules from different agents are indicated by double-direction arrow (e.g., the relationship between the RACF location module and the facility choice module).

Existing research models and empirical findings are the foundation of simulation modules which performs essential mechanisms of agent's behavior rule and their interrelationships with agents or environments. Therefore, we will introduce the related studies and findings.

### **3. BEHAVIOR RULES OF THE ELDERLY**

#### **3.1 Elderly Lifecycle Module**

Aging is the essential issue in the life course study among gerontology, and sociology. The life course relies on the life trajectory, important life

events, and role /status transition (Riley, Johnson, & Foner, 1972). Elder (1975) found that the historical times and places where they experience over their lifetime, embedded and shaped the life course of individuals. The life events generally refer to schooling, marriage or divorce, retirement, death of a spouse, and etc (Li, Deng, & Xiao, 1999). The role/status change of elderly mainly include the biological, social, psychological aspects, such as the transition of sensory function, cognitive abilities, lifestyles, social contribution, intergenerational relationships, values, and well-being ( Hooyman & Kiyak, 1988; Moen, Dempster-McClain, & Williams, 1992; Riley,1987).

According to the study by Morgan and Kunkel (2011), we conclude the different dimension of life course, including the elderly life course especially (Table. 1). In short, age related life course events in later life include children leaving home, retirement, death of a spouse, declines in health, and reductions in income which will significantly impact the later life of individual.

Table.1 various dimensions of life course

Age	... 20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Life course	...	Young adult	adult	Middle age		Later maturity		Old age	
Job/ retirement	...	Job experiment	Job advancement		Retiremen t planning	Retireme nt occur	retirement		
household	...	Marriage/parents	parents		spouses		Widowhood?		
Intergenerati on relationship	...	Kids under 6	Kid 6-12	Kids 12-18	Empty nest		Depend on child?		
					Adult-adult				

According to the age, elderly can be parted to pre-elderly (55 – 64 years old), young-elderly(65 – 75 years old), middle-elderly(75 – 85 years old ), and old-elderly(85+ years old) (Atchley, 2000; Bures, 1997; Longino, Perzynski, & Stoller, 2002). Carr and Komp (2011) proposes a new idea to the conception of life course, present the third age of elderly which is described as the period in the life course that occurs after retirement but prior to the onset of disability, revealing a period in which individuals have the capacity to remain actively engaged. And the third age ends when the fourth age- characterized by declining health and loss of independence-begins. The phases of third age emphasize the role of health status to life course, and is response to the concept in gerontology---productive aging which focus on senior’s productive participation (e.g., engaged in work, care giving of grandchildren, caring for sick friends, and educational training) (Morgan, & Kunkel, 2011).

Although, the transition of life cycle influence the decision making process of elder individual, elder people are planful within their particular limitations (Clausen, 1993; Elder, 1975). Therefore, as a rational person with independent consciousness, the living arrangement, health care, social care,

and facility select of later life already have considered within elderly decision-making scopes, and abide by the principle of maximum utility of elderly within their current life course (Wu, & Jiang, 2006).

### **3.2 Care Pattern Shift Module**

From the life course modules of elderly, we examine the different life course within the physical, psychological and social aging process. Living environment, including physical environment, social environment and senior care service, is closely linked with senior's life. Then how does the urban environment impact elderly citizen in different life course, and influence senior's life? It is the essential task in this module.

Elder people are more sensitive to the environmental impact than young people (Hooymann and Kiyak, 1988). Golant (1979) argued the elder person's geographic experience in their neighbourhood involves a complex of action, orientation, feeling, and fantasy that together provide a holistic expression of the individual's adjustment (such as move to an institution, locomotion within the proximate environment, and movement to the occasional long-distance vacation trip), within their physical and psychological capabilities and unique life history. Lawton (1982) developed a predictive model for the behaviour of senior citizens, based on the relationship between senior and their living environment. After the Lawton's ecological theory, the relationship between of elderly and environment has been studied further. Evans (2009) provided a research on social well-being of the elderly people living in "housing with care" (e.g., retirement villages and extra care housing). The sense of community is critically important for elder people's quality of life. The factors include social networks, inclusive activities, diversity and the built environment. Phillips et al. (2005) categorized these dwelling conditions as interior environment (e.g. indoor lighting, crowdedness, temperature, security devices, lift/escalator, etc.) and exterior environment (e.g. lighting in public spaces, green areas/parks, recreational or sitting & rest areas, passages, flyover/subways, air pollution in estate/community, etc.), and demonstrated the greater impact of the interior environment on residential satisfaction than the exterior environment. Yan and Gao (2014) revealed that in different neighbourhoods (e.g. the Traditional courtyard housing block, Low-income rental housing neighbourhood, Commodity Apartment neighbourhood, etc.), residential environments play a significantly different role in the aging process of diversifying seniors who is aging in place in China.

Therefore, based on the fitness of the elderly person with environment, and the well-being or satisfaction of elderly, we can predict the adjustment or behavior of the seniors, e.g., the changing of living arrangement. The elderly care pattern changing-desire module is just the process to assess the

relationship between elderly and their living environment, and the probability of some behaviors.

### 3.3 Living Arrangement and Care Pattern Choice Module

The relationship between elderly and their environment are influencing their mental status (e.g. depression), quality of life, and individual behavior. The adjustment of living arrangement and residential location can be view as a critical manifestation of the ways in which elder people have adjusted to the social, behavioral, environmental factors.

Generally, the living arrangement includes independent living (live alone or with spouse), co-residence (living with at least one child or other kin), and living in an institution. It has many implications for the current well-being of an elderly person, and is a dynamic decision which should be responsive to changes in individual circumstances and to changing expectations about the future (Phillips et al., 2005). Functional losses and low life quality, like Alzheimer’s disease, require an increase in informal/formal care services and more supportive dwelling environment. Therefore, it is at a higher probability of the movement into a skilled nursing facility (Kaplan, & Andersen, 2013). Different value, cultural specificity, and assimilation of elder people are the essential factors to the decision making of living arrangement also. The foreign-born elderly Asian in Canada/America were usually under the auspices of family reunification, the percentage living with family instead of living alone or with a nonrelatives is highest, and the socioeconomic correlates with this patterns( Boyd, 1991; Kamo, & Zhou, 1994; Phua, Kaufman, & Park, 2001). Although, in China, the traditional preference of elderly is to live with their children, but recently, under the influence of acculturation, economic feasibility, and demographic availability, there is an increasing preference among elderly to live independent or entrance an institution (Gao, & Yan, 2012).

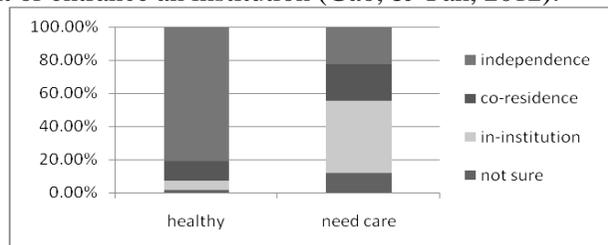


Fig. 3 Chinese elderly’s living arrangement based on Beijing survey (Gao, & Yan, 2012)

Living arrangement choice of elderly is associated with their functional losses and the changes in the level of care and received assistance (Dostie & Liger, 2005). Based on the current living arrangement, as the physical

energy, mobility, and health status changing, elderly need more services, including ADL(activities of daily living) care, IADL(instrumental activities of daily living) ) care. These services belong to different care patterns which are supplied by various care providers (See Table2).

Table 2. Relationships between living arrangement, and urban long-term care system

Living arrangement	Care pattern	Care provider	long-term care (ADL care, IADL care)			
			Emergency/ acute treatment	technical recovery health care	recovery health care(non-technical)	Supportive real-time health care
<b>In-institution</b>	Residential care	Hospital	Δ			
		Residential care facility		Δ	Δ	Δ
<b>Co-residence / independence</b>	Community care / In home care	Community-based facility /Day care center				Δ
		At-Home Care Company		Δ	Δ	Δ
		Community elderly center				Δ
		Relatives/ Friends: Informal care service				Δ

Policy concern over elderly living arrangements arises from the large effect of living arrangement choices on elderly care and welfare, especially for those suffering from physical limitations or health problems. This concern may be especially cogent in rapidly developing countries, such as those in China, where the percentage of elderly living independently (alone or with their spouse) has increased substantially. However, public senior social services remain relatively defect (e.g., most of elderly living in public nursing home is health urban retiree, rather than disabled old-elderly; the care places is at great shortage.). Some studies on this has been already conducted, for example, Dostie and Liger (2005) suggested that policies may be more effective at reducing institutionalization if, among elderly living independently, policies are targeted at married females with fewer children and at encouraging seniors to return to community care or in home care if, among those who are living in a nursing home.

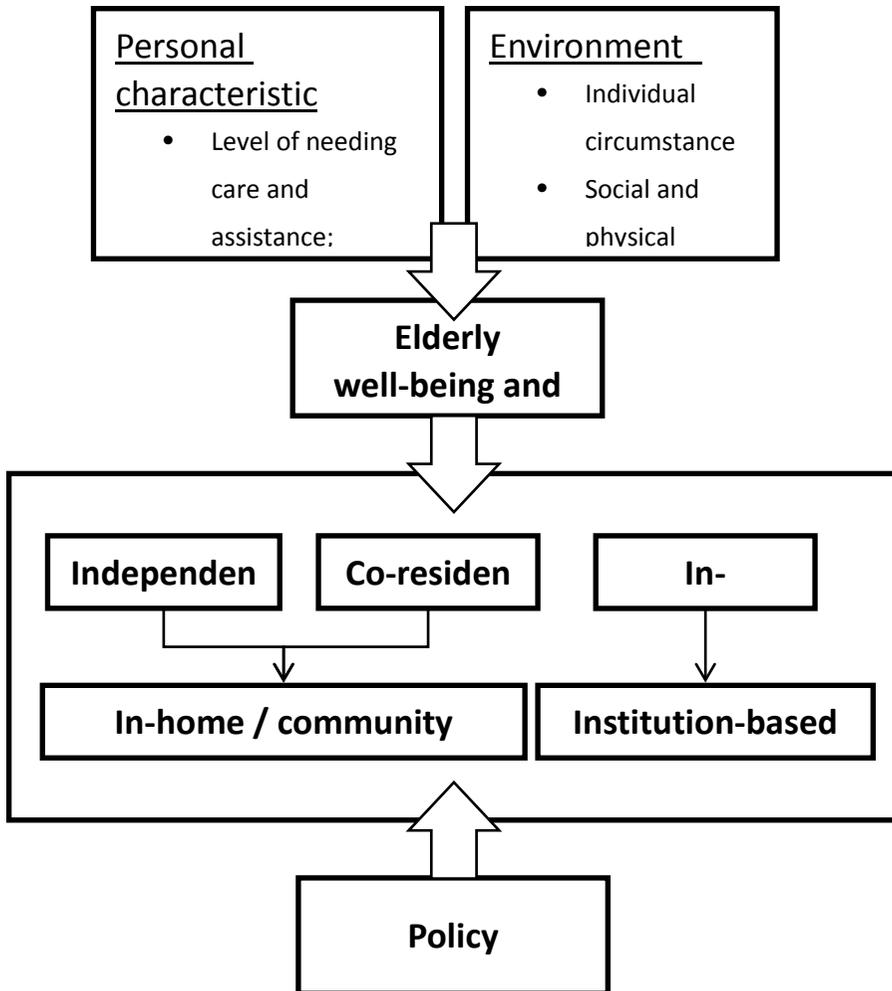


Fig. 4 Elderly living arrangement and care pattern selection

Consequently, we design the elderly living arrangement and care pattern select module to clarify the relationships between individual elderly, the living circumstance, and related policy. And this module will run to illustrate, to what extent, that the relationship and concerning policy will impact the well-being or expectation of elderly and induce them to choose a certain kind of living arrangement and the corresponding senior care (Fig. 4).

### 3.4 Residential Moving of the Elderly

Because of limited mobility, frailty or other physical/mental health problems, many elderly require the long-term care, including in-home care, community-based care, and institution-based care, and the more supportive

living environment (See Tab. 2). Therefore, according to the different demands of physical/social environment and senior service, great many of elderly choose to relocate.

Borup (1983) identified four types of relocation of elderly: Type 1) inter-institutional (e.g., from hospitals to nursing facility, continuing care retirement community); Type 2) residential (move from one residence to another); Type 3) residential or institutional (such as from home to a residential aged care facility) and Type 4) intra-institutional (e.g., just inside the facility). Wiseman and Roseman (1979) identified local mover including 6 types: suburbanization, inner city relocation, apartmentalization, communalization, homes of kin, institutionalization. The simulation of senior's migration is complicated, refers a long-term decision, impacted by several factors, especially, the life course of elderly, and the benefit of alternatives. Based on the study of different relocation by Borup (1983) and Wiseman et al. (1979), we suggest that when a senior decides to move, the alternative places are just other local community (e.g. near-by community and relatives' home), residential care facility.

### **3.4.1 Relocation Module**

Majority of elder people prefer to age in their home or relatives' home. The aim of this module is to simulate the senior's migration to other communities. Because elder people are usually long-term in-home residents, how senior's physical/social environment (e.g., out space, transportation, dwelling condition, social participation, social inclusion and etc. ) and daily social services (e.g. the service provided by senior center, meal delivery service, information and referral service, home care and health care, protective service, etc.) are provided within the communities is extremely important.

The classic migration decision models (e.g., push-pull model, stress-threshold model, spatial equilibrium model, human capital/cost-benefit models, behavioral model, location-specific amenities model, etc.), tend to clarify the complicated process of decision making (Gregory et al., 2009; Northcott & Petruik, 2011). Wiseman (1980) involved "push" (e.g., physical decline or death of a spouse, and environmental press) and "pull" (e.g., the therapeutic landscape in a community, relocated relatives) factors, which were defined as "triggering mechanisms" impacted by senior's indigenous factors (e.g., personal attributes, neighbourhood ties) and exogenous factors (e.g., cost of care and housing). In spatial equilibrium model and cost-benefit model, elderly migrate through seeking housing location with a maximizing utility (Rudzitis, 1979) or the largest benefit-least cost. The behavior model emphasizes the individual's belief, attitude, perception, which will influence

the evaluation of their dwelling and neighborhood. Their ability (such as the social-economic stratification, health status, and housing status) to obtain access to health and social welfare services promote the migration (Golant, 1979; Fokkema, & Van Wissen, 1997). De Jong, (1999) argue that the decision making should based on the balance of five parts: demographic factors, social networks, values and expectations, residential satisfactions, behavior restrict, and then have the migration intentions. The location-specific approach argued that relocation is as a result of change in demand for location-specific amenities, which can only be satisfied by moving to elderly desirable site or place (Rudzitis, 1979).

Some studies presented that besides aging in place, seniors prefer to age “near” place by moving, for example, to other nearby communities, moves within the same city/town/village (Northcott & Petruik, 2010). Focusing on the different attracting of suburb and central city, most preferred destinations of several elder movers were the suburbs, followed by nonmetropolitan area, and center city was a distant third (Golant, 1979). However, several elderly were attracted by the central city, because the convenience of public transportation and easy access to a wide range of urban facility addressed to the need of elderly, and the availability of smaller sized, less expensive rental accommodations and relatively low cost of traffic, more attractive social situation for high density of elder people (Golant, 1979).

In other studies, the proximity of elder people to relatives (Cai, 2012; Fokkema & Van Wissen, 1997; Longino, Perzynski, & Stoller, 2002; Warnes, 1993), and the therapeutic landscapes in living environment are specifically emphasized (Andrews, & Phillips, 2005). Cuba (1991) found that individuals may repeatedly spend their vacations at the locations that eventually become their retirement places.

According to review of research on elderly relocation, the most important process in this module is how the individual senior will find the location with the maximizing utility, by comprehensively considering other factors, such as the various attributes of senior, the advantage of alternative location, the impact of relatives, and etc. And the comparison between original location and new location, or to what extent, there is the improvement from the new location, is essential factor for the decision of relocation also.

### **3.4.2 RACF Choice Module**

When elderly become disabled, they usually need to make an environmental modification to preserve their independence (Litwak & Longino, 1987; Longino et al., 1991). Although aging in place is the preferred pattern always, it is too hard to deal with daily activity for the disabled elderly, for the narrow doorways, stairs, etc. Or, they have to use the meal delivery and nursing care in home, while it is expensive actually. And

not all stayers among elderly are voluntary aging in place, some may prefer to move, but without resources, and be viewed as “blocked movers” (Moore & Rosenberg, 1997).

Therefore, this module focus on the elderly who decide to migrate to a RACF (residential aged care facility), simulate which or what kind of facility will be selected, such as nursing home, continuing care retirement communities. Because of the different life history, the family structure, income, education, hukou ( in China), social-economic and cultural diversity are the essential features of the seniors, and will influence significantly on the perceiving, evaluation, preference and selection of RACF (Shapiro & Tate,1985).

Firstly, according to the service contents, location, business size (large or small), profit or non-profit, type (public, voluntary, private) of RACF, residential care, such as the assisted living, nursing home, or the continuing care retirement, are discrete category. It makes the individual selection of RACF is not simple choice.

Cheng et al. (2012) analyze the accessibility of seniors to residential care facility. They suggested that geographical access, information access, economic access, socio-cultural access, and the socio-managerial environment, are the primary factors influence elder people and their family members' decision-making process of RACF choice. The study on the preference of urban elderly for caring facilities conducted by Gao (2013) pointed out that about 40% of the old people preferred public facilities, and 70% preferred facilities of which the monthly expenditure is no more than 2000 RMB in Beijing, China. As Barnes (2002) suggested, there are two types of assessment tools can be applied to assist elderly to select the preferred facility. The first type is the multiphasic environmental assessment procedure (MEAP), which focuses on physical and architectural features of physical facility (e.g., community accessibility, physical amenities, social and recreational services, and safety), staff characteristics, the social environment (Barnes, 2002; Moos & Lemke, 1979); the second type is the assessment tool specifically for dementia care setting, such as, the professional environmental assessment protocol (PEAP), therapeutic environment screening survey( TESS-NH)(Barnes, 2002). Focusing on MEAP, Sheffield Care Environment Assessment Matrix(SCEAM) was provided, it emphasize several architectural elements, such as the location, outsidess space, building form, bathrooms and toilets, private rooms, and etc.( Parker et al., 2004).

And there are other conceptions remarkably related with RACF, focusing by environmental gerontologist, which are “place”, “home”, “being at home”. It is presented as the quite important factors for the selection of RACF. Places are more than environmental context to be modified when elderly become frail, are holistic, dynamic, and meaningful entities with histories and evolutionary trajectories with which they have the intimate

relationships and on which they depend. Therefore, in assisted living environments, the relationship between the new RACF and home is highlighted and called as “connectedness” (Cutchin, 2013; O’Shea, & Walsh, 2013).

Therefore, the precondition of elderly relocation to a RACF is the match between elderly preference and the specific facility. And the selection of RACF is related with the service levels, staffs, and the physical environment of facilities (e.g., the natural landscapes, building design, and amenities), and influenced by the health status, social-economic attributes of seniors. On the base of abundant suggestion from the existing study, this module will emphasize the elderly preference firstly, and then will use one MEAP to simulate the RACF selection decision making process.

#### **4. BEHAVIOR OF FACILITY AGENTS**

The living environment refers to the physical/social environment and senior services, and it includes two kinds of particularly essential facilities (i.e. the day care center and RACF) which closely related to their health care services. Therefore, we select day care center and RACF as the agent in this simulation. They will be simulated through four modules (i.e., day care center business cycle module, day care center location module, RACF business cycle module, RACF location module). Given space limitations of this paper, we take the RACF as an example, to introduce the simulation of the business cycle and location of RACF.

##### **4.1 RACF’s Business Cycle Module**

The business of RACF refers to the provision of services and the revenues generated by the provision of services to aiming customers. Meanwhile, there is the cost of business, such as the payment for materials, labor, and equipment. Therefore, based on the profit, the business will remain or bankrupt. But, not-for-profit RACF will be different, and depends on whether the revenue from government or through donation covers its expenses. This module will simulate the business cycle of RACF (see fig. 5), which will influence the system of urban senior services provision.

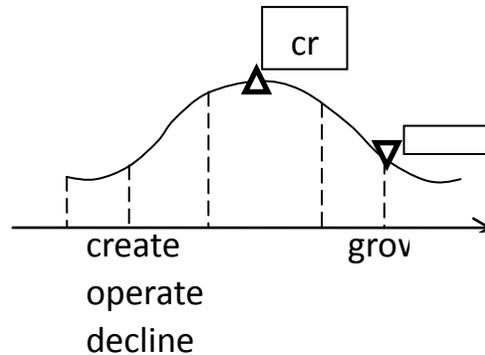


Fig. 5 The business cycle of RACF

In most countries, there are some acts, codes, standards on senior service implemented by local authorities. In British, “Home Life: a code of practice for residential care” (UK Centre for Policy on Ageing, 1984), was the first code of practice which concentrated on care standard, residents’ rights, privacy and financial affairs, facility administration, physical features and staffing. Then, the policy (e.g., “A Better Home Life: a code of good practice for residential and nursing home care” (UK Centre for Policy on Ageing, 1996), “Fit for the Future? National Required Standards for Residential and Nursing Homes for Older People”, (UK Department of Health, 1999), mainly focused on health and personal care, daily life and social activities, accessibility, evaluation of care and cost, complaints procedures and protection, environmental standards, staffing requirements and standard, and management and administration standards (Andrews, & Phillips, 2005). Therefore, policies for protecting the older residents significantly emphasize the regulation of quality, accessibility, and cost of care.

Research on the business of RACF following the legislation of above documents indicated that some RACFs have recently had to close due to their inability to meet the new standards (Andrews, & Phillips, 2005). Many private facilities will have to reduce capacity and may face financial difficulties to meet the new standards. It presented that the poor prior financial and quality performance increases the risk of failure, but larger size is protective, decreasing the likelihood of performance failure (Andrews, & Phillips, 2005).

The business cycle of RACF related to the places demand of elderly. For example, in Beijing, policies on the development of social senior services suggests the social senior services system is characterized as “9064”, which indicates that 90 % of old people will rely on in-home care, 6% on community care, 4 % on residential care by 2015 (Beijing Municipal Bureau of Civil Affairs, 2008). It means the demand for the place of RACF will be up to 140-160 thousands, by 2015. In Australia, there is an aim to maintain a national target level (i.e. 113 places per 1000persons aged 70 years and over)

and to meet the needs and preferences of care recipients. In the allocation of places under the policy of aged care, the places applicant are required to make them operational within 2years, otherwise the place lapse or the applicant need to apply for an extension (Australian Institute of Health and Welfare, 2012; Department of Health and Ageing, Australian Government, 2006). Therefore, in macro-region, the places allocation approach was well-practiced through the older population projection and the allocating processes controlled by some policies.

Therefore, the important factors within the business operation of RACF include the health care, places, cost, and accessibility of RACF. And the policy influence on RACF will be emphasized in this module. The main simulation process should include the two parts, such as service position, business size increase/decrease, and finally decide to create new facility or bankrupt the RACF.

## **4.2 RACF's Location Module**

This module is conducted to simulate how the RACF agents choose a location, and which factors are essential indicator for the decision of RACF. These will influence seniors' availability of RACF's places, and selection of RACF.

The location of RACF is impacted by several factors. Public or private facilities have distinct distribution. Early research identified that historical influences and the varying policies of local government are primary factors for the spatial variation of public facility provision (Andrews, & Phillips, 2005). The existing studies on private RACF suggest that funding changes, management decision, and local planning influence the location of private RACF(Phillips and Vincent, 1988). Demographic and social-economic differentiations across areas influence the distribution of residential aged care facility. The concentration and affluence of local aged population are reliable predictors of location of both public and private RACF. According to the interview conducted by urban planner in Shenzhen, China, the anticipant distribution of RACF is significantly related to green space, medical service, suburb, residential land (see fig. 6) (Shenzhen Urban Planning and Land Resources Committee, 2013).

Location of RACF involved the urban land use planning. Code for Planning of City and Town Facilities for Aged, in China, specifies the basic principal of location. RACF should be adjacent to area with high density of elderly, hospital, and park, and located in natural and sunny environment. The land should be flat and well-ventilated. The infrastructure and transportation should be convenient, and keep away from the highway, heavy traffic intersection, pollution sources, and dangerous goods (Ministry of

Housing and Urban-Rural Development of the People’s Republic of China, 2007).

Location process of the RACF is relevant to the senior services planning, which confirm the target level of RACF places (e.g., 4 places per 100 persons in Beijing ) to ensure an adequate supply of care places and to achieve equitable access to services between center city, suburb and rural areas. Then according to the number of places planned to provide in different regions, government or private investors make the decisions to operate the RACF and choose the location of the RACF. The land from three aspects, the land of bankrupted RACF, the land that can transit its original land use (e.g., industry land, commercial land, infrastructure land, and etc.), and the new land, which allocate according to the principal of RACF land location, such as Code for planning city and town facilities for the aged, in China. (See fig. 7).

## 5. ENVIRONMENTS AND THEIR INTERACTION WITH THE AGENTS

As mentioned above, living environment is linked significantly with seniors’ life. The concepts of WHO’s Age-friendly city indicate the detailed knowledge on environment of age-friendliness (WHO, 2007). It is suggested that age-friendly city was defined as eight parts which overlap and interact each other (See Fig. 8).

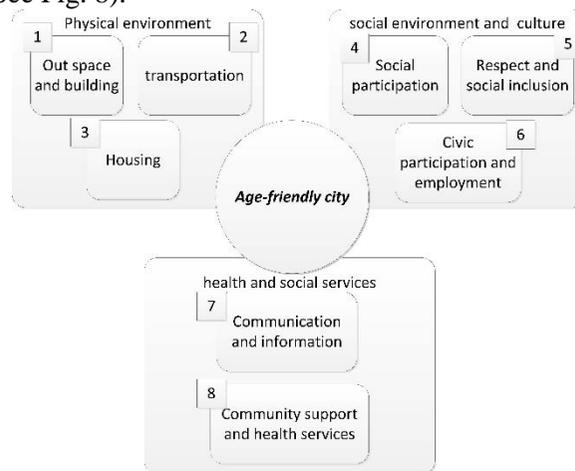


Fig. 8 Age-friendly city framework of WHO

Outdoor spaces and buildings, transportation, and housing are key features of a city’s physical environment. Social environment affect the mental wellbeing of seniors. The health and social services is offered for promoting, maintaining and restoring health (WHO, 2007). Therefore, living environment plays a fundamental role in the daily lives of the elderly,

especially for senior who is ageing in place. Many social geographers, urban planners and architects make the further studies on some specific enabling environments, such as barrier-free environments, parks, and recreational settings, for the elderly (Carp & Christensen, 1986; Kaplan, 1985; Phillips et al., 2005; Rosenberg, 1998). In addition, different types of neighbourhoods are characterized by location, environmental quality, access to services and facilities, and residential density. And seniors living in different neighbourhoods have significant difference in socio-economic attributes and behaviors (Wu, 1992; Cai, 2010; Knox, & Pinch, 2000). They will have discriminated assessments on different dimensions of senior's living environment (Cunningham, & Michael, 2004; State Advisory Council on Aging, 2007). Therefore, the enabling environment in different neighbourhood should be diverse.

In this simulation, the input of environment should primarily include physical environment, social environment, health services, and the urban distribution of different types of neighbourhoods. According to the environment parameters (e.g., the number of bus stations, size of outdoor space), and the agent evaluation indicators (e.g., older person's accessibility, satisfaction), we build the interactions between agents and environments. The statistic report of these factors provides a method to support the elaborate and systematic allocation of infrastructure or facility, and the urban planning for age-friendly city. The urban policy is an essential environment as well. It includes the direct policy, such as the social senior service policy and indirect policy, such as social security system policy, and household registration policy. We will select the critical contents of policies, and translate them into the parameter which is important in the rules of agents, or the interaction between agents or agents and environments.

## **6. INTEGRATED SIMULATION AND DISCUSSION**

The ECSS model includes three simulation parts: 1) several simulation modules, 2) the section of the database and data input, and 3) the definition of output reports. The simulation modules are related to elderly population, urban environment, and external factors. The integration of the micro simulation modules of ECSS model is shown in Figure 9. Through inputting the data of individual elderly, day-care center, RACF, and other environmental facilities in simulation modules, changes and transitions of different agents are processed according to their behavior rules as what this paper introduced above.

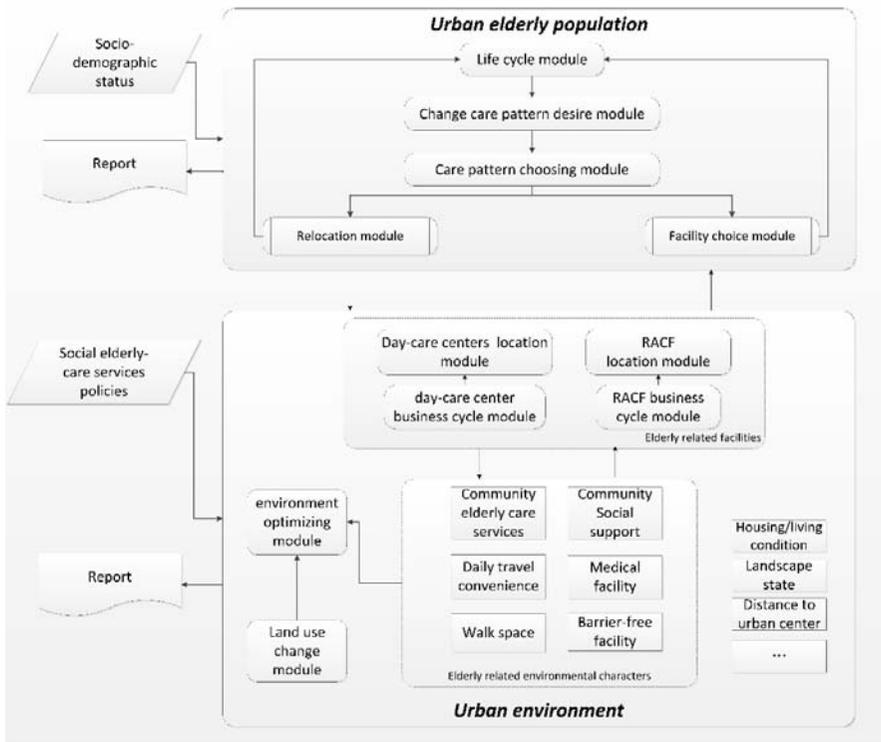


Fig. 9. Urban elderly population and environment change processes and micro simulation modules

With the Agent-based modeling (ABM) approach, there are several platforms can be used to integrate the agents, modules, and interactions, and simulate the complicated processes. The platforms now widely used are MASON, NetLogo, Repast, and the Java and Objective-C versions of Swarm. And NetLogo is the highest-level platform of them, providing a simple but powerful programming language, with built-in graphical interfaces, and comprehensive documentation.

The expected results include two parts, i.e., the prediction of senior service and the improvement of senior service provision. As to prediction, the behavior of elderly within their life cycle courses, the living environment evaluation, the probability of living arrangement change and the relocation decision-makings are imported into the corresponding modules in each simulation cycle. Consequently, aged population and service need will be forecasted. Based on this, RACF and their places are provided, and the adjustments of the aged-friendly environment in different space are conducted. Then, these changes will impact on the business cycle of facility and the whole social care system which will be regulated by government further. Therefore, focusing on the individual behavior, micro space and the

dynamic change of agents, the prediction accuracy of our study will be better than prior researches.

In view of the uncertainty of various policies, we design the different policy-scenarios, which are completely different from the traditional approach---SAP (survey-analyze-plan). Therefore, we will simulate the social senior services provision accordingly, and find the suitable provision plan in long-term.

This study is one of the first studies that design a simulation framework to model the demand-supply of senior services with MAS. The findings will be a great support to the provision of elderly services facility and the environmental improvement in urban living neighbourhoods. The reasonable provision of aged service will be extremely important to the rapidly ageing society and the developing country for the reason of the limited capitals and resources. And the study approach (e.g. simulation, scenario analysis) is prominently useful to the urban planning. This study has, however, its limitations in term of the selection of agent. Actually, relatives or child of elderly play important role in the senior life, even though the impacts reduce gradually. However, we didn't program child as agent, because of the data availability. On account of cross-disciplinary studies, the diversity of urban policy, and complicated external environment, the rules and interaction of agents, and the quantitative set of the external impacting factors are difficult to be considered comprehensively, and that maybe the source of errors. In the future, these points should be further studied by us or other researcher.

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## Century-old Taipei City Planning and Multicultural Symbolic imagery Change

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**Key words:** Taipei City, multi-cultural, symbolic imagery, Visual images

**Abstract:** With a unique strategic location, Taiwan develops multi-cultural characteristics; particularly, to view from the political and economic-based history of Taipei City, it experienced western culture, Confucian culture, Japanese culture, local awareness coupled with fast forward of modern urban life, so that its symbolic imagery lies in the accumulation of historical memory, and Taiwan-specific human touch that multiple properties can be seen in Taipei city with unique impression. This thesis focuses on the understanding of the century-old city and its symbolic, with main discussion on four parts in the century-change Taipei City: 1. Urban planning shape and change: Taipei in the Qing Dynasty had overall planning of urban scale, and had initial size of modern city during the period of Japanese occupation, and after the recovery of Taiwan, it also immediately had a new change planning or expansion; 2. Century-old schools and architectural monuments: Taipei has century-schools, for example, National Taiwan University and National Taipei University of Technology, and also retains many period of architectural monuments; 3. Urban cultural landscape: With the times, Taiwan has unique multi-cultures, which also show in the urban-style visual forms; 4. Multicultural Style: Such characteristics as Taiwan unique human touch, or the fantastic life between the alleys, and the night market activities. The research method of this thesis is based on contemporary American urban planning master Kevin Lynch's "users' feelings and experiences" as the starting point of view, and integrates public psychology, iconography and related theoretical semiotics, to compare and analyze the basic elements, and principles with a series of conception. In this paper, the importance of inspiration, An urban style represents the facade of a country. In a globalized world, we may be moving for activities in different spaces, and the visual images of urban style is the most direct experience people can feel. For example, in Taipei City, for the process of shaping urban form, compare whether image elements and symbolic significance transform with changing times. The study found, for the process of shaping urban form, looking around the visual elements of whole urban landscape, whether government agencies,

architecture of schools, or the overall planning of streets, public facilities, and transportation, the electoral system for its urban style usually is decided by the symbolic significance on aesthetics and cognition of those in power, or construction-related experts. Although the general population is basically unable to intervene, what the residents who live in the metropolitan area, whose eyes reached is everywhere of the urban space, in which taste will be also incorporated. Accordingly, the connotations of a city lie in constant intersection and integration of cultural history; an urban landscape lies in retention and renewal of each period's style. Viewing from multi-cultures, the symbolic imagery of century-old Taipei City can allow us to better remember with visualization the magnificent impression of Taipei city.

## **1. PREFACE**

Since 1884, Taipei has been founded for more than a century. As time goes by, the symbolized meanings of direction, aesthetic, and conception of urban planning was determined by different rulers, including those in the Qing Dynasty, Japan, the National Government, or related architectural experts. Generally, citizens could not interfere with or participate in the urban planning. However, what citizens, who lived in the urban communities, saw was every spot in the city, so they would include their taste in the urban planning. In history, visual impressions or human cultures and scenery in Taipei, having undergone western culture, Confucian culture, Japanese culture, native consciousness, and the modern progress, feature a variety of cultures.

In terms of time and space, Taipei City is the core of political and economic activities in Taiwan, regardless of transfer of power. It is the earliest city where urban planning was promulgated in Taiwan, with the oldest construction and largest scale. Although the urban planning in Taipei has multiple characteristics, there are too many topics to be selected from literatures. As a result, the study focused on the "ruling government agencies" in order to link "urban landscape, visual imagery, and multi-culture". Taking Taipei City for example, the author read many literatures on Taipei, summarized the history and cultures of the city, and further concluded with four dimensions: form of planning, centurial buildings, change urban landscape, and multiple cultures. Regarding the process of establishment of urban form, the study aimed to analyze whether styles of imagery and symbolized meanings have changed as time goes by.

## **2. LITERATURE REVIEW**

To understand the past and current status of a city, the study explored the perspective and how to understand the structure and content of the entire city and further form a complete picture and symbol. Taking Taipei City for

example, the study selected appropriate concepts and literatures. 1. Regarding the theory of the process of establishment of urban planning and urban form, the study focused on processes and strategies of modern urban planning in the backdrop of globalization, urban historical sites and social and culture descriptions, and urban symbols and images (Kevin Lynch,1960). 2. Regarding the exploration of important literatures on Taipei City, the study emphasized the ruler, urban development and scale, landscape and human scenery. In terms of time and space in history, since Taiwan has undergone transfer of power for three times, the politics and ideology are two elements that have influenced the urban planning in Taipei most (Lu ,Fang-sang ., Wu-Dar Huang et al. 2000). In the Japanese Colonial Period, a foundation of becoming modern city was set up in Taipei City with relatively complete urban planning (Wu-Dar Huang, 2009). Based on oral history from seniors of urban planning, the study understood more the general picture of urban planning in Taipei City after the war. In addition (Academia Sinica, 2000), the official literature, including the chapter of city, autonomy, and organizations in the society in Taipei Journal (Taipei City Archives Committee '1988), and various records, journals, books and digital archive of ancient maps, images, relics, and the public cultures have been compiled by the government, scholars, and the general public. Many literatures are well archived.



Figure 3. Course of evolution in Taipei City

Note. Drawing and finishing: Chang, Han-Yun

### 3. RESEARCH METHOD

The study focused on the “ruling government agencies” in order to link “urban landscape, visual imagery, and multi-culture”, and further concluded with four dimensions: form of planning, centurial buildings, change of urban landscape, and multiple cultures.

Historical literatures were the main sources for the study. Since Han people extremely emphasized the tradition of historiography, the historical records were compiled in details, which were good sources and strengths for the researcher. Relatively, due to mass and complicated data, it was hard to

extract essence in the aspects of summary and analysis because terms used under the backdrop of time and space and nowadays differed significantly, such as name of location, personal narrative, and perspective of historiography. The author should explore the difference between the past and the present carefully and discourse in the present perspective. As a result, after reading many literatures on Taipei and summarizing the history and cultures of the city, and the author described the whole story and sources concisely and focused on the change of urban imagery.

Moreover, observation and records were important references in the process of research. The study carried out interviews with citizens in Taipei to explore more deeply into the “users’ feelings and experiences”. The related case study also benefited the analysis of topics. In terms of theory, the study adopted five spatial elements (Path, Edge, District, Node, and Landmark) and three elements of environmental imagery (Feature, Structure, and Meaning) from “*The Image of the City*” proposed by Professor Kevin Lynch, carried out the conclusion and analysis from the perspective of “users’ feelings and experiences”, and integrated folk psychology, iconology, and semiology to analyze and compare fundamental elements and principles based on series of concepts.

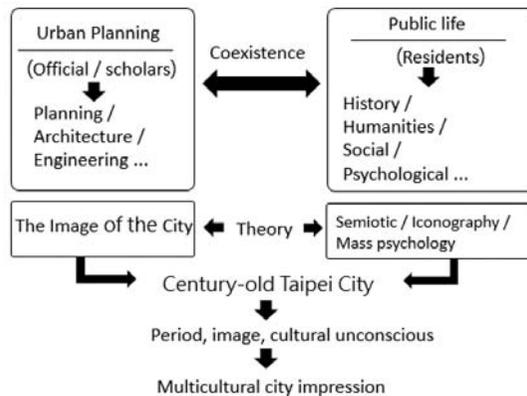
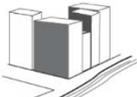


Figure 2 The process of design of research method

Table 2. city image into five elements

Five elements	Symbol	Image	Illustrate
PATH			Path movement
EDGE			The boundary of the two parts

Five elements	Symbol	Image	Illustrate
DISTRICT			Block area
NODE			Moving in intersection
LANDMARK			Recognizable elements

*Note.* From *The Image of the City*, by Kevin Lynch(1960) .  
 Drawing and finishing: Chang, Han-Yun

*Table 2. Integration of analysis of urban imagery*

Topic Title				
Brief introduction				
Environmental images	Feature	Structure	Meaning	Description
five elements				
PATH				
EDGE				
DISTRICT				
NODE				
LANDMARK				

*Note.* From *The Image of the City*, by Kevin Lynch (1960).  
 Finishing: Chang, Han-Yun

#### **4. GOVERNMENT AGENCY: ANALYSIS OF CHANGES OF URBAN PLANNING AND URBAN IMAGERY IN TAIPEI CITY**

The development in Taipei area can be traced back to Uncharted Waters in the 17<sup>th</sup> century. Due the trade and colonial interests, Spanish and Dutch successively built western castles in North Taiwan as the trade center. Later, Han people Zheng Chenggong recovered Taiwan. In 1682, Taiwan was included as part of China in the Qing Dynasty. In 1875, the agency “Taipei City Government” was founded and later Taipei City was officially founded in 1884. The following indicated changes of urban planning in Taipei from

the historical perspective and the analysis of imagery elements in five periods.

#### **4.1 1884-1895: Establishment of Taipei City in the Qing Dynasty**

In this period, three main streets in Taipei were: Monga, Tataocheng, and Chengnei. Monga and Tataocheng were where marketplaces located. Since the port in Tamsui opened in 1860, Monga and Tataocheng became the important harbor villages and distribution centers due to convenient traffic and increase of trade. In North Taiwan, the development of tea, camphor, and coal industry brought more prosperous business activities than South Taiwan. Founded in 1884, Taipei City became the official city and the core of politics. It took two years and ten months to complete the stone pavements. Five gates were located at peripherals, and one square and complete city was located inside, also known as Chengnei, where administrative agencies, military, and culture activities and education concentrated. Since then, the core of politics officially moved from Tainan to Taipei, and Taipei became the capital of Taiwan. The most iconic feature of main urban planning in Chengnei was the Chinese traditional architectural based on Feng Shui, a traditional architectural concept in China. In addition to important government agencies, new roads, street lights, hygiene, water, and important institutions, including post offices, telegram offices, and banks, were built. Although Taipei City was founded the latest with the smallest scale of public construction, it was the most modernized city in the Qing Dynasty. In 1895, Taiwan and Penghu were ceded to Japan, representing the end of the Qing Dynasty and start of the Japanese Colonial Period.

#### **4.2 1895-1945: Foundation of Modern City in the Japanese Colonial Period**

After WWI, Japan took all measures to deploy the ruling institutions and appease residents in order to rule Taiwan successfully. Upholding equal treatment, Japan actively constructed Taipei City and promulgated most of laws and urban planning for implementation; 1937, Sino-Japanese War began. Since Japan consumed hugely and needed materials and human power from Taiwan desperately, it began to actively eliminate Taiwanese citizens' national consciousness and changed their ideology by detaching them from original lifestyles and cultures of Han people. In terms of urban landscape, Japan advocated the comprehensive Japanese-style management and accelerated the industrialization and urban development in Taiwan. Regardless of active management, Japan held discriminative and racially

discriminative attitude of toward Taiwanese citizens in the aspect of treatment and education, for example. Japan dealt with things differently for Taiwanese citizens, which could be reflected from the business level, occupational structure, population distribution, and daily life.

The draft and development of urban planning in Taiwan featured the compliance with colonial policies in all fundamental construction. For Japan, the control of human power and natural resources were two approaches. At first, Japanese rulers did not have a specific urban plan for Taipei City. Due to threat of infectious diseases, the health engineering was in dire need of emergency, which opened the opportunity for transformation of Taipei City from the health perspective. The main purpose was to build a favorable environment for rule and bring economic benefits to the colonist.

In 1899, the first implementation of “district modification” program was limited to Japanese residential areas, including the improvement of old streets and implementation of new roads. In 1905, relatively complete urban planning was equipped. The estimated capacity of the city was 150,000 residents, including Chengnei, Monga, Tataocheng, and the scale of the city was doubled. In addition, all walls built in the Qing Dynasty were demolished. In 1932, the “Greater Taipei City Program” was promulgated with the estimated capacity of 600,000 residents and 9.5 times the scale of the original city. Due to continuous development with absence of systematic laws, the “Taiwan Urban Planning Law” was promulgated in 1936 for land redistricting. Although owners were not willing or able to follow the law, the Japanese ruler enforced it imperatively. Overall, during 50 years of colonial rule by Japan, most of urban landscapes built in the Qing Dynasty were destroyed and traditional road structures and architectural styles in Taiwan were removed and replaced with European buildings, which symbolized the dignity and modernization of the country. In contrast, Japanese rulers managed Taipei City through extremely strict urban planning and set up the foundation of modern city based on practical-based scientism.

### **4.3 1945: Establishment by National Government after WWII**

After the National Government moved to Taiwan after the war in 1945, Taipei City became a provincial city and the capital of Taiwan, the center of politics and economy, military and diplomacy, and culture and education. It was a large city with the population of 500,000. At that time, to stabilize the society and operate the economic activities well and to prevent the turmoil caused by transfer of power, the urban planning was modified based on the old one. In 1951, the “Regulation of Urban Land Reform in Taiwan” was promulgated, aiming to implement the average land ownership in order to reform land, set up the price, collect land administration tax, and buy private

land according to the price. In 1952, the urban planning law set up in the Japanese Colonial Period was revoked and replaced with the localized urban planning law. In 1963, the population in Taipei City exceeded one million, and Taipei City had a scale of international city. In 1965, as the economy in Taiwan was speeded up with growth of industrial construction and development of foreign trade, the urban development in Taipei City was continuously extended from the west the east and entered the next stage of reform

#### **4.4 1967-1990: The Reform of Municipal and Regional Expansion**

In 1967, Taipei City was upgraded to a municipal and had the local autonomy. In 1968, villages in the neighborhood were included in the Taipei area for the economic growth and social changes based on a new urban planning. The estimated capacity was 2,500,000 residents. During 1974-1979, the “Ten Major Construction Projects” led by Chiang Ching-kuo, Premier of Executive Yuan, were completed, which greatly influenced the economic indicator at that time. In addition to smooth development of trade, citizens from different regions gathered in Taipei to look for jobs. In 1980s, the development of “Xinyi District” was an important milestone in Taipei mainly because the Ximen business zone, government agencies and train stations could no longer respond to the fast growth of the city. The population became to move toward the east. Due to the connection of major roads among new and old districts, various activities tended to move to the east as well. To respond to the trend of development and to take advantage of vast space in the east, Taipei City Government set up a strategy for dual-core urban development and moved the City Hall to the current location on Shifu Road in Xinyi District in 1994 as the new center of municipal administration. The East District has become the important center of commerce and consumption in Great Taipei. In the aspect of landscape, taking architecture for example, typically the old buildings were built based on traditional styles. With the addition of the concept of urban design, the new urban planning presented changes on new buildings.

#### **4.5 After 1990s: The Century of Globalization and Spatial Liberation**

After 1990s, several major changes occurred in politics and economy and people’s livelihood in Taiwan. Due to fast economic growth and globalization, cross-strait openness and changes on surroundings, vast changes on landscapes occurred due to changes of urban lifestyles, streets

and time and space in history. Talents, foreign immigrants, and tourists from all places brought human and cultural changes to Taipei City and led to a variety of food cultures and shopping streets. It also meant that Taipei City has become an internationalized city. In terms of changes on landscapes in Taipei City, in 2000, the first transfer of power in political parties occurred in Taiwan, and the government promoted spatial liberation. For example, the Chiang Kai-shek Memorial Hall was renamed “People’s Square” and most of statues of Chiang Kai-shek were removed, which referred to the reform of symbols left from the Authoritarian era. In addition, the construction of Taipei 101 was completed in 2004. Since then, Taipei 101 has become the major landmark, a composite commercial building with a combination of financial business, shopping, gourmet, and tourism. It is the must-visit place for tourists, and the annual firework show always catches people’s attention around the world.

*Table 3. Integration of analysis of urban imagery*

Establishment of Taipei City in the Qing Dynasty				
Three main streets in Taipei were: Monga, Dadaocheng, and City. Founded in 1884, Taipei City became the official city and the core of politics. Five gates were located at peripherals, and one square and complete city was located inside, also known as City, where administrative agencies, military, and culture activities and education concentrated. The most iconic feature of main urban planning in was the Chinese traditional architectural based on Feng Shui, a traditional architectural concept in China. Although Taipei City was founded the latest with the smallest scale of public construction, it was the most modernized city in the Qing Dynasty.				
Environmental images	Feature	Structure	Meaning	Description
five elements				
PATH	Stone pavements	T-shape road	Main road	Traffic demand
EDGE	Walls, turrets	Red bricks	Protection, storage, rest	Red walls
DISTRICT	City	Square	Official city	Taipei City
NODE	Shopping streets	Three long-shape streets	Modern construction, new public facilities	Shifang Street, Ximen Street, and Xinchu Street

Establishment of Taipei City in the Qing Dynasty				
LANDMARK	Gate, Official's office, military, culture, religion	Chinese Jiangnan-style architecture	Official's office	Taipei City Office, Yamen, college, Machinery Bureau, temples, five gates

Note. Finishing: Chang, Han-Yun

Table 4. Integration of analysis of urban imagery

Foundation of Taipei City in the Japanese Colonial Period				
During 50 years of colonial rule by Japan, most of urban landscapes built in the Qing Dynasty were destroyed and traditional road structures and architectural styles in Taiwan were removed and replaced with European buildings, which symbolized the dignity and modernization of the country. Japanese rulers managed Taipei City through extremely strict urban planning and set up the foundation of modern city based on practical-based scientism.				
Environmental images	Feature	Structure	Meaning	Description
five elements				
PATH	Downtown modification	checkerboard	Road network modification	Traffic demand
EDGE	Tamsui River	No walls	Urban planning with 150,000 residents	Demolish walls and replace them with three-lane roads
DISTRICT	Separate districts for Taiwanese and Japanese	Villages, Japanese styles	discrimination	Taiwanese lived in Monga and Tataocheng, while Japanese lived in Taipei City
NODE	Circled park avenue, large greenbelt	Large and wide places	Place where people gather	Foundation of development of modern city
LANDMARK	Official institution	Western-style architectures	Symbol of dignity and modernization of the country	Based on new style and western and classic style

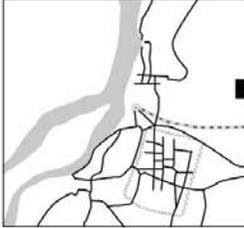
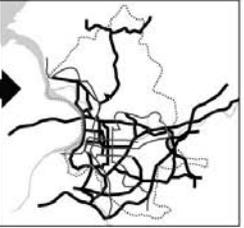
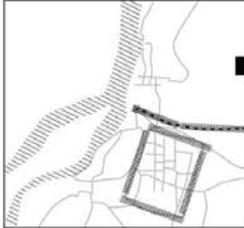
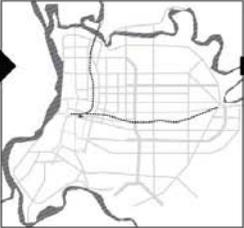
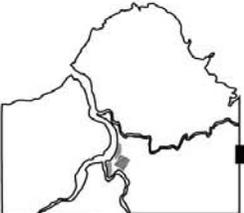
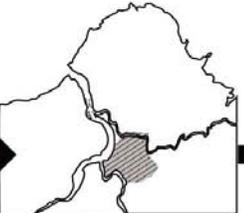
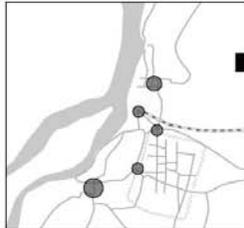
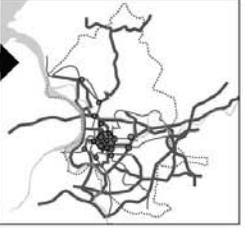
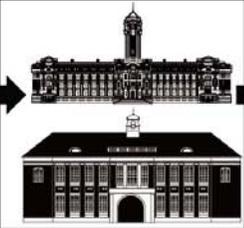
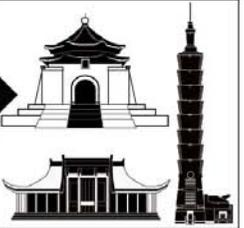
Note. Finishing: Chang, Han-Yun

*Table 5. Integration of analysis of urban imagery*

Modern Taipei City				
Environmental images	Feature	Structure	Meaning	Description
five elements				
PATH	Vertical and horizontal roads, Elevated	Checkerboard , Ring-type	Using old road network	Expansion of traffic demand
EDGE	No obvious boundaries	Natural terrain	New urban planning has the capacity of 2,500,000 residents	Hills and rivers
DISTRICT	East District and West District	Dual-core urban development	New and old district	Based on Taipei Basin
NODE	Public transit	MRT system, Urban road system	Important nodes for residents' traveling	Taipei Metro, Expressway, Urban Expressway
LANDMARK	Iconic places and buildings	Public space and commercial facilities	Visible highlights	Chiang Kai-shek Memorial Hall 、 Sun Yat-sen Memorial Hall 、 National Palace Museum, Taipei

*Note.* Finishing: Chang, Han-Yun

Table 6. cultural unconscious

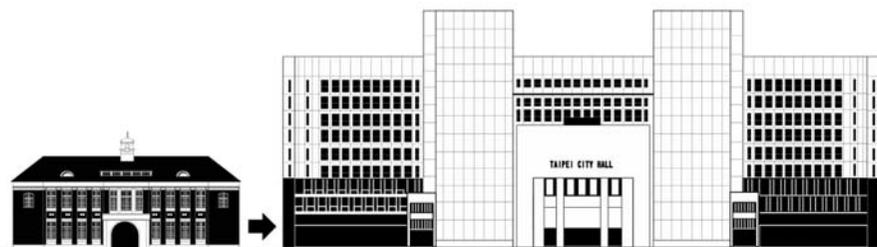
five elements	Establishment of Taipei City in the Qing Dynasty	Foundation of Taipei City in the Japanese Colonial Period	Modern Taipei City
<p>PATH</p> 			
<p>EDGE</p> 			
<p>DISTRICT</p> 			
<p>NODE</p> 			
<p>LANDMARK</p> 			

Note. Drawing and finishing: Chang, Han-Yun

## **5. CHANGE ON IMAGERY: EXPLORATION AND ANALYSIS OF FOUR DIMENSIONS**

### **5.1 Form of Planning: The Scale of City and Government Agencies**

In the Qing Dynasty, a comprehensive urban planning was organized in Taipei. Since the beginning of the Japanese Colonial Period, the scale of modern city was implemented in the construction of Taipei City. After the recovery of Taiwan, new urban planning and expansion were carried out, and the population as of today exceeds 2,600,000 residents. Taipei City is also the center of politics in Taiwan and offices for government agencies. The titles used in the Qing Dynasty no longer exist today. “Taiwan Sotokufu” used in the Japanese Colonial Period was changed to “Office of the President”. However, the title of Control Yuan remained. The bigger change in Taipei City was the changes on locations of agencies as well as on architectural styles. The most obvious one is Taipei City Government. In the early times, the old City Hall was built on Chang’ an West Road in 1921 with red bricks and wooden frameworks combined with a western classic style; today, the City Hall is located on Shifu Road in Xinyi District in the east and becomes the new center of municipal administration. The entire building presents a modern architectural style with the shape of “double ten”. Due to the complete change of the City Hall, the surroundings have changed as well with more and more modern architectures.



*Figure 3. Evolution of Taipei City Government*

*Note. Drawing and finishing: Chang, Han-Yun*

## 5.2 Centurial Buildings: Historical Sites and Schools

There are many centurial buildings in Taipei City. Currently, “Taipei City-Dongmen, Nanmen, Xiaonanmen, and Beimen” have been listed in the national historic monuments. In the Japanese Colonial Period, the western-style architectures were built in order to present modernization, mostly for government agencies. The Office of the President was the representative with grand and gorgeous demeanor, which fully expressed the prosperity of colonization. After the National Government moved to Taiwan, the architectures were mainly built with modern styles. Accordingly, the architectural style can reflect the background as well as the trend. In addition, the educational institutions are indispensable systems for cultivation of citizens. Among centurial schools in Taiwan, the most representative one is National Taiwan University, with college-based historical buildings and European-style buildings embedded with Japanese-style spatial planning, representing a concept of new education. Besides, National Taipei University of Technology still retains historical buildings like “Red Building”, which symbolizes the times.

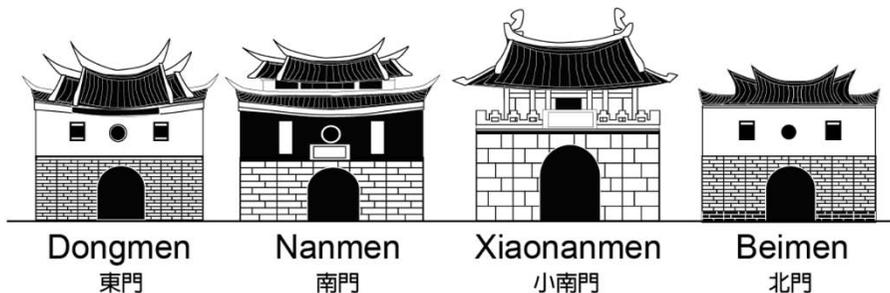


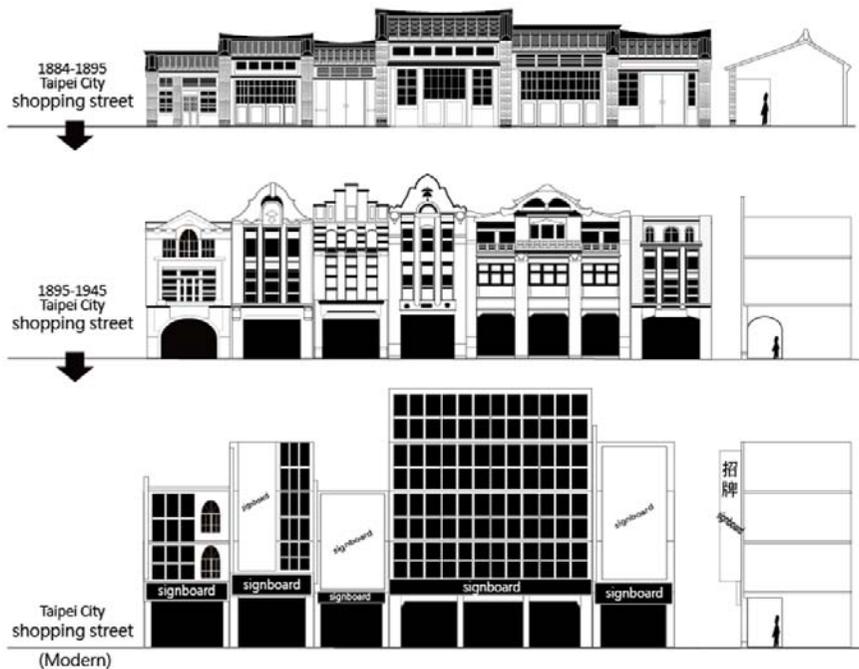
Figure 4. Existing four gates

Note. Drawing and finishing: Chang, Han-Yun

## 5.3 Change on Landscapes: Development of Business Zones and Transportation Construction

The changes on landscapes in Taipei may be seen from the development of business zones and transportation construction, which are the important indicators. In the aspect of changes on traditional business zones, the earlier business zones were derived from Dihua Street and Bopilia. In the past, the traditional business activities concentrated in Ximending. After China Mall, which was in fact the most prosperous area in Taipei at that time, was demolished, the business zones gradually moved toward the east until the

current area of Sun Yat-sen Memorial Hall. Transportation construction in the urban planning also led to great changes. In 1990s, as the railways were built underground, combined with the gradual completion of express way Xinsheng Viaduct, bus lanes, and MRT network, the residents' living perimeters and habits were expanded. From the abovementioned situation, one can see the relevance between diverse changes and landscapes in Taipei.



*Figure 5. Evolution of architectural styles on streets*

*Note. Drawing and finishing: Chang, Han-Yun*

## **5.4 Multiple Cultures: The Public Lifestyles and Cultural Landscapes**

Originally, Taiwan was a conservative society, where no change occurred internally. The public lifestyles changed due to external stimulation and influences. Also, different groups have different cultural landscapes. The main reason why diversity exists in Taipei is the remains of Japanese lifestyles and cultures from the Japanese Colonial Period, such as the hot spring area in Beitou. Many lanes still remain reminiscent. People can see

changes on the public lifestyles from evolution of costumes, which also demonstrate intersection and coexistence of various cultures, such as Chinese-style, western-style, Japanese-style costumes, and non-distinctive costumes from global brands nowadays. The culture of food diversity is a big highlight. For example, the National Government brought about one million of mainlanders to Taiwan after the war, leading to the establishment of military villages across Taiwan or in Taipei City. Since the snack shops were easily run, various restaurants appeared across Taiwan. Many mainlanders missed the taste from their hometown, so they made Chinese cuisine accordingly, which was a kind of demonstration of culture. During the Korean War and Vietnam War, the American military stationed here, and the clubs for the American military appeared on Zhongshan North Road in Taipei City. After Martial Law was abolished, more and more foreign food cultures, such as Korean, Vietnamese, and Indian food, have been brought into Taiwan due to overseas traveling, openness of foreign tourists and foreign immigrants, import of foreign workers and engaging the world. Due to more different consumer groups and behaviors, various restaurants and famous night markets appear in Taipei. In the early times, the media was relatively closed. The freedom of media and the growth of TV and internet are also the important drivers for the changes of public lifestyles. Taiwan has become a country where information and interest are prosperously developed, which is especially influenced by Japanese or Korean TV shows. Thus, people may see a lot of landscapes, such as Japanese and Korean stores, in Taipei City. Overall, in terms of urban planning in the public lifestyles in Taipei City, no changes have been made due to diverse cultures; instead, some plans are made in response to cultures.

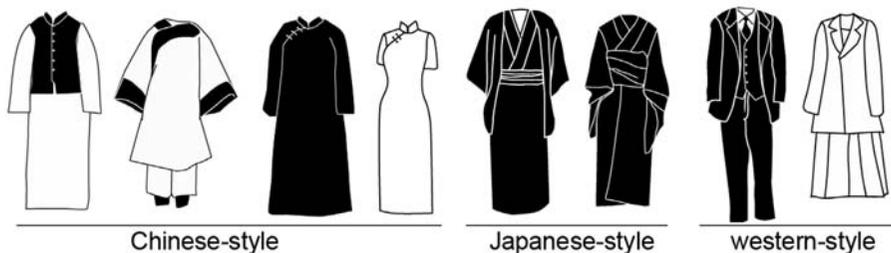


Figure 6. Evolution of costumes under diverse cultures

Note. Drawing and finishing: Chang, Han-Yun

## 5.5 Cultural Unconscious: Brief Discussion on Urban Imagery and Symbol of Taipei City

When Taipei City Government held activities, we found that it would use past cultural elements on the visual images and symbols. It is a frequently seen approach. According to Freud's personal unconscious idea and Jung's collective unconscious idea, cultural codes exist in the subconscious level of the public, which encode people's subconsciousness and endow it with a meaning based on peoples' life, major events, and social collective life experiences. In addition, cultural memories also mean that people have conception of joint emotions at the same time and space and region. In case of occurrence of any major event, cultural memories will help us define the meaning of current appearance, extend its spiritual value, and influence our instincts subconsciously. Several cultural codes relating to Taipei City are listed as follows in order to understand the reasons and response.

*Table 7. cultural unconscious*

City Images	Symbolic	Description
Copper statue	Politics, Authoritarianism	Educational function, to promote great deeds
Coconut trees	Imagery of Southland	Planted in the Japanese Colonial Period, such as Coconut Avenue in National Taiwan University, and trees on sidewalks.
Books	Young artists, scholarly demeanor	Also known as hipsters, particularly referring to groups of people who love literature, do not follow the trend, and feature distinctive ambition and taste.
Taipei Station	Pursuit of hope and struggle	Usually for people from Central or South Taiwan. Trains are the main transportation to go to big cities.
Lanes and alleys	Reminiscence, beautiful days, gathering	Lanes and alleys left from the Japanese Colonial Period. They become places with leisure atmosphere nowadays.
Military villages	Mainlanders, noodles	After WWII, a million of mainlanders came to Taiwan and formed military villages.
Night markets	Night markets, shopping	The places for daily supplies and snacks. The night market is the representative of common people.
Board games	Clubs, puzzles, role plays	Unplugged games. Board games depend on boards instead of electronic products.

*Note.* Finishing: Chang, Han-Yun

## 6. CONCLUSION: DEMONSTRATION OF URBAN IMPRESSION OF CULTURAL DIVERSITY

Two urban impressions of cultural diversity demonstrated in Taipei City are: 1. under the backdrop of time and space, different policies and directions of urban planning would lead to different urban landscapes and imagery due to different rulers; and 2. Under the globalization and free democracy, Taipei City contains more different cultures and the cultural landscapes feature diversity, especially in the food culture, due to implementation of policies, such as open tourism, import of foreign works and foreign brides. However, the cultivation of a city lies in the continuous intersection and combination of human and history; the landscapes of a city form through the remains and renewal of styles in each period. From the perspective of cultural diversity, the symbolized imagery of centurial Taipei City allows people to visualize the elegance of Taipei City. Due to vast and complicated data from related literatures on Taipei City, it is hard to summarize and analyze the topic without being diverted from the core. I am fortunate to have Associate Professor Song, Lih-Yau, who understand urban planning in Taipei City very well and has guide me through the research as a senior resident in Taipei City, and friends in Taipei who have shared their experiences through interview, to help me complete and publish the study. Moreover, I thank God for giving me strength in prayer.

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NO.112

## Road Network and Crime

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**Key words:** Crime Prevention, Space Syntax, Road Network, Safe City

**Abstract:** As the anxiety of citizens is growing due to the continual occurrence of crime threatening our valuable lives and properties, the measures to prevent crimes are keenly required. In the meantime, various approaches for the prevention of crimes have been undertaken across the world. However, in view of the fact that crimes are frequently occurring on the road, this study focuses on the relationship between the road networks and crimes. J City in Korea was selected as a case study and for the analysis of the road networks, this study adopted space syntax theory. Three space syntax parameters were calculated; 'Connectivity', 'Control', and 'Integration'. Then, we investigated the relationships between crimes happened along with the individual road for three years, 2008, 2011, 2012 and with the three space syntax parameters by regression analysis. The study results demonstrate that 'Integration' would have the most significant positive effect on crimes. In terms of the 'Connectivity' and 'Control', they both have positive correlations with crime occurrence too. However, 'Control' has a weak correlation with crime. The findings suggest that the creation of a safer city from crimes would be realized depending on the careful design and development of road networks.

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## Prospective living arrangement of China's urban elderly and an ABS model for elderly care needs

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**Key words:** Agent, simulation, ageing, senior service, supply, environment, policy

**Abstract:** China is characterized by huge aged population, rapid ageing speed, urbanization, and social-economic transformation, the senior service issue is quite typical and urgent. To support the urban planning and decision-making of relevant policy for senior service which are significantly challenging, this research employs the MAS (multi-agents simulation) approach to simulate the complicated process of Chinese senior service provision. We define the elderly, daycare center, and RACF (residential aged care facility) as the kernel agents, determine the behavior rules of different agents, and confirm the interaction between agents, individual agent and urban environments. And 9 simulation modules were designed and integrated.

We focus on the diversifying elderly population, complexity of senior services system, and uncertainty of developing background. Senior's socio-economic attributes such as income, family structure, education and hukou status, daycare center and RACF agents' characteristics such as price, location, service standard, public /private were emphasized in a microscopic scale. With the bottom-up approach, the neighbourhood differentiation was considered as the main natures of the senior service need. Through the design of different policy-scenarios, we determine the critical parameters which have the most important influence to the senior service need and provision. The regulation of these crucial indicators will be a great scientific support to the provision planning of senior services facility, and the decision-making of the environmental improvement policy in different urban neighbourhood.

MAS approach is acknowledged as a modeling paradigm for capturing the dynamics of complex systems. This research is prominently useful to support the provision of elderly services facility and the environmental improvement of urban living neighbourhood and to promote future urban planning.

## **1. INTRODUCTION**

The global trend of aging gradually raises the senior service into a critical issue world widely. Senior service is a complicated, dynamic, systematic social problem, significantly subject to population growth, socio-economic institution, economy, regional infrastructure, culture and value, and service management. The senior service system is composed of a large number of autonomous stakeholders (service supplier, elderly persons, policy maker, etc.) who play fundamental role within the system, and interact with each other in a dynamic urban environment.

The sixth census, conducted in 2010, demonstrated that the population above 60 years old had reached 178 million, accounting for 13.3% of the total population. It was predicted that by 2030, the figure will double (CPC Central Committee and State Council, 2011). Due to the reduced fertility rate and increasing life expectancies over the last few decades, China is experiencing rapid demographic change. Since aging overlays with the industrialization, urbanization, and social-economic transformation (Peng, 2011), elderly service issue in China is more typical, has to face more challenges, such as aging before getting rich, huge population of disabled senior, old elderly and “empty-nest” seniors, traditional role of families decreasing. At present, the most acute and fundamental contradiction of senior service is structural imbalance between the demand and provision.

To resolve this problem, three of the most important factors to be adequately addressed are demographic transitions, senior’s diversification, and policy reform. One-child policy has played a key role in this demographic transition, and greatly reduced the number of children available to support ageing parents. The deep hesitation whether to enter the facility which is departs from tradition, or to rely on the care of single-child, who is extremely busy and stressful, is very common feeling of urban seniors. After the policy of reform and opening up, social-economic differentiation (e.g., income, hukou status) has emerged significantly in China. It makes a big difference in terms of senior service demand between elderly people with different characteristics. The utility levels of senior care services remarkably varied, for the senior’s social-economic diversification. The health care reform, social security system reform, and household registration system are conducted recently and a series of policy related to senior service will be formulated in future. All of the policies will have important implications for the viability of future senior service strategies.

Most of the existing study on senior service need is multi-disciplinary, because it is difficult to clarify this problem with investigation and analysis method of one single discipline. According to the behavioral model in gerontology and sociology, three sets of variables can account for difference in health service use among elderly. These are predisposing variables (e.g. age, sex, and education), enabling variables (e.g. family income, finance

ability of elderly and their accessibility to service) and need variables (e.g. symptoms of health and illness, functional health problem, and perceived need for health care) (Andersen, 1995). From sociology and psychology, the health belief model focuses on the role of individual's perceptions in seeking the health services, not on the role of demographic and social conditions (Hooyman & Kiyak, 1988). It suggests that senior's belief about health problem, perceived benefits of action and barriers to action and the self-efficacy trigger the health service utilization (Janz & Marshall, 1984). The P-E fit model, conducted by the environmental gerontologists, was presented that the integration of elder persons with their physical and social environments hugely impact the health service demand ( Lawton & Simon, 1968; Longino, Perzynski, & Stoller, 2002; Rowles & Bernard, 2013). Studies on public health, present that China has experienced an epidemiologic transition in the leading causes of death, from infectious disease and acute illness to chronic disease and degenerative illness (Gong et al., 2012). The changes lead to an ageing society with the changing health and disease patterns, and the different health service expenditure form (Levit et al., 2003).

To address the issues of mismatch between demand and supply of elderly care service, abundant research shows the importance of different factors, such as the various statuses and life courses of elder people, the relationship between elderly and urban living environment, the facility's attributes (e.g. location, care service), and the policy effect (Barnes, 2002; Gao, 2013; Gao, Yan, & Ji, 2012; Golant, 1979; Moos & Lemke, 1979; Shapiro & Tate, 1985; Yan & Gao, 2014). Nevertheless, the statistic method, social approach, and traditional spatial analysis, are too macroscopic, aggregate, and static to solve this problem. They are disadvantaged to respond to the elder individuals' behaviors and the individual facility's operation in the diversifying society, and to understand the concrete challenges in this comprehensive, systematic, and integrated problem.

Multi-Agent System (MAS) has remarkable advantage to simulate the complex, dynamic system from microscope (e.g., simulate the urban land use, and urban transportation changes ), by modeling the interacting, autonomous 'agents' in a dynamic environment (Batty, 2011; Ligtenberg et al., 2004; Shen et al., 2011; Suryanarayanan, Theodoropoulos, & Lees, 2013). Agents have behaviors, often described by simple rules, and have interactions with other agents, which in turn influence their behaviors and the whole system (Macal, & North, 2010). In urban development simulation, the most important topics are the selection of agents, definition of behavior rules, expression of interactions between agents, extraction and import of environment variables (Chen & Gao, 2013). Not all the numerous stakeholders should be considered as the agents. The confirmation of the agent's behavior is prior knowledge-based and impacted by the research target, involving an interdisciplinary study, in which need to coordinate the

theoretical conflict. The circular interaction within the agents is simultaneous, difficult to model. And the interface of environment contains the urban social, economic, nature environment, culture and policies variables which are the essential input of the simulation and needs to be quantified.

Therefore, we use MAS to construct the ECSS (elderly caring service supply) model to reasonably address provision of elderly care services dynamically, and to expand the application of MAS to model the urban complex system.

Based on the gerontology, sociology, urban geography, etc., we select the essential agents, (e.g., the elderly, facility), confirm the agent's evolution laws and the behavior rules, design the agent behavior modules. According to the interaction between various agents, we integrate the agents' behavior, frame out the affecting mechanism of different agents' modules, simulate the urban elderly care services demand-supply system in micro scale and find out the macro evolution law. Consequently, based on the forecasting outcomes of micro behaviors of elder individuals and facilities, we can conclude the macro laws in the whole demand-supply system of elderly care services. According to this, we can provide the intellectual support more reasonably and predictably, to the planning and provision of elderly care service. Moreover, in the complicated environment, the microscopic simulation and scenario analysis will bring a brand new perspective to the regional and urban planning, and significantly influence in the distribution and allocation planning of infrastructures, public service facilities.

## **2. FRAMEWORK AND AGENT-BASED SIMULATION**

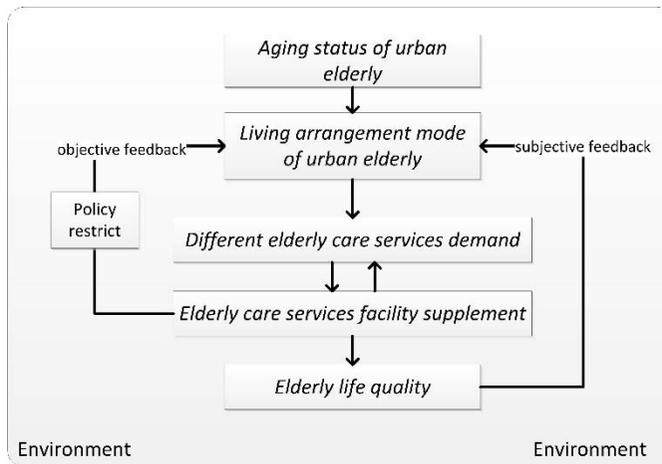
### **2.1 General framework of the simulation**

The ECSS Model aims at developing, testing, and applying a new type of integrated urban old people services supply model, simulates the interaction between elderly and environment (*Figure 1*) in a whole system, under the rapid aging and urbanization process.

Firstly, the characteristic of elder people in the urban region will be defined, such as age, healthy status, income, education, and etc. Then, creates their demands for spatial interaction, such as shopping, leisure travel, activity participation, receiving care, etc. Meanwhile, several elderly need more care for the declining health and loss of independence. These daily activity or specific treatment/health care of old people occurs in the different areas with different level of the accessibility, service convenience, and that will trigger their reaction (e.g. their morale, mood, well-being, of life satisfaction)

consequently. Secondly, adjustment of living arrangement as a deliberate behavior of senior, significantly influence the senior care services demand further. Then, urban senior services system will provide the services accordingly, and improve the elderly life quality. In the whole process, there is a remarkable need to consider the different dimensions of environment such as personal space, buildings, neighbourhoods, facility, and etc. Their locational and physical attributes should be taken into account in the interaction between the physical environment and the elder population.

And there are two most important feedbacks in this systemic model: 1) subjective feedback. Based on the existing senior service and urban living environment, elderly will conduct the evaluation of the wellbeing which will influences their future decisions of living arrangement; 2) objective feedback. The allocation of elderly care services facility will impact urban living arrangement mode of urban senior in turn. Meanwhile, the provision of urban senior service system would be restricted by the government policy significantly.



*Fig. 1 ECSS model framework*

This theoretical framework recognizes the elderly diversity, complexity of senior service system and the uncertainty of developing background. It can be used for predicting the growth of elderly population and the demand of senior services in future, and assessing to which extent these urban environment can effectively meet the needs of elder people for senior services, evaluating the efficiency and impact of potentially social senior services system policies.

## **2.2 Selection of agent and module relationship**

According to the multi-agent system, we firstly select the essential agents, and then confirm their behavior rules, and the interactions between agents, agents and environments through various simulation modules.

The ECSS Model is microscopic, including 3 types of agents, 1) elderly agent, 2) residential aged care facility agent, 3) day care center agent. As to elderly agent, which is the kernel agent of this simulation, all healthy, economic status and social support changes, life course, living arrangement mode, elderly care choosing will be modeled by multi-agent based simulation. For residential aged care facility agent and day care center agent, the profit or non-profit, location, capacity for visitors, content of services, and business cycle can be simulated by individual facility. The interactions between elderly care service demand (e.g. home-based services, community-based services and care service from aged care facility) and facility supply (e.g. residential aged care facility, day care center, hospitals) are modeled at the level of individuals. Within simulation environment, urban policies like senior service facilities plan will be inputted to the simulation environment. Meanwhile, urban governor will be simulated to manage, restrict, and supervise the provision of elderly service system, and also select the urban development strategy, regulate the urban environment construction (e.g., hospital, leisure space, transport facility, etc.). While, the urban aging process, urbanization, and other developing macro background of this model is essential factors to the simulation, impacting the behavior of different related agents, should be represented and inputted as well.

According to characteristics of different types of agents, the elementary behavior and decision-making process are encoded to basic computer programmers unit as different running modules. The ECSS Model is consist of 9 modules, e.g. 5 modules conducted by elderly agent (i.e., life cycle module, care pattern shift module, living arrangement and care pattern choice module, relocation module and facility choice module) , and 4 modules execute by day-care center, residential aged care facility(RACF ) agents ( i.e., day-care center business cycle module, day-care center's location module, RACF business cycle module, RACF's location module).

The simulation modules of ECSS Model interact in various ways with each other. Interactions between the modules and agents-environment are operated by a coordinating program. Figure 2 show that the main interactions which is complicated and enormous, and would be even larger if also indirect impacts were taken into account. Among the relationships of modules and agents-environment, there are three types of influences. 1) The impacts from the same agent are demonstrated by arrow with dotted line (e.g., elderly agent's life cycle module will influence care pattern shift module). 2) The effects from different agents or the interaction of agents-environment are shown by arrow with solid black line (e.g., urban environment will affect the

elderly location module). And 3), the interactions between several modules from different agents are indicated by double-direction arrow (e.g., the relationship between the RACF location module and the facility choice module).

Existing research models and empirical findings are the foundation of simulation modules which performs essential mechanisms of agent's behavior rule and their interrelationships with agents or environments. Therefore, we will introduce the related studies and findings.

### **3. BEHAVIOR RULES OF THE ELDERLY**

#### **3.1 Elderly lifecycle module**

Aging is the essential issue in the life course study among gerontology, and sociology. The life course relies on the life trajectory, important life events, and role /status transition (Riley, Johnson, & Foner, 1972). Elder (1975) found that the historical times and places where they experience over their lifetime, embedded and shaped the life course of individuals. The life events generally refer to schooling, marriage or divorce, retirement, death of a spouse, and etc (Li, Deng, & Xiao, 1999). The role/status change of elderly mainly include the biological, social, psychological aspects, such as the transition of sensory function, cognitive abilities, lifestyles, social contribution, intergenerational relationships, values, and well-being ( Hooyman & Kiyak, 1988; Moen, Dempster-McClain, & Williams, 1992; Riley,1987).

According to the study by Morgan and Kunkel (2011), we conclude the different dimension of life course, including the elderly life course especially (*Table. 1*). In short, age related life course events in later life include children leaving home, retirement, death of a spouse, declines in health, and reductions in income which will significantly impact the later life of individual.

Table.1 various dimensions of life course

Age	...	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100
	20								
Life course	...	Young adult	adult	Middle age	Later maturity			Old age	
Job/ retirement	...	Job experiment	Job advancement	Retiremen t planning	Retireme nt occur			retirement	
household	...	Marriage/parents	parents		spouses			Widowhood?	
Intergenerati on relationship	...	Kids under 6	Kid 6-12	Kids 12-18	Adult-adult	Empty nest		Depend on child?	

According to the age, elderly can be parted to pre-elderly (55–64 years old), young-elderly(65–75 years old), middle-elderly(75–85 years old ), and old-elderly(85+ years old) (Atchley, 2000; Bures, 1997; Longino, Perzynski, & Stoller, 2002). Carr and Komp (2011) proposes a new idea to the conception of life course, present the third age of elderly which is described as the period in the life course that occurs after retirement but prior to the onset of disability, revealing a period in which individuals have the capacity to remain actively engaged. And the third age ends when the fourth age- characterized by declining health and loss of independence-begins. The phases of third age emphasize the role of health status to life course, and is response to the concept in gerontology--productive aging which focus on senior’s productive participation (e.g., engaged in work, care giving of grandchildren, caring for sick friends, and educational training) (Morgan, & Kunkel, 2011).

Although, the transition of life cycle influence the decision making process of elder individual, elder people are planful within their particular limitations (Clausen, 1993; Elder, 1975). Therefore, as a rational person with independent consciousness, the living arrangement, health care, social care, and facility select of later life already have considered within elderly decision-making scopes, and abide by the principle of maximum utility of elderly within their current life course (Wu, & Jiang, 2006).

### 3.2 Care pattern shift module

From the life course modules of elderly, we examine the different life course within the physical, psychological and social aging process. Living environment, including physical environment, social environment and senior care service, is closely linked with senior’s life. Then how does the

urban environment impact elderly citizen in different life course, and influence senior's life? It is the essential task in this module.

Elder people are more sensitive to the environmental impact than young people (Hooymann and Kiyak, 1988). Golant (1979) argued the elder person's geographic experience in their neighbourhood involves a complex of action, orientation, feeling, and fantasy that together provide a holistic expression of the individual's adjustment (such as move to an institution, locomotion within the proximate environment, and movement to the occasional long-distance vacation trip), within their physical and psychological capabilities and unique life history. Lawton (1982) developed a predictive model for the behaviour of senior citizens, based on the relationship between senior and their living environment. After the Lawton's ecological theory, the relationship between of elderly and environment has been studied further. Evans (2009) provided a research on social well-being of the elderly people living in "housing with care" (e.g., retirement villages and extra care housing). The sense of community is critically important for elder people's quality of life. The factors include social networks, inclusive activities, diversity and the built environment. Phillips et al. (2005) categorized these dwelling conditions as interior environment (e.g. indoor lighting, crowdedness, temperature, security devices, lift/escalator, etc.) and exterior environment (e.g. lighting in public spaces, green areas/parks, recreational or sitting & rest areas, passages, flyover/subways, air pollution in estate/community, etc.), and demonstrated the greater impact of the interior environment on residential satisfaction than the exterior environment. Yan and Gao (2014) revealed that in different neighbourhoods (e.g. the Traditional courtyard housing block, Low-income rental housing neighbourhood, Commodity Apartment neighbourhood, etc.), residential environments play a significantly different role in the aging process of diversifying seniors who is aging in place in China.

Therefore, based on the fitness of the elderly person with environment, and the well-being or satisfaction of elderly, we can predict the adjustment or behavior of the seniors, e.g., the changing of living arrangement. The elderly care pattern changing-desire module is just the process to assess the relationship between elderly and their living environment, and the probability of some behaviors.

### **3.3 Living arrangement and care pattern choice module**

The relationship between elderly and their environment are influencing their mental status (e.g. depression), quality of life, and individual behavior. The adjustment of living arrangement and residential location can be view

as a critical manifestation of the ways in which elder people have adjusted to the social, behavioral, environmental factors.

Generally, the living arrangement includes independent living (live alone or with spouse), co-residence (living with at least one child or other kin), and living in an institution. It has many implications for the current well-being of an elderly person, and is a dynamic decision which should be responsive to changes in individual circumstances and to changing expectations about the future (Phillips et al., 2005). Functional losses and low life quality, like Alzheimer’s disease, require an increase in informal/formal care services and more supportive dwelling environment. Therefore, it is at a higher probability of the movement into a skilled nursing facility (Kaplan, & Andersen, 2013). Different value, cultural specificity, and assimilation of elder people are the essential factors to the decision making of living arrangement also. The foreign-born elderly Asian in Canada/America were usually under the auspices of family reunification, the percentage living with family instead of living alone or with a nonrelatives is highest, and the socioeconomic correlates with this patterns( Boyd, 1991; Kamo, & Zhou, 1994; Phua, Kaufman, & Park, 2001). Although, in China, the traditional preference of elderly is to live with their children, but recently, under the influence of acculturation, economic feasibility, and demographic availability, there is an increasing preference among elderly to live independent or entrance an institution (Gao, & Yan, 2012).

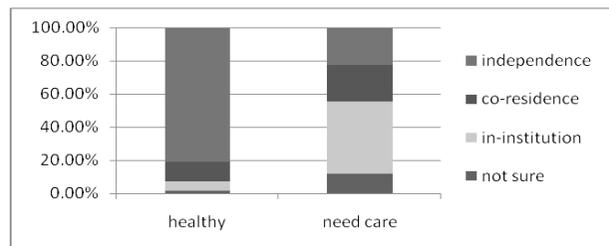


Fig. 3 Chinese elderly's living arrangement based on Beijing survey (Gao, & Yan, 2012)

Living arrangement choice of elderly is associated with their functional losses and the changes in the level of care and received assistance (Dostie & Liger, 2005). Based on the current living arrangement, as the physical energy, mobility, and health status changing, elderly need more services, including ADL(activities of daily living) care, IADL(instrumental activities of daily living) care. These services belong to different care patterns which are supplied by various care providers (See Table2).

Table 2. Relationships between living arrangement, and urban long-term care system

Living arrangement	Care pattern	Care provider	long-term care (ADL care, IADL care)			
			Emergency/ acute treatment	technical recovery health care	recovery health care(non-technical)	Supportive real-time health care
<b>In-institution</b>	Residential care	Hospital	Δ			
		Residential care facility		Δ	Δ	Δ
<b>Co-residence / independence</b>	Community care In home care	Community-based facility /Day care center				Δ
e		At-Home Care Company		Δ	Δ	Δ
		Community elderly center				Δ
		Relatives/ Friends: Informal care service				Δ

Policy concern over elderly living arrangements arises from the large effect of living arrangement choices on elderly care and welfare, especially for those suffering from physical limitations or health problems. This concern may be especially cogent in rapidly developing countries, such as those in China, where the percentage of elderly living independently (alone or with their spouse) has increased substantially. However, public senior social services remain relatively defect (e.g., most of elderly living in public nursing home is health urban retiree, rather than disabled old-elderly; the care places is at great shortage.). Some studies on this has been already conducted, for example, Dostie and Liger (2005) suggested that policies may be more effective at reducing institutionalization if, among elderly living independently, policies are targeted at married females with fewer children and at encouraging seniors to return to community care or in home care if, among those who are living in a nursing home.



Fig. 4 Elderly living arrangement and care pattern selection

Consequently, we design the elderly living arrangement and care pattern select module to clarify the relationships between individual elderly, the living circumstance, and related policy. And this module will run to illustrate, to what extent, that the relationship and concerning policy will impact the well-being or expectation of elderly and induce them to choose a certain kind of living arrangement and the corresponding senior care (Fig. 4).

### 3.4 Residential moving of the elderly

Because of limited mobility, frailty or other physical/mental health problems, many elderly require the long-term care, including in-home care, community-based care, and institution-based care, and the more supportive living environment (See Tab. 2). Therefore, according the different demands of physical/social environment and senior service, great many of elderly choose to relocate.

Borup (1983) identified four types of relocation of elderly: Type 1) inter-institutional (e.g., from hospitals to nursing facility, continuing care retirement community); Type 2) residential (move from one residence to another); Type 3) residential or institutional (such as from home to a residential aged care facility) and Type 4) intra-institutional (e.g., just inside the facility). Wiseman and Roseman(1979) identified local mover including 6 types: suburbanization, inner city relocation, apartmentalization, communalization, homes of kin, institutionalization. The simulation of senior’s migration is complicated, refers a long-term decision, impacted by several factors, especially, the life course of elderly, and the benefit of alternatives. Based on the study of different relocation by Borup (1983) and Wiseman et al. (1979), we suggest that when a senior decides to move, the alternative places are just other local community (e.g. near-by community and relatives’ home), residential care facility.

### **3.4.1 Relocation module**

Majority of elder people prefer to age in their home or relatives' home. The aim of this module is to simulate the senior's migration to other communities. Because elder people are usually long-term in-home residents, how senior's physical/social environment (e.g., out space, transportation, dwelling condition, social participation, social inclusion and etc. ) and daily social services (e.g. the service provided by senior center, meal delivery service, information and referral service, home care and health care, protective service, etc.) are provided within the communities is extremely important.

The classic migration decision models (e.g., push-pull model, stress-threshold model, spatial equilibrium model, human capital/cost-benefit models, behavioral model, location-specific amenities model, etc.), tend to clarify the complicated process of decision making (Gregory et al., 2009; Northcott & Petruik, 2011). Wiseman (1980) involved "push" (e.g., physical decline or death of a spouse, and environmental press) and "pull" (e.g., the therapeutic landscape in a community, relocated relatives) factors, which were defined as "triggering mechanisms" impacted by senior's indigenous factors (e.g., personal attributes, neighbourhood ties) and exogenous factors (e.g., cost of care and housing). In spatial equilibrium model and cost-benefit model, elderly migrate through seeking housing location with a maximizing utility (Rudzitis, 1979) or the largest benefit-least cost. The behavior model emphasizes the individual's belief, attitude, perception, which will influence the evaluation of their dwelling and neighborhood. Their ability (such as the social-economic stratification, health status, and housing status) to obtain access to health and social welfare services promote the migration (Golant, 1979; Fokkema, & Van Wissen, 1997). De Jong, (1999) argue that the decision making should based on the balance of five parts: demographic factors, social networks, values and expectations, residential satisfactions, behavior restrict, and then have the migration intentions. The location-specific approach argued that relocation is as a result of change in demand for location-specific amenities, which can only be satisfied by moving to elderly desirable site or place (Rudzitis, 1979).

Some studies presented that besides aging in place, seniors prefer to age "near" place by moving, for example, to other nearby communities, moves within the same city/town/village (Northcott & Petruik, 2010). Focusing on the different attracting of suburb and central city, most preferred destinations of several elder movers were the suburbs, followed by nonmetropolitan area, and center city was a distant third (Golant, 1979). However, several elderly were attracted by the central city, because the convenience of public transportation and easy access to a wide range of urban facility addressed to the need of elderly, and the availability of

smaller sized, less expensive rental accommodations and relatively low cost of traffic, more attractive social situation for high density of elder people (Golant, 1979).

In other studies, the proximity of elder people to relatives (Cai, 2012; Fokkema & Van Wissen, 1997; Longino, Perzynski, & Stoller, 2002; Warnes, 1993), and the therapeutic landscapes in living environment are specifically emphasized (Andrews, & Phillips, 2005). Cuba (1991) found that individuals may repeatedly spend their vacations at the locations that eventually become their retirement places.

According to review of research on elderly relocation, the most important process in this module is how the individual senior will find the location with the maximizing utility, by comprehensively considering other factors, such as the various attributes of senior, the advantage of alternative location, the impact of relatives, and etc. And the comparison between original location and new location, or to what extent, there is the improvement from the new location, is essential factor for the decision of relocation also.

### **3.4.2 RACF choice module**

When elderly become disabled, they usually need to make an environmental modification to preserve their independence (Litwak & Longino, 1987; Longino et al., 1991). Although aging in place is the preferred pattern always, it is too hard to deal with daily activity for the disabled elderly, for the narrow doorways, stairs, etc. Or, they have to use the meal delivery and nursing care in home, while it is expensive actually. And not all stayers among elderly are voluntary aging in place, some may prefer to move, but without resources, and be viewed as “blocked movers” (Moore & Rosenberg, 1997).

Therefore, this module focus on the elderly who decide to migrate to a RACF (residential aged care facility), simulate which or what kind of facility will be selected, such as nursing home, continuing care retirement communities. Because of the different life history, the family structure, income, education, hukou ( in China), social-economic and cultural diversity are the essential features of the seniors, and will influence significantly on the perceiving, evaluation, preference and selection of RACF (Shapiro & Tate, 1985).

Firstly, according to the service contents, location, business size (large or small), profit or non-profit, type (public, voluntary, private) of RACF, residential care, such as the assisted living, nursing home, or the continuing care retirement, are discrete category. It makes the individual selection of RACF is not simple choice.

Cheng et al. (2012) analyze the accessibility of seniors to residential care facility. They suggested that geographical access, information access, economic access, socio-cultural access, and the socio-managerial environment, are the primary factors influence elder people and their family members' decision-making process of RACF choice. The study on the preference of urban elderly for caring facilities conducted by Gao (2013) pointed out that about 40% of the old people preferred public facilities, and 70% preferred facilities of which the monthly expenditure is no more than 2000 RMB in Beijing, China. As Barnes (2002) suggested, there are two types of assessment tools can be applied to assist elderly to select the preferred facility. The first type is the multiphasic environmental assessment procedure (MEAP), which focuses on physical and architectural features of physical facility (e.g., community accessibility, physical amenities, social and recreational services, and safety), staff characteristics, the social environment (Barnes, 2002; Moos & Lemke, 1979); the second type is the assessment tool specifically for dementia care setting, such as, the professional environmental assessment protocol (PEAP), therapeutic environment screening survey( TESS-NH)(Barnes, 2002). Focusing on MEAP, Sheffield Care Environment Assessment Matrix(SCEAM) was provided, it emphasize several architectural elements, such as the location, outdoors space, building form, bathrooms and toilets, private rooms, and etc.( Parker et al., 2004).

And there are other conceptions remarkably related with RACF, focusing by environmental gerontologist, which are “place”, “home”, “being at home”. It is presented as the quite important factors for the selection of RACF. Places are more than environmental context to be modified when elderly become frail, are holistic, dynamic, and meaningful entities with histories and evolutionary trajectories with which they have the intimate relationships and on which they depend. Therefore, in assisted living environments, the relationship between the new RACF and home is highlighted and called as “connectedness” (Cutchin, 2013; O’Shea, & Walsh, 2013).

Therefore, the precondition of elderly relocation to a RACF is the match between elderly preference and the specific facility. And the selection of RACF is related with the service levels, staffs, and the physical environment of facilities (e.g., the natural landscapes, building design, and amenities), and influenced by the health status, social-economic attributes of seniors. On the base of abundant suggestion from the existing study, this module will emphasize the elderly preference firstly, and then will use one MEAP to simulate the RACF selection decision making process.

## 4. BEHAVIOR OF FACILITY AGENTS

The living environment refers to the physical/social environment and senior services, and it includes two kinds of particularly essential facilities (i.e. the day care center and RACF) which closely related to their health care services. Therefore, we select day care center and RACF as the agent in this simulation. They will be simulated through four modules (i.e., day care center business cycle module, day care center location module, RACF business cycle module, RACF location module). Given space limitations of this paper, we take the RACF as an example, to introduce the simulation of the business cycle and location of RACF.

### 4.1 RACF's business cycle module

The business of RACF refers to the provision of services and the revenues generated by the provision of services to aiming customers. Meanwhile, there is the cost of business, such as the payment for materials, labor, and equipment. Therefore, based on the profit, the business will remain or bankrupt. But, not-for-profit RACF will be different, and depends on whether the revenue from government or through donation covers its expenses. This module will simulate the business cycle of RACF (see *fig. 5*), which will influence the system of urban senior services provision.

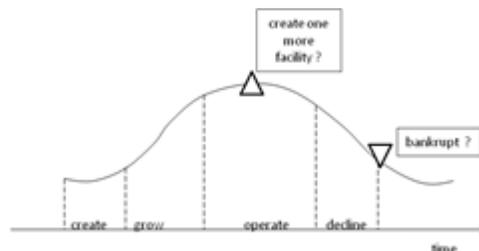


Fig. 5 The business cycle of RACF

In most countries, there are some acts, codes, standards on senior service implemented by local authorities. In British, “Home Life: a code of practice for residential care” (UK Centre for Policy on Ageing, 1984), was the first code of practice which concentrated on care standard, residents’ rights, privacy and financial affairs, facility administration, physical features and staffing. Then, the policy (e.g., “A Better Home Life: a code of good practice for residential and nursing home care” (UK Centre for Policy on Ageing, 1996), “Fit for the Future? National Required Standards for Residential and Nursing Homes for Older People”, (UK Department of Health, 1999), mainly focused on health and personal care, daily life and social activities, accessibility, evaluation of care and cost, complaints

procedures and protection, environmental standards, staffing requirements and standard, and management and administration standards (Andrews, & Phillips, 2005). Therefore, policies for protecting the older residents significantly emphasize the regulation of quality, accessibility, and cost of care.

Research on the business of RACF following the legislation of above documents indicated that some RACFs have recently had to close due to their inability to meet the new standards (Andrews, & Phillips, 2005). Many private facilities will have to reduce capacity and may face financial difficulties to meet the new standards. It presented that the poor prior financial and quality performance increases the risk of failure, but larger size is protective, decreasing the likelihood of performance failure (Andrews, & Phillips, 2005).

The business cycle of RACF related to the places demand of elderly. For example, in Beijing, policies on the development of social senior services suggests the social senior services system is characterized as “9064”, which indicates that 90 % of old people will rely on in-home care, 6% on community care, 4 % on residential care by 2015 (Beijing Municipal Bureau of Civil Affairs, 2008). It means the demand for the place of RACF will be up to 140-160 thousands, by 2015. In Australia, there is an aim to maintain a national target level (i.e. 113 places per 1000 persons aged 70 years and over) and to meet the needs and preferences of care recipients. In the allocation of places under the policy of aged care, the places applicant are required to make them operational within 2 years, otherwise the place lapse or the applicant need to apply for an extension (Australian Institute of Health and Welfare, 2012; Department of Health and Ageing, Australian Government, 2006). Therefore, in macro-region, the places allocation approach was well-practiced through the older population projection and the allocating processes controlled by some policies.

Therefore, the important factors within the business operation of RACF include the health care, places, cost, and accessibility of RACF. And the policy influence on RACF will be emphasized in this module. The main simulation process should include the two parts, such as service position, business size increase/decrease, and finally decide to create new facility or bankrupt the RACF.

## **4.2 RACF’s location module**

This module is conducted to simulate how the RACF agents choose a location, and which factors are essential indicator for the decision of RACF. These will influence seniors’ availability of RACF’s places, and selection of RACF.

The location of RACF is impacted by several factors. Public or private facilities have distinct distribution. Early research identified that historical influences and the varying policies of local government are primary factors for the spatial variation of public facility provision (Andrews, & Phillips, 2005). The existing studies on private RACF suggest that funding changes, management decision, and local planning influence the location of private RACF (Phillips and Vincent, 1988). Demographic and social-economic differentiations across areas influence the distribution of residential aged care facility. The concentration and affluence of local aged population are reliable predictors of location of both public and private RACF. According to the interview conducted by urban planner in Shenzhen, China, the anticipant distribution of RACF is significantly related to green space, medical service, suburb, residential land (see *fig. 6*) (Shenzhen Urban Planning and Land Resources Committee, 2013).

Location of RACF involved the urban land use planning. Code for Planning of City and Town Facilities for Aged, in China, specifies the basic principal of location. RACF should be adjacent to area with high density of elderly, hospital, and park, and located in natural and sunny environment. The land should be flat and well-ventilated. The infrastructure and transportation should be convenient, and keep away from the highway, heavy traffic intersection, pollution sources, and dangerous goods (Ministry of Housing and Urban-Rural Development of the People's Republic of China, 2007).

Location process of the RACF is relevant to the senior services planning, which confirm the target level of RACF places (e.g., 4 places per 100 persons in Beijing ) to ensure an adequate supply of care places and to achieve equitable access to services between center city, suburb and rural areas. Then according to the number of places planned to provide in different regions, government or private investors make the decisions to operate the RACF and choose the location of the RACF. The land from three aspects, the land of bankrupted RACF, the land that can transit its original land use (e.g., industry land, commercial land, infrastructure land, and etc.), and the new land, which allocate according to the principal of RACF land location, such as Code for planning city and town facilities for the aged, in China. (See *fig. 7*).

## **5. ENVIRONMENTS AND THEIR INTERACTION WITH THE AGENTS**

As mentioned above, living environment is linked significantly with seniors' life. The concepts of WHO's Age-friendly city indicate the detailed knowledge on environment of age-friendliness (WHO, 2007). It is

suggested that age-friendly city was defined as eight parts which overlap and interact each other (See Fig. 8).



Fig. 8 Age-friendly city framework of WHO

Outdoor spaces and buildings, transportation, and housing are key features of a city’s physical environment. Social environment affect the mental wellbeing of seniors. The health and social services is offered for promoting, maintaining and restoring health (WHO, 2007). Therefore, living environment plays a fundamental role in the daily lives of the elderly, especially for senior who is ageing in place. Many social geographers, urban planners and architects make the further studies on some specific enabling environments, such as barrier-free environments, parks, and recreational settings, for the elderly (Carp & Christensen, 1986; Kaplan, 1985; Phillips et al., 2005; Rosenberg, 1998). In addition, different types of neighbourhoods are characterized by location, environmental quality, access to services and facilities, and residential density. And seniors living in different neighbourhoods have significant difference in socio-economic attributes and behaviors (Wu, 1992; Cai, 2010; Knox, & Pinch, 2000). They will have discriminated assessments on different dimensions of senior’s living environment (Cunningham, & Michael, 2004; State Advisory Council on Aging, 2007). Therefore, the enabling environment in different neighbourhood should be diverse.

In this simulation, the input of environment should primarily include physical environment, social environment, health services, and the urban distribution of different types of neighbourhoods. According to the environment parameters (e.g., the number of bus stations, size of outdoor space), and the agent evaluation indicators (e.g., older person’s accessibility, satisfaction), we build the interactions between agents and environments. The statistic report of these factors provides a method to support the elaborate and systematic allocation of infrastructure or facility, and the urban planning for age-friendly city. The urban policy is an

essential environment as well. It includes the direct policy, such as the social senior service policy and indirect policy, such as social security system policy, and household registration policy. We will select the critical contents of policies, and translate them into the parameter which is important in the rules of agents, or the interaction between agents or agents and environments.

## 6. INTEGRATED SIMULATION AND DISCUSSION

The ECSS model includes three simulation parts: 1) several simulation modules, 2) the section of the database and data input, and 3) the definition of output reports. The simulation modules are related to elderly population, urban environment, and external factors. The integration of the micro simulation modules of ECSS model is shown in *Figure 9*. Through inputting the data of individual elderly, day-care center, RACF, and other environmental facilities in simulation modules, changes and transitions of different agents are processed according to their behavior rules as what this paper introduced above.

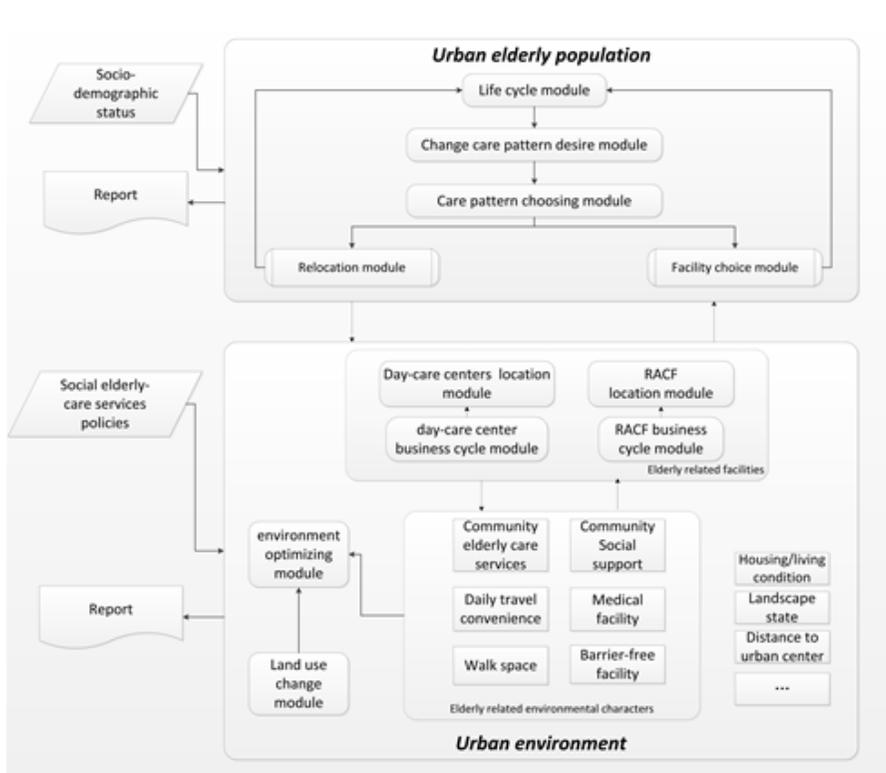


Fig. 9. Urban elderly population and environment change processes and micro simulation modules

With the Agent-based modeling (ABM) approach, there are several platforms can be used to integrate the agents, modules, and interactions, and simulate the complicated processes. The platforms now widely used are MASON, NetLogo, Repast, and the Java and Objective-C versions of Swarm. And NetLogo is the highest-level platform of them, providing a simple but powerful programming language, with built-in graphical interfaces, and comprehensive documentation.

The expected results include two parts, i.e., the prediction of senior service and the improvement of senior service provision. As to prediction, the behavior of elderly within their life cycle courses, the living environment evaluation, the probability of living arrangement change and the relocation decision-makings are imported into the corresponding modules in each simulation cycle. Consequently, aged population and service need will be forecasted. Based on this, RACF and their places are provided, and the adjustments of the aged-friendly environment in different space are conducted. Then, these changes will impact on the business cycle of facility and the whole social care system which will be regulated by government further. Therefore, focusing on the individual behavior, micro space and the dynamic change of agents, the prediction accuracy of our study will be better than prior researches.

In view of the uncertainty of various policies, we design the different policy-scenarios, which are completely different from the traditional approach---SAP (survey-analyze-plan). Therefore, we will simulate the social senior services provision accordingly, and find the suitable provision plan in long-term.

This study is one of the first studies that design a simulation framework to model the demand-supply of senior services with MAS. The findings will be a great support to the provision of elderly services facility and the environmental improvement in urban living neighbourhoods. The reasonable provision of aged service will be extremely important to the rapidly ageing society and the developing country for the reason of the limited capitals and resources. And the study approach (e.g. simulation, scenario analysis) is prominently useful to the urban planning. This study has, however, its limitations in term of the selection of agent. Actually, relatives or child of elderly play important role in the senior life, even though the impacts reduce gradually. However, we didn't program child as agent, because of the data availability. On account of cross-disciplinary studies, the diversity of urban policy, and complicated external environment, the rules and interaction of agents, and the quantitative set of the external impacting factors are difficult to be considered comprehensively, and that maybe the source of errors. In the future, these points should be further studied by us or other researcher.

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## **The Challenging Path to Urban Sustainability** *Urban Growth and Future Strategies in UAE*

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**Abstract:** The large availability of fossil fuel reserves and the flow of revenues derived from oil extraction and export, has progressively shaped the urban aspect of United Arab Emirates in the last 20 years. The initial model of undefined urban growth characterizing UAE's main urban centres until now is already showing defined limits in terms of development and resources' consumption. Assuming the Emirate of Abu Dhabi as reference, the country is having a constant population growth of about 7,5% per year since 2005, with a consequent increasing in water and energy demand of 2,5% and 3,1% per year respectively. This extraordinary growth rate is pushing the urban structures and local environment under pressure, with foreseeable implications on future resources' availability and rising concerns about sustainability. Relying on food and goods necessity largely outsourced, and energy demand still largely satisfied by hydrocarbons from local resources, UAE's urban settlements are currently embodying a development model that cannot be duplicated, or even merely pursued as it is, despite its extraordinary success as economic model for others emerging Gulf cities. Scope of this paper is to gather attention on the current UAE's urban realm and its future developments, with the aim to contribute in the discussion about the phenomenon of growing urbanization worldwide, and how to conjugate this trend with a necessary sustainability.

### **1. INTRODUCTION**

The WWF's biannual Living Planet Report compiled for the year 2008, showed an alarming increase of global CO<sub>2</sub> production associated with a rapid depletion of natural resources. Fishery, cropland, and grazing were reducing dramatically as never registered since 1970. Several factors were been considered in the report both at local and regional scale, such as Ecological footprint and Water footprint, in order to assess the impact of

human activity on the global ecosystem. The argument was if the current rate of development pursued by the global human community, intended as economic and social domain, could be considered sustainable by our living planet in long term. The following biannual reports, until the last published in 2014, reinforced these assumptions, are showing an even dull and deteriorating perspective.

At current rate of consumption, 1.5 Earths needed to meet the expected demands in term of food, water, and energy security, with unsurprisingly peaks in high-income countries. In other terms, we are demanding more renewable resources and CO<sub>2</sub> sequestration than the planet can naturally provide in an entire solar year. Practically, the global demand is overshooting planet resource's availability by the ninth month every year, reducing progressively the capability of the planet to replenish it.

Since the 1961, the global bio-capacity available per person, calculated in gha (global hectares), decreased from 3,2 gha to 1,7 gha per capita, due increasing population, changes in economies, and lifestyles (WWF, 2012).

Among these figures, UAE's Ecological Footprint is the third largest in the world with 8.4 gha per capita, despite the country itself has only 0.6 gha of bio-capacity available per person. It means that UAE's residents are mainly dependent on external resources imported from other nations to meet their needs in terms of food, goods, and services, with the sole exception of energy. This reliance expose the country to a potential risk of disruption if such resources would become more constrained in future.

Apparently, growing concerns about increasing scarcity of fundamental resources are sweeping the entire global community. The quest for a more sustainable impact of socioeconomic activities is becoming the top priority in almost any political agenda of developed countries, after decades of unsustainable exploitation of their resources. This fact seems particularly questionable when applied to developing countries, impatient to fill the gap with developed world assuming it as model to follow and repeat tout court.

On this purpose, UAE represents an interesting test bed capable to show limits and contradictions of a supposed globalized model.

## **2. URBAN SUSTAINABILITY**

### **2.1 Early Account of Sustainability**

The first quote about sustainability date back at early 18<sup>th</sup> Century, when the German nobleman and mining administrator Hans Carl von Carlowitz wrote “‘daß es eine kontinuierliche beständige und nachhaltende Nutzung gebe,’ (that there would be a continuous, steady and sustained use)”. His book *Sylvicultura Oeconomica* still considered the first treatise about

forestry, containing recommendations for a sustainable use of timber resources adopted until today.

At that time, forestry was the most important resource for energy and building material, thus a continuous and steady availability of timber was the key component for a proper social, economic, and technical development of a region. Differently by other natural resources, forest for timber production is almost inexhaustible and capable to regenerate itself when properly maintained, unless to exploit it more rapidly than the regeneration process could take place within an acceptable lapse of time.

Until 18<sup>th</sup> Century, almost any utensil, with very few exceptions, fabricated using exclusively timber, as well largely used in building construction. Easy to carve and shape, light and resistant, timber was essential component for any transportation vehicles, such as coaches, carts, and ships. Practically, timber was the quintessence of civilization and an indispensable resource in almost any human activity.

Unconcerned of a possible sudden scarcity of this resource, apparently naturally present everywhere, European populations overused it carelessly, thus at the end of the same century almost all primeval forests in Central Europe were completely depleted. As happen many times in the history of human civilization, even long time before 18<sup>th</sup> Century and in different geographical areas, an apparently inexhaustible resource dissipated shortly due an unsustainable behavior. (Diamond, 2005)

For many authors, in the millenary history of civilizations any step forward in technology was the dictate of a stringent necessity, the answer time by time to the struggle in searching for new forms and sources of energy, a way to face front to a sudden scarcity resulted by a precedent unsustainable behavior in use of natural resources apparently inexhaustible. It happen with wood as primary resource for energy marking the following step towards the intensive use of coal, then the increasing needing of energy has shifted the attentions towards oil as the most powerful and economic energy resource from the beginning of the 20<sup>th</sup> Century until nowadays.

## **2.2 Sustainability as Behaviour**

*Sustainable*, is an adjective became very popular in recent times. Often used as a label, sufficient to assign a supposed patent of environmental awareness, the term sometimes is closely-related with others similarly evocative, like green, eco-friendly, and smart.

The increasing awareness of public opinion about the fragility of the planet, associated with raising concerns about climate change, and growing scarcity of resources that could affect important sectors of industry and economy at global level, has put in the term *sustainability* more than one hope, assigning a sort of implicit miraculous power in the word itself.

Nowadays, almost every sector of human activity, with very few exceptions, is declaring to strive in pursuing the path towards sustainability, even knowing this goal is hard to reach due the current global economy system and the model of development followed until today. Almost every declaration of intent in pursuing the way of sustainable development presents detailed lists of punctual issues and goals largely sharable, but the further steps about how, when, or in what measure are often missed. The crucial point is how the idea of development, as normally intended as economic and social step forward, would be also sustainable.

The current consumption rate of high-income countries, supposed the most developed in the world, is proved to be the principal responsible of rapid depletion of renewable and non-renewable resources, other than one of the main contributors in rising carbon footprint worldwide. Despite this clear evidence, it is hard to figure out a rapid shift in environmental behaviors of richest countries, or a dramatic slowdown of their GDP, at least until the problem itself will not have reached such dimensions to become ineludible or insurmountable.

On this regard, it would be useful to recall the definition of *sustainable development* as written in the report “Our Common Future”, edited by the World Commission on Environment and Development on 20<sup>th</sup> March 1987, also known as Brundtland Commission. The report quoted that: “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs”.

This report represents a turning point in the international context, a fundamental contribution towards public awareness about the implications of environmental deterioration. For the first time, the socioeconomic development is presented with a holistic approach, as a multidimensional process which effects can affects and reflects into economic, social, and ecological levels.

Undoubtedly the need of the present, as well it was in the past and shall be in the future, is the inviolable right for everyone to be sheltered against weather, being warmed or cooled when needed, properly fed, and provided of running water. How much this purpose could be pursued in a sustainable way is another matter. The common sense usually associates with the past an allure such as a lost golden age of positive human behaviors toward the environment irremediably compromised nowadays by contemporary lifestyle. Even in the past, at any latitude and any historical period, human settlements developed at expenses of local resources immediately available, and then expanding their search elsewhere when depleted.

A continuous struggle in search of vital resources has characterized the path of human civilization on this planet, since our first ancestor raised his sight beyond the horizon. Along this path, our species has assumed the role of sole proprietor of the planet at expenses of any other living being, and treated the environment alternatively as a gigantic supermarket for our

necessities or endless landfill for our refuses. Compared to our ancestors, very little has changed in our behaviors toward the environment, except the total number of individuals and the enormous exploitation capacity pushed by technology.

For the first time in the recent human history, our generation is facing the problem of an increasing scarcity of resources, driving into a dramatic raise of inequality and a real threat for global community development as a whole. Never as before, is urgently requested an evolution of our behaviors towards the environment, and becoming conscious of the fact that increasing scarcity of all kind of resources is the sign of last threshold before collapse.

### **2.3 `Gulf Cities and Quest of Urban Sustainability**

The Gulf Cooperation Council area (GCC, formed by Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates) is one of the most urbanized areas in the world with 70% of resident population living in urban areas, reaching peaks of almost 100% in Kuwait and Qatar. The region, characterized by hot-arid climate, is also one of the most harsh and dry on the planet, with very scarce water resources and limited cultivable land suitable for intensive agriculture. In spite of these unattractive climatic characteristics, the area is having one of the higher urban population growth rate in the world, despite a relatively modest total population growth rate of 1-2% in the entire region.

The urban population is concentrated in few urban centres along the coastline of Arabian Gulf, Red Sea, and Indian Ocean. The only exceptions are represented by urban populations concentrated in Saudi Arabia's capital city Riyadh (pop. 4,848,000), and the holy cities of Mecca and Medina (pop. 1,484,000 and 1,104,000 respectively), placed inland of the Arabian Peninsula (UN-Habitat, 2012).

Fast urban population growth is therefore one of the main concern of local agencies, requiring a continued urbanization to face front of housing demand, and upgrade of service infrastructures to satisfy the rising level of water and energy consumptions. This implies also a constant refinement of planning and urban management tools, in order to avoid chaotic urban development and dissuade unregulated building activities.

Almost all countries in the region adopted different spatial development strategies in order to manage urban growth, and most of them are shifting further development toward secondary cities. The purpose is to lighten demographic pressure on main cities and in some cases, notably Bahrain, Saudi Arabia, and Kuwait, extend the availability of areas suitable for building construction even through reclaimed land and creation of new infrastructural corridors (UN-Habitat, 2012).

Enforced by oil revenues, and strengthened by national GDPs constantly in growth even during the last global financial crisis, the ruling authorities of GCC countries seem firmly intentioned to pursue the path of urban expansion as a driving tool for further socioeconomic development.

Born as modest economies based on semi-nomadic livestock rearing, fishery, and local trading, the wealth of GCC countries grew enormously after oil discovery, boosting a fast urban and infrastructural development still in process. The recent years, saw a further diversification of these originally oil-based economies with GDP's share increasing significantly on information technology, telecommunications, financial services, knowledge-based activity, real estate, and tourism sectors.

Notably, UAE launched a programme of liberalization in order to grow non-oil sectors, with the aim to diversify its economy attracting knowledge, advance-technology investment, and professionals. Tourism, real estate, and construction are the sectors that benefitted mainly of such programme, recently pushing UAE among top destinations in the world for travel tourism and real estate investments. Most of economic activities are currently concentrated in Abu Dhabi, the capital city of UAE federation and the Emirate with largest oil reserves, and Dubai, the Emirate already known for its openness to international trade and multi-cultural environment.

### **3. URBAN DEVELOPMENT IN UAE**

Since its constitution in 1971, the UAE federation put massive urban, agricultural, and infrastructural modernization as top priority in its agenda. In few decades the unified country rose from an early condition of seven independent and underdeveloped Sheikdoms into what considered nowadays one of the most advanced country in the Gulf, and second largest and diversified economy in the entire GCC. Scarce in water resources and land suitable for intensive agriculture, most of the initial efforts addressed to boost these sectors in order to set the platform for further social development.

Simultaneously, a massive urban development program took place, with a focus primarily on transport and energy infrastructures as necessary framework. In less than two decades Abu Dhabi and Dubai, the two main urban agglomerations, changed completely their size and aspect, from small coastal towns of local traders and fishermen, into modern and vibrant growing metropolis.

#### **3.1 Three Stages of Urban Modernization**

With the aim to better understand the chronological transformation sequence, which has led to the current form of UAE's contemporary cities,

and the aim of identifying possible corrections and strategies for future sustainable development, the authors of this paper individuated three main turning points in the historical timeline of urban formation, or what we have called *stages of urban modernization*. Around them, economic, social, and consequently urban frameworks received a contributive impulse towards a further step of development. Among the many initiatives and directions of development assumed in the past, and still worthy of note, some have proved to be effective in the short term only, or later revealed to be functional to the achievement of a single goal, but at unsustainable expenses of other resources.

As recalled in the first part of the paper, the initial conditions of urban development in the Gulf region set out from an area whose environmental and climatic characteristics have always limited the development of human settlements with characteristics of stability. Unlike other areas of the Middle East, the few urban settlements present in this area until the 19<sup>th</sup> Century did not develop their own local urban tradition, importing methods and construction practices from neighboring countries with which they had business relationships. Dubai, for example, by the end of the 18<sup>th</sup> Century had focused its economy on pearl fishing and sea trade with Iran and India. The presence in the city of traders' communities from these countries, brought with them building traditions originate from their countries of origin, such as the wind towers from Iran to cool and ventilate residential houses, adapted to the availability of materials on site such as gypsum, coral rocks, palm leaves, acacia wood, and rammed earth.

Other tribal communities present in the area from ancient times had developed their settlements in territorial areas definitely more favorable for agricultural and pastoralism development. As example, the tribal community originating from the oasis of Al Ain, placed inland at foot of mountains at border with Oman and benefitted of groundwater reserves, migrated towards the coast only in a later stage, establishing the first settlement of what would later become the city of Abu Dhabi.

### **3.1.1 The First Stage (1960-1970)**

The first stage of modernization took place at the beginning of oil era in the region. Starting from early 1960s – the first cargo of crude oil sailed from Abu Dhabi port in 1962 - the original existing urban structures wiped out almost completely, with a massive replacement of old buildings, made of ephemeral materials, with a new generation of reinforce concrete buildings. The growing revenues following oil discovery in the Sheikdoms of Abu Dhabi and Dubai independent at time, supported the financial expenditures necessary to shape the early stage of these emergent oil-based economies.

During this period, characterized by a growing interest from international oil companies and operators, the urban imperative was *replacement*. The main urban frameworks were put in place at expenses of the old city that lose its appearance with massive demolitions and reshaping; almost all traditional architecture existing in the main coastal towns, except very few remarkable examples, disappeared to be replaced by standardized urban buildings. This early attempts of urbanization marked in many aspects all following stages of urban development, adopting road-centered planning largely derived by western examples.

Urban orthogonal grid became the distinctive common trait, facilitated by flat geography typical of desert coastlines. It is particularly important to note that same period witnesses a profound transformation of almost unaltered urban structures until then. In retrospect, we can say that here, as elsewhere, a precious heritage made of old consolidated vernacular building traditions, which would be able to suggest new directions for sustainable development, was deleted irretrievably.

This early replacement of the old underestimated urban structure, judged inadequate for a development centered on rapid mechanization, marked a sudden shifting in spatial organization and perception of the urban settings. From dense, introverted urban settlements, with narrow circulation spaces between low rising buildings arranged around enclosed courtyards, as typological response dictated by harsh environmental conditions like many other urban settlements in the Middle-East, they were transformed into extroverted settlements of urban plots, surrounded and permeated by roads, suitable for the massive arrival of a new generation of transport vehicles.

### **3.1.2 The Second Stage (1971-1990)**

The second stage coincided with the establishment of UAE federation in 1971. On 2<sup>nd</sup> December, the seven Sheikdoms of Abu Dhabi, Dubai, Sharjah, Fujairah, Ras Al Khaima, Umm Al Quwain, and Ajman formed a union under one flag and one constitution. As new country in the international context, with a strong ascending economy and leading political role in the Gulf area, the newly born federation concentrated its first efforts on building an internal organization centered on development agenda, adopting the most advanced institutions in the world as benchmark.

The mastermind behind the plan to unite seven almost inconsequential micro-states, divided by ancestral times, into modern, politically and economically influential country, is undoubtedly represented by H.H. Sheik Zayed Bin Sultan al Nahyan, founding father and first President of UAE. In his vision, the subsequent economic and social development would have to be preceded by a substantial increase in the quality of life for the existing population and fundamental basis for future generations.

The environment was one of the main objectives, both in term of food production and protection as well. The agricultural capacity increased through extraordinary efforts transforming desert areas into land suitable for plantation and afforestation. During his ruling, almost 100 million of trees planted, irrigation techniques from groundwater resources developed in remote areas, and latest desalination plants installed along coastlines in order to improve existing and future urban settlements.

Cutting edge technologies for irrigation, sewage and farming adopted, hunting banned to protect bio-diversity, and protected areas for endangered species, such as the Arabian Oryx and sand gazelle, established. Thanks to these initial efforts, UAE alone is capable today to produce 20% of date's palms in the world, and the Abu Dhabi Emirate - the largest in territory extension compared to remaining six other Emirates - is recipient of extensive terrestrial and marine protected areas (14.6% and 13.5% respectively). Creation of a solid social welfare also received similar efforts and substantial investments, literacy rates increased and overall health of resident population improved in few years.

It is the golden period in UAE's urban history, dominated by the word *expansion*. It is the period also dominated by an intensive use of fossil resources, largely available more than groundwater resources, but also responsible of the constant rising in carbon footprint of the country from this time onwards. Oil extraction and petrochemical manufacturing represented the largest part of GDP and main financial asset to sustain the massive development effort.

From a poor past of rural economy, starting from this period the country assumed a character decisively urban, extending the road network and creating the main framework for further, urban development of an oil-rich country.

### **3.1.3 The Third Stage (1991-2013)**

The third stage represents a recent shift in country's economy, also called post-oil era. The booming growth that characterized the previous period had lost the momentum characterized by the urgency of a rapid development, to settle the pace towards consolidation of started initiatives.

As the peak of production of its oil reserves is approaching, the Emirate of Dubai started about ten years ago a process of economic diversification, in order to compensate the expected progressive decline in the local GDP of the share percentage in oil production. Considerable efforts in economic planning diverted towards tertiary economic sectors, primarily financial, trade, and tourism. Since 2006, the Dubai Stock Exchange is operating in synergy with London Stock Exchange, rising the reputation of the city as influential key indicator for the economy in the Gulf and the region.

Large amount of investments interested the sector of hospitality and tourism-related activities, including a strengthening of the airport and its Dubai-based airline Emirates, realization of mega-malls and tourist destination as amusement parks, and centers dedicated to entertainment.

The two challenging master plans *Palm Jumeirah* and *The World*, managed by the master developer Nakheel and realized through massive cutting edge reclaiming technologies, doubled the coastline length of Dubai and catapulted the city on the front pages of travel magazines, architectural and engineering reviews, and on economic news. The extraordinary and largely publicized performances of the dynamic Emirate attracted the interest of investors and speculators, other than tourists and professionals, as well as rising reasonable doubts about long-term sustainability of this massive construction boom. The opening of trading free-zones open to foreign investors, and permission for foreign stakeholder to invest in local real estate sectors, fueled a speculative bubble in the late 2008 accompanied by unprecedented booming in building construction, overtaking Abu Dhabi in number of residential units and construction sites.

The global financial crisis of 2009 has delayed many of the urban development projects that should have set off in the same period, and some have been permanently deleted, but they have not been resized. With the announcement in the early 2013 of the choice of Dubai as host city for the next Expo in 2020, these projects have taken new force and have been joined by others, in anticipation of the extraordinary opportunity to host such a world stage.

The remarkable aspect characterizing the second half of this latest stage of modernization, certainly represented by a new environmental awareness widespread in agencies and offices responsible for the development, in policymakers, and decision-making circles. The environment is newly perceived as asset and resource, and its care and maintaining as long-term investment.

#### **4. FUTURE STEPS AND CONCLUSIONS**

The urban dimension of environmental issues is apparent. This is particularly evident in a country such as UAE that has witnessed a rapid growth of urban agglomerations compressed in a short timeline.

Despite remarkable efforts set by government agencies in order to reduce energy and water consumption, enhance renewable energy resources, and foster eco-friendly practices through educational programs specifically addressed, the environmental impact of urban and rural settlements seems don't know any remarkable mitigation, especially regarding increasing water depletion and energy consumption. Many of the current issues are the long-term effects of some of the early strategic decisions, assumed in the past

to face front an immediate necessity, and compatible with the circumstances of that time, but requiring now an urgent re-visitation.

Between them, one of the main issues affecting the path towards a sustainable urban environment represented by mobility.

Currently, UAE is one of the most motorized country in the world. Car ownership ratio in Dubai, as example, is 541:1,000 surpassing those of London (345:1,000), and New York (444:1,000), resulting as the most congested city in the Middle-East, with losses caused by congested traffic of US\$1.3 billion, equal to 3.2% of its yearly GDP. As quoted in UN-Habitat's *State of the World Cities Report 2012-13*: "Over the past two decades, the Arab region has witnessed phenomenal growth in motorization. In 2008, the total number of motor vehicles reached 26.7 million –having grown at an annual average rate of 4.2 per cent between 1997 and 2008. The region features one of the highest ratios of vehicle ownership in the developing world. Factors behind this trend include the affluence occasioned by the region's oil-driven economic boom, strong preference for private cars, subsidized fuel, greater availability of car finance and lack of effective public transportation".

As one of the first improvements that took place immediately after UAE federation established, road infrastructure became the driving force for rapid development, interconnecting the growing urban centers and facilitate commerce and exchanges. Road networks in UAE are currently the most capillary and well maintained in the region, but despite massive investments in order to keep it constantly upgraded, these are almost ineffective in keeping pace with rising number of private vehicles.

In order to reduce traffic pressure on urban road infrastructure, Dubai Emirate launched the first mass transport system in the region, inaugurated on September 2009 with opening of the first Dubai Metro line of the three expected when fully operational. Dubai Metro represents the first step in construction of an efficient urban public transport system, integrated with tram and bus lines, expected to reduce of 30% the number of private cars.

The experience provided by the first experiment represented by the Dubai Metro, fueled the interest of other local and regional agencies, responsible for land use planning and transport development. Immediately after Dubai, also the municipalities of Abu Dhabi, Doha and Jeddah have developed plans for metropolitan public transport, both on surface and underground, to be realized within 2020.

Thought and planned long ago, but never actually passed beyond the concept stage, recently also the railway link project between the GCC countries took new consistency. The project Etihad Rail will consist of a 1,200 km network that will extend across UAE, from the border of Saudi Arabia to the border of Oman.

As stated in the official Etihad Rail website: "The network will run from Ghweifat to Abu Dhabi, Dubai and the Northern Emirates with major

connecting points in between, including Al Ain and Madinat Zayed. Etihad Rail will have an extensive national network with freight terminals, distribution centers and depots located close to major transport hubs, warehouses, and storage facilities across the UAE, including Mussafah, Khalifa Port, Jebal Ali Free Zone, Port of Fujairah and Saqr Port. The Etihad Rail network will also connect with the GCC network and this - once fully established - will cover the five GCC countries of The Kingdom of Bahrain, The State of Kuwait, Oman, Qatar, The Kingdom of Saudi Arabia and UAE". The project is currently in construction process, on mid 2014 have been realized and tested 264 km of railroad from the western outskirts of Abu Dhabi towards Ghweifat, at border with Saudi Arabia, and currently for freight. Other 628 km are expected to be realized within 2017 and additional 279 km on 2018, for a total of 1,171 km of railway ready for passengers and freight.

The endemic scarcity of water resources, characterizing the entire region, represented and still represents the first and foremost challenge for policymakers, planners, and stakeholders.

As stated in water consumption reports, in 2005 have been consumed about 4,180 Million cubic meters of water: 60% destined to agriculture (2,508 Million cubic meters), followed by 25% in domestic consumption (1,045 Million cubic meters), 9% in industry sector (376 Million cubic meters), and finally 6% in landscaping (251 Million cubic meters)

The UAE listed by the United Nations as a high-rank country when it comes to water stress, a situation which occurs when the availability of water is not in balance with demand. While resources are limited and in rapid depletion, UAE is keeping one of the highest water consumption rates in the world. The Dubai School of Government reported in 2011 that: "The luxury lifestyle and lack of conservation measures amongst residents has resulted in high levels of water usage and waste. It has been reported that in the UAE, per capita water usage is 550 liters per person per day, as compared to a global national average of 250 liters per person each day. In addition to increasing supply through desalination, there is widespread realization at political level that water management is required for further successful development of the country. Future water stress might be caused by continuous increase of water demand due to population growth, higher domestic water use, and policy decisions regarding irrigation of the agricultural and landscape amenity sectors."

Literally grabbed from desert, the widening of cultivable land for agriculture was one of the greatest achievements of the newly born UAE, but at expenses of an intensive exploitation of already scarce groundwater resources. The capability of aquifers revealed soon to be inappropriate for intensive agriculture and programmed urban expansion, then a massive use of desalination plants represented the only viable solution.

Energy intense desalination plants represent today 15% of CO<sub>2</sub> emissions in Abu Dhabi Emirate, a remarkable contribution in carbon footprint produced by UAE, and one of the main environmental concern of the entire Gulf area. Almost 52% of desalinated water produced in the world is concentrated in the Gulf countries, and for most of them represents the only water resource available (Economic Review, 2015).

The large amount of energy needed for desalination process, and substantial contribution in carbon footprint, is not the only environmental concern. The desalination process includes also the collateral production of thousands cubic meters of brine, that cannot be stored and are discharged in the same Gulf waters, with a consistent contribution in rising water's salinity with a consequential impact on the entire marine environment.

Therefore, desalinated water is a very precious resource, representing a high cost in terms of energy, subsidized costs, and environmental impact. Standing the rapid depletion in groundwater resources, even recycled waste water for irrigation is a precious resource, and several governmental initiatives are currently addressed in this direction.

Based on estimation dated in 2011, the UAE ranked at 26<sup>th</sup> place in the world with a gross production of 245,400,000 metric tons of CO<sub>2</sub>/yearly, after Netherlands with 253 million and before Singapore with 212 million. If considered the CO<sub>2</sub> emissions per capita produced globally, things radically change: UAE jump at the 4<sup>th</sup> place with 47.66 mt/capita, after Qatar with 76.01 mt/capita, and before Singapore with 44.80 mt/capita.

Definitely, UAE resident population have a huge carbon footprint, largely depending by use of fossil resources to produce the necessary amount of energy for their current lifestyle. As per 2010 Report of total electricity consumption in the world, UAE ranked at 33<sup>rd</sup> place, with a gross consumption of 85,170 million of KWh/year. When considered the consumption per capita, UAE is jumping to the 4<sup>th</sup> place in the world with a consumption of 17,118 KWh/capita per year.

Since 1991 until 2010, UAE's power generation capacity has quintupled with an average growth in demand of 8.5% per year, to reach current generation rate of 24.9 GW. Considering industrial districts in UAE are not currently capable to drain huge quantities of power for industry processes, would be reasonable to assume that the majority of power consumption addressed to air-conditioning, water transformation (i.e. desalination plants) and housing services. Huge investments have been dedicated to alternative resources, including renewable solar, wind, and nuclear energy, with the scope to reach 30% of electric power generation from non-fossil resources within 2020.

Due harsh climatic conditions, urban settlements in UAE are characterized by sealed building envelopes heavily air conditioned for most part of the year. Consequently, urban agglomerations are voraciously energy intensive, with almost 60% of electrical capacity absorbed by residential and

commercial buildings, in large part used for chillers and fan-coil units to compensate inefficient building envelopes.

UAE is seeking to be one of the leaders of Sustainability and Energy performance in the world, but although these strong efforts in introducing several new policies and rules in order to allow more efficient and sustainable building design, the old existing building stock seems to remain out of the scope. In a recent past, the high cost correlated to energy retrofit and integral retrofit technologies, compared to the cost for new construction, has represented the main obstacle and often the only reason to decide the demolition and reconstruction, instead to retrofit the existing edifice. Huge amount of energy are required in demolition and reconstruction processes, without consider the amount of energy embodied in the existing structure as account of energy invested in early construction and irretrievably lost with its destruction. Nowadays, a new generation of building technologies and materials specifically developed for this task can allow transformation from existing buildings with poor energy efficiency into new models of sustainability at reasonable cost and low impact on environment in terms of carbon footprint and waste production.

More recently, even governmental agencies in UAE are considering the option of retrofits existing buildings as viable solution to keep energy consumption and carbon footprint within sustainable limits. The municipality of Dubai launched at end of 2014 the DIES2030 program (acronym of Dubai Integrated Energy Strategy), with the target to retrofit 30,000 existing building within 2030, mostly of them already mapped, with an expected amount of 1.7 TW/h of energy, and 5.6 IG billion of water saved per year.

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NO.

## **Smart Cities and Urbanization**

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**Key words:**

**Abstract:**



NO.

## From Idea To Action: Practice and Thinking of Community Development and Community Planning in Chongqing

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**Key words:** Community development, Community planning, Community empowerment, Public participation, Planner role, Chongqing

**Abstract:** Entering the New Normal era of emphasizing on "people first" and "internalized development", Chinese urbanization process is stepping to shift from "incremental construction" to "stock management". Therefore, a new viewing angel is called for to respond the new period while the urban development would be characterized by the slogan of "back to daily life" and reviewing the problems of urban construction in community scale. Taking Chongqing Yuzhong sub-district as the example, "community development" is a quite new word. In 2010, Yuzhong local government improved the regional action of Community Environmental Renewal and finished by the end of 2011. Then, Yuzhong sub-district entered the phase of urban community development. Based on five research and practical projects of community development during 2010-2015, this paper reviews and analyzes the process of the community development and community planning of Yuzhong sub-district, which reflects the vapid transformation of the demand of urban development in one hand, and that of the planning from the traditional spatial planning to comprehensive social one in the other. Through the comparative analysis of key issues, planning object, planning idea, planning strategy, planning method, public participation and planning characteristics, according to the real stock condition and development orientation, this paper proposes starting with community daily life, utilizing the community development planning platform, and striving to realize idea transformation and action innovation, in multiple aspects such as new ways of knowledge production, community development planning content, community management participation, planner role and education.



**Urban and Rural Industry &**  
**Tourism and Recreation**





NO.10

## The Hybrid Shopping Process of Search Goods and Experience Goods: Book and Clothing Purchases in Northern California

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**Key words:** Internet shopping , e-shopping , travel behavior , shopping channel

**Abstract:** Several scholars have studied the relationships between e-shopping and store shopping. The growing interest is not surprising given the proliferation of e-commerce in retail businesses and its potential impact on transportation systems. Shopping trips account for a substantial proportion of the total number of daily vehicular trips, and if, as many expect, online purchases can substitute for traditional shopping, this channel could provide a way to reduce personal shopping trips.

Previous studies concluded that e-shopping may replace or induce physical shopping trips. The studies overwhelmingly focused on e-shopping and store shopping as a transaction channel: how do online sales of particular products impact sales of the same products or other products at traditional stores and hence the corresponding physical travel? However, they ignored communication channels which allow consumers to be aware of a product and to acquire product information from retailers.

Conventionally, most shopping activities occur at brick-and-mortar stores on a single visit. The internet alleviates spatial and temporal constraints of shopping activities. The spread of internet communication and transaction channels complicates the conventional shopping process. For example, an individual may become aware of a product when browsing the internet, then go to a local store to try the product, and finally purchase the product via the internet. In this hybrid shopping process, although internet purchasing substitutes for travel to the store for purchasing, it generates trips for product trial. Therefore, internet purchasing does not offer net benefits for personal trip reduction. However, previous studies seldom examined the shopping process and hence ignored the travel demand resulting from the hybrid process.

Individuals' shopping process may vary based on the types of products. Researchers have distinguished two types of qualities of a product: search

qualities and experience qualities. Search qualities refer to the traits that consumers can fully ascertain prior to use, while experience qualities indicate those that cannot be determined until using the product. A particular product may possess both search qualities and experience qualities. If search qualities dominate the attributes of a product, such as software, it is called a search good. Conversely, if experience qualities of a product, such as apparel, outweigh its search qualities, it is called an experience good.

Using a 2006 survey of about 960 internet users in Northern California, this study decomposes the shopping process of products into four stages: first awareness of the products being purchased, information search, product trial, and transaction. We focus on the interactions between two shopping media: traditional store and internet, and compare two types of products: search goods (book/CD/DVD/videotape) and experience goods (clothes).

We find similarities and differences between search goods and experience goods through descriptive analyses. First, internet is the most important pre-purchase medium for internet buyers. For store buyers, traditional stores are the most important pre-purchase medium for experience goods, but not for search goods. Second, first awareness through internet is more likely to promote trans-medium transactions than first awareness at store. For experience goods, information search through internet is more likely to be associated with trans-medium transactions than information search at store, but this is not true for search goods. Product trial through internet is more likely to be associated with trans-medium transactions than product trial at store. Third, first awareness and product trial of search goods are more likely to generate trans-medium transactions than first awareness and product trial of experience goods. Last but not the least, internet purchases of experience goods generate more information search and product trial trips than do those of search goods.

Binary logit models confirm that for both search goods and experience goods, pre-purchase stages in store had more important impacts on the choice of transaction channels than those through internet. Therefore, to promote online buying, retailers should enrich shoppers' online shopping experience, especially for experience goods. On the other hand, pre-purchase behaviors through internet were more likely to facilitate shopping medium mixing than those at store. Because of the changes in shopping media in the shopping process, first awareness through internet generates shopping demand and hence store trips. However, information search and product trial through internet may or may not generate new trips because store buyers may get the online information at store. Therefore, for the sake of trip reduction, store retailers should provide free WiFi service to enable shoppers' online information search/trial when people shop and facilitate shoppers to complete their hybrid shopping process with a single trip to the store.

In conclusion, although e-shopping replaces some personal trips to traditional stores, it stimulates new shopping demand. It also generates trips to traditional stores for information search and trial. The share of internet buyers who travel in the shopping process is nontrivial for experience goods.



NO.24

## **Exploring the politico-cultural dimensions for development of smart cities in India**

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**Key words:** Smart city, cultural theory, urban governance, environment challenge, socio-economic challenges

**Abstract:** Indian cities are seemed to be in transition regardless of the various sustainability challenges faced by them in recent years. Globalisation, market economy, and technological developments have brought economic, social and infrastructural advantages. However, population growth, proliferation of urban functions, insurmountable increase of size of cities, and environmental crises because of climate change has made the cities face severe spatial, infrastructural and environmental ailments. Besides, the significant rise of Information Technology (IT) industries in the cities and their socio-economic and spatial influence has brought about inequitable development. At this juncture development of a political will to build smart cities in India provides a new impetus for changing the planning perspectives and warrants a politico-cultural discourse to examine the prerequisites and paradigms, which could aid in development of smart cities in India. Drawing upon the eclectic mix of past experiences and prospective approaches across the world discussions with experts in the political science, local governance and urban development, this explorative paper provides a discourse on the concept of smart cities, opportunities, challenges and the way forward to realise the goals of smart city development in a heterogeneous but democratically unified country like India. Based on the discourse it is argued that the current urban governance system is not congruent for development of smart cities in India. Therefore, it is advocated that a cultural theory inspired politico-cultural mechanism be crafted and explored to assemble the requisite elements of urban governance system, that should enable the dynamics and cohesion needed for developing smart cities in India.

## **1. INTRODUCTION**

Majority of Indian cities are seemed to be in transition because of the changes in global economic and technological scenarios. Certain phenomena like globalisation, adoption of market economy, technological developments, particularly in Information Communication Technology (ICT) sector and consequent shifting in the industrial economic scenarios (like ICT and service industry have become more predominant than conventional industries) have brought some economic, social and infrastructural advantages in the cities. However, concurrently there have been severe sustainability challenges experienced. For example, population growth, proliferation of urban functions, insurmountable increase of size of cities, and environmental crises because of climate change has made the cities face severe spatial, infrastructural and environmental ailments. A concern is increasingly growing among the common men and professionals alike that whether the cities of India will remain functional and contribute to the socio-economic development of the country effectively or degenerate and bring misery to people. At this juncture development of a strong political will to build smart cities in India offers new challenges to planners and as such provides impetus to change the planning perspectives.

Urban development is considered by many as mostly a physical and spatial challenge, although some also combines it with socio-economic challenges to certain extent. Yet, it is equally a political and cultural issue in a large and diverse country like India. The democratic set up of governance has offered a political platform, which is perhaps the single most dominating factor that decides the fates of cities in India. The mammoth diversity that exists in the country in the form of race, religion, caste, class and socio-economic inequality, varied culture, etc., adds another dimension to the challenges. Thus, the political and cultural issues can not be kept away while deciding new paradigms and evolving policy interventions for developing urban areas particularly smart cities in the country. Thus, this scenario warrants a politico-cultural discourse to examine the prerequisites and paradigms, which could aid in development of smart cities in India. Therefore, the objective of this explorative paper entails to the examination of the challenges of development of smart city development in India; and to proffer a politico-cultural discourse for engagement and participation of different social solidities to realise the goals of smart city development in a heterogeneous but democratically unified country like India. The article follows an argumentative discourse drawing upon the eclectic mix of past experiences and prospective approaches across the world available in the literature as well as discussion with experts and stakeholders involved in the field of urban development, political science and local governance. The discussions with the various experts and stakeholders were conducted through semi-structured interviewing, which encompassed over 47 people

belonging to political science, local governance, urban development and industry. The respondents were selected purposively through snowballing approach in order to get wide range of opinions and perspectives. Based on the discourse it is argued that the rationale behind developing smart cities in India is not explicitly defined, the current social and morphological characteristics of the cities and governance system for development of cities are not congruent for development of smart cities in India. However, a cultural theory inspired programme be crafted and explored to assemble the requisite elements of urban governance system, that should enable the dynamics and cohesion needed for developing smart cities in India, which could also help in achieving long term sustainability of such cities.

## **2. CHALLENGES OF DEVELOPMENT OF SMART CITIES IN INDIA**

### **2.1. Challenges against the rationale behind the development of smart cities in India**

An enthusiasm is clearly visible among the political, business leaders and professionals alike regarding the development of smart cities in India. Perhaps, the idea of building smart cities in India is emanated from the current poor plight of Indian cities and visual experiences some of the European, American and of late Asian cities provide. It is perhaps thought that if countries across the world could able to build such cities, why India should fall behind. However, as indicated earlier, developing cities in India is more or less political decision than any other rationales<sup>1</sup>; the hapless professionals like urban planners do not have a choice than jumping the gun to comply with the political decisions<sup>2</sup>. However, experiences have shown that many things have gone wrong in the past, if not well conceived and not well comprehended at the outset. For example, the case of ambitious programmes like Provision of Urban Infrastructure in Rural areas (PURA) (Ramesh,2012; Indra. 2012) and various urban development and renewal schemes, which have met with failures or in some cases mixed successes<sup>3</sup>; although people advocating such programmes and schemes, the decision makers and the executive authorities differ to this view point. However, the results are clearly visible from the plight of the cities in India, which are

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<sup>1</sup> Expert opinion obtained from discussions with Chief executives and councilors from Municipalities of Odisha State, India

<sup>2</sup> Urban planner from Urban Development Authorities of Odisha

<sup>3</sup> Urban planners from Development Authorities of Odisha and Maharastra and expert opinion

facing severe spatial, infrastructural and environmental challenges. So, there is a need to explore how success in development of smart cities can be achieved, which essentially needs a discourse eliciting the challenges of building smart cities in India, and evolving of a politico-cultural perspective that can be considered while considering building of such cities in India.

A few important questions emanate on this discourse. What is a smart city, what does it entail to? What is it really intended at in India while deciding to build such cities- like whether to transform some of the existing cities to smart cities or build new cities, which should be smart? And, for whom these cities should be built and what implications they will have on the country as a whole or on individual entities like people, society, economy, built environment, and so on? The answers to these questions perhaps would be able to provide directions that are essential for developing smart cities in India.

Elucidating smart city reveals that there are no cities as such built until now with a particular programme or intention to make them smart. It is obviously a recent phenomenon, where it was observed that certain characteristics of some cities are better performing than the others and certain aspects are more functional than the others. There is no exact way to define a smart city, although certain characteristics and indicators have been identified. The concept is emanated from Europe, particularly in the early 21st century. As per the policy vision of European Union for developing smart cities in Europe, it is derived from the combination of concepts of the Connected city (smart logistics and sustainable mobility), the Entrepreneurial city (economic vitality), the Pioneer city (social participation and social capital), and the Liveable city (ecological sustainability) (Nijkamp, and Kourtik, 2011). It is not considered in a holistic manner rather with reference to various aspects, which range from ICT (Digital) districts to smart populace in terms of educational level. Indicatively, use of modern technology in everyday urban life, which includes innovative transport systems, infrastructures and logistics as well as green and efficient energy systems are often integral part of a such a city. Further, a strong relationship observed to exist between city government and citizens in terms of good governance. Additionally, certain other factors of urban life associated with such types of cities are participation, security/safety, and cultural heritage (Giffinger et al., 2007; Komminos, 2002; Lombardi 2011; Shapiro, 2008). To sum up, as Giffinger, (2007) pointed out that, it is a well performing forward-looking city (middle size) built on the smart combination of endowments and activities of self-decisive, independent and participative responsive citizens (Giffinger, 2007) having a number of important dimensions, which includes smart economy (related to competitiveness), smart mobility (related to accessibility and connectivity); smart environment (related to natural resources); smart human capital (related to people); smart living (related to the quality of life) and smart governance (related to participation) (Giffinger et al., 2007; Komminos, 2002; Lombardi 2011;

Shapiro, 2008; Van Soom, 2009). These six dimensions are observed to be based on theories of regional competitiveness, transport and ICT economics, natural resources, human and social capital, quality of life, and participation of citizens in the governance of cities (Lombardi, 2011; Komminos, 2002; Giffinger et al., 2007; Shapiro, 2008; Van Soom, 2009). However, there is not a single city available in the world, which can absolutely be considered as a smart city. For example, if a number of Scandinavian as well as Dutch cities and Luxembourg are better in creating smart people; Austrian cities are very good in smart governance. Smart mobility is very good in cities from Benelux countries and Denmark. French, Slovenian and Greek cities have done very well in smart environment, although have not performed so well in the other smart characteristics. The smart living condition is lead by Austrian, Belgian and Finnish cities as well as Luxembourg (Giffinger et al, 2007). Luxembourg, which is considered as one of the top ranked smart city have performed very well in smart economy, smart people and mobility, however, it is average in smart governance, and smart living while is poor in smart environment, although on aggregate it performed much better than many of the similar cities in Europe. The examples of these cities shown that none of them have been build with a particular aim to make them smart; neither they have become absolutely smart. Rather policy interventions based on their potentials have made them more functional and better performing in one or more of their characteristics, which is articulated as smart.

In Indian context, there is a need to examine what it is exactly aimed at, while trying to build smart cities. Is it to transform the existing cities or part of cities to smart cities or build absolute new cities improving all or one or more characteristics? In both cases, while transforming the existing cities to smart cities or building new smart cities, the challenges to be faced are plenty. In case of exiting cities, broadly the morphology of the cities, huge population, the spatial extent, and heterogeneity in urban functions are the barriers in transforming the cities to smart cities. Rather, if one or two aspects are made better or more functional, depending on the potential the cities have and opportunities they offer, perhaps some success may be achieved. For example, cities which provide opportunities for entrepreneurial activities or educational or communicational activities (ICT industry development) like Ahmadabad, Pune, or Bhubaneswar could be transformed to entrepreneurial or pioneer cities. Cities like Pilani, Kharagpur, Roorkee, etc., which have a very strong presence in education and knowledge based activities can be transformed to cities with smart people and so on.

The other aspect is, whether the idea is to build new smart cities. Then, the questions arise are what is the motivation behind building such cities at a huge expense, when the existing cities need more attention. Further, for whom these cities are to be built; who will be benefitted; what kind of cities they will be; who will invest and what will be their implication on the society and so on. For example, if digital connectivity (ICT connectivity) is taken as

the sole consideration to make the cities smart, then digital cities will be built, which is far away from the concept of smart cities. Besides, there is no distinct requirement to make a few cities digitally connected, as digital connectivity is not necessarily bound by spatial boundaries. Rather, there is a necessity to digitally connect the whole country. Secondly, creating a few advanced buildings- more recently known as green buildings, eco-friendly buildings, energy efficient building and similar along with digital connectivity and using it for specific purposes in a specific area can not be counted as development of smart cities. Besides, developing new cities in proximity to existing large cities like satellite cities with all modern infrastructures and using it for specific purposes may not serve the purpose. The reason are: with the fast expansion of cities, which is being witnessed over last decades, these new developed areas will soon be engulfed by the existing cities and get assimilated with them; and further the unequal infrastructure development may create disparity among different areas of the existing cities. So, building new cities or transforming a part of the city with digital connectivity and advanced buildings does not make a city smart. On the contrary, it may create spatial, infrastructural and environmental inequality, and add unwarranted pressure on the existing built environment, which may compromise the sustainability of both the new and existing cities. Further, it requires investment, a lion share of which is likely to come from public exchequer and from common tax payers. However, only a few people or entities like enterprises, and corporate sector will get benefitted at the expense of the common people<sup>4</sup>.

## **2.2 CHALLENGES OF THE PREVALENT GENERAL CHARACTERISTICS OF INDIAN CITIES**

There is a need to examine the general prevalent characteristics of Indian cities and understand if they could suffice to the six mentioned characteristics on which development of a smart city rest. Most of Indian cities regardless of their size and character have some economic functions. However, barring a very few cities, most of the cities lack innovation, entrepreneurship, trademarks, productivity and flexibility of the labour market as well as integration in the national and international market<sup>5</sup>. Although, many medium and large cities of late boast of higher education system and the level of qualification or education of the people have been enhanced, yet they lack quality and

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<sup>4</sup> Expert opinion: Consultants and academicians involved in urban development

<sup>5</sup> Expert opinion: Consultants involved in urban development and members from Chamber of Commerce, India

employability (Aspiring Minds, 2010; Sarkar and Choudhury, 2014). There are some social interaction and integration but it is quite sporadic and sectoral, which is evident from intolerance and unwarranted communal happenings in the city life over the years. The participation of people in public life and the receptive attitude and openness towards the outer world is very limited<sup>6</sup>. These features of the cities indicate towards lower level of smartness of the urban population in the country. The 73<sup>rd</sup> and 74<sup>th</sup> amendment of Indian constitution enabled for governance by people at the local level. It entails for facets of political participation, services for citizens and the functioning of the administration. However, it is observed that the local governance been limited to political processes by political leaders and executives and the will and wishes of the majority of the citizens are grossly being neglected. The local governance has become a tool for personal benefits of unscrupulous politicians, greedy business men and entrepreneurs<sup>7</sup>. For example the cityscape and development of industrial and commercial zones are dictated by real estate developers and industrial entrepreneurs. Obviously the opportunity for smart governance is very minimal. In recent times there are enhanced local and international accessibility in the form of sustainable physical transportation system and information and communication technologies. One can argue that at least in this sector the cities can score well and may provide opportunities for smart mobility. However, unfortunately the reality is something different. Despite being digitally accomplished the level of physical movement is still enormous. The traffic scenario is deplorable (Absar Alam and Ahmed, 2013; Kumar, 2013; Rao and Rao 2012). Public transportation is not a popular choice nor efficient enough to encourage people to adopt it (Absar Alam and Ahmed, 2013). The greediness of the automobile industries, the business model around automobile and related service industry, such as finance sector, insurance sector, energy sector, etc., and the false vanity of owning a private car make the situation worse<sup>8</sup>. On the other hand, although it is emphasized that the ICT sector in cities have developed by leaps and bounds, the service providers are more interested in business and profits than efficient services and consequently lower performance is experienced<sup>9</sup>. With regard to smart environment, the question is do the cities have attractive natural conditions - climate, green open space, level of pollution, resource

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<sup>6</sup> Political Scientist and Expert in local governance from Odisha

<sup>7</sup> Retired professor and expert in Regional development, political Scientist and Expert in local governance

<sup>8</sup> Expert opinion and professionals from urban development field

<sup>9</sup> Member from Chamber of Commerce India, and professionals from urban development field

management and efforts towards environmental protection. The answer is obvious and of course negative. It is physically visible to everyone. Open drainage and poor sewerage system are common, and solid waste management is almost non-existent in many cities in India (Annepu 2012; Bundela, Gautam, Pandey, Awasthi, Sarsaiya; 2010). If the characteristics of smart living is analysed, which includes parameters such as, culture, health, safety, housing, tourism, etc., it can be found that there are paradoxes in each and every aspect. The country has great culture but often lack communal and social harmony<sup>10</sup>. Health care service has become an unsavoury business model with the collusion of health care centres, pharmaceutical industries, diagnostic centres, medical insurances, and other stakeholders. Maximisation of profit is the major motive at the expense of services (Das and Sonar, 2012). The poor environment, unwarranted physical and mental stresses are leading to more unhealthy people in the cities. Nobody will argue in favour of safety and security in the cities. Terrorism and crime have become part of the city life. Housing scenario is no better. Slums, squatters and urban sprawl are integral part of the cities<sup>11</sup>. Many of the cities have good tourism potential, and it is the only silver lining under this characteristics (GRAPL, 2012; KPMG, 2013).

In the wake of such challenges, it is observed that most of cities are not tuned towards transforming to smart cities and it is also difficult to comprehend if new smart cities can be developed because of the challenges of people, governance, living and environmental factors.

### **2.3 THE CHALLENGES OF STAKEHOLDERS PARTICIPATION IN DEVELOPMENT OF CITIES IN INDIA**

It is imperative that a coalition of relevant stakeholders and collaborative and participative approach is key to sustainable development of cities. However, most studies undertaken to assess the functioning of municipalities or urban local bodies in India point out that their performances have deteriorated over time (Aijaz, 2007 Fahim, 2009). They are confronted with a number of problems, such as inefficiency in the conduct of business, ineffective participation by the weaker sections of the population in local governance, weak financial condition, lack of transparency in the planning and implementation of projects, etc., which affect their performance adversely (Aijaz, 2007 Fahim, 2009). Under this premise the 74th Amendment Act, 1992 of Indian Constitution was enacted with an aim to

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<sup>10</sup> Expert opinion: a Political scientists

<sup>11</sup> Expert opinion from local governance and political scientist

provide a basis for the State Legislatures to guide the State Governments in the assignment of various responsibilities to municipalities/ urban local bodies and to strengthen their governance; and in a bid to achieve democratic decentralization and provide constitutional endorsement to local self governance authorities with participation of people at the grassroots level aided with devolution of greater functional responsibilities and financial powers to municipalities/ urban local bodies; adequate representation of weaker sections and women in municipalities; regular and fair conduct of municipal elections; and constitution of Wards Committees, District Planning Committees, Metropolitan Planning Committees and State Finance Commissions. The central objective of this amendment is the decentralization of planning and decision making procedures at urban area level. It also has the implicit intention of removing centralized notions of control and monopoly over development of resources. On this account obviously, the local governments or councils are the representative of the people and they have the right for the governance of their cities and are empowered to take appropriate decisions on behalf of people. Furthermore, people or stakeholders are also consulted at the planning stage of any city development/ redevelopment process and feedbacks are taken before finalizing the plan. On this supposition the system looks to work fine. However, it is observed that while many of provisions of the 74<sup>th</sup> amendment act are met at structural level, such as constitution of three types of Urban Local Bodies, reservation of seats, and constitution of State Financial Commissions, yet same cannot be said to certain provisions, such as, constitution of Wards Committees, District Planning Committees and Metropolitan Planning Committees because of lack of commitment from the state governments, which essentially hinders the stakeholders' participation (Aijaz, 2007 Fahim, 2009; Govinda Rao, and Singh, 1999; Singh and Govinda Rao, 2006). Besides, the council or local governments although are set up constitutionally, it is highly visible that most of the decisions are taken based on the pull and push factors (Das and Sonar 2013; Stone and Sanders, 1987). In some instances the individuals representing in the council sway the decisions although they have conflicts of interest, as conflict of interest in Indian conditions is not strictly defined. Political hegemony takes precedence over scientific logic and rationality. The council is also at times not well advised of their decisions by the professionals- may be due to various personal and professional reasons such as individual affiliation to the decision makers, fears of loss of job, personal benefits, lack of actual knowledge or skills, rejection of professional advice, or the likes<sup>12</sup>. Above all the stakeholders or the people at large are essentially not a part of such decision making. Also, although the system of feedback from the people or stakeholders do exist and sometimes practiced, it is done at a very late stage

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<sup>12</sup> Expert opinion: Political scientists and local governance expert

where their wishes or arguments do not hold much significance and are also not given enough priority<sup>13</sup>. Besides, in some cases there are peoples' committees at various levels from neighbourhoods, area to city levels, and also at various professional levels like chamber of commerce, industry, culture, etc., whose advices are sought. However, those committees do not have much authority and are basically advisory in nature without much significance in the decision making process<sup>14</sup>. Moreover, those committees are also characterized by conflicts, factions and self motives, thereby do not contribute much to the democratic decision making process of the development of the cities as envisaged by the constitution (Stone and Sanders, 1987).

The major reasons attributed are lack of responsibility and accountability and lack of respect to the stakeholders. Although, the said amendment was enacted with a spirit of governance at the grassroots level, and it can be viewed as being successfully functional from structural point of view, the role of various stakeholders, such as, common citizens of the city/ urban area, business man, civil society, etc., are absolutely ignored thereby limiting the city development process in the hands of a few technical and administrative hands under the auspices of local political elected leaders<sup>15</sup>. Thus, the question arises when there is a clear mandate from the constitution, which strengthens the local governance with a sprit for sustainable development of cities per say urban areas by preparing and implementing plans for economic development and social justice, why most of the cities of India are languishing with improper development and poor services and facilities. The argument here is that possibly the top down approach of governance even within the urban local governance; the ignorance and non assimilation of critical mass of stakeholders, the manipulation of unscrupulous developers (real estate and property) with a sole aim of short term gain are the major barriers in achieving sustainable development. Reflecting these concerns, it is argued here that in the city development process procedural equity is more important to achieve desire smart growth and appropriate sustainable development<sup>16</sup>. It is much more than legalistic and bureaucratic procedures for establishing and enforcing obligations and rights. In addition, it needs to embrace wider processes of public engagement, where multiple democratic and participative forms and channels are brought into play to foster participation and engagement with processes of change. This concern suggests that all people should have access at different points into public decision-making processes (in particular at the junction of public and private decision-making affecting common city people). This requires a balancing of democratic and participative methods of engagement with decision-making,

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<sup>13</sup> Executive officers, urban development authorities

<sup>14</sup> Members of Chamber of commerce of Bhubaneswar and Cuttack city in Odisha

<sup>15</sup> Expert opinion: Political scientists and local governance expert

<sup>16</sup> Expert opinion: Local governance and urban development

rather than a displacement of necessary democratic responsibilities by urban local bodies.

It is thus construed that, there are several challenges which stand as the barriers against the development of smart city. The challenges range from the rationale behind the decision to build smart city, prevalent spatial and social characteristics to issues in urban governance and stakeholders participations. However, even if the first two challenges (rationale and prevalent city characteristics) are left out, in the current scenario participation of various social solidarities development Indian cities, which is minimal is a major issue. Therefore, while developing smart cities in the country, this governance issue need to be resolved. This essentially seeks a new politico-cultural perspective that can bring fruitful engagement among the stakeholders, which can lead to development of smart cities based on the requirement of the various solidarities of the society than benefiting only one segment of the society.

### **3. POLITICO-CULTURAL PERSEPECTIVES FOR DEVELOPMENT SMART CITIES**

As evident from the previous sections, in a populous, diverse and democratic country like India, it is ironic that most of the planning and development are concentrated in the hands of a few authorised people-executives and decision makers, who more often succumb to idiosyncratic demands of the political/local leaders and/or pressure groups. Although, the 74th amendment of the constitution has leveraged the urban local bodies to take decisions in an intention to involve local leaders and people in the development of their cities, yet it does not necessarily true that the local political leaders, who are divided though ideology, race, religion, caste, and so on represent the requirements of common people<sup>17</sup>. In other words, the opinions or the decisions of the political leaders or pressure groups at times hardly reflect the demands of the society. Despite the constitutional interventions, the planning process largely remains a top down approach. Therefore, at the current state, it would be wrong to assume that development of smart cities in India will follow a different approach.

However, for sustainability of smart cities can be achieved if smart growth principle for development is adopted. Examples across the world are plenty. The cities of Europe particularly from Austria, Switzerland, Benelux and Scandinavian countries are the leading flag bearer, which has shown that how cities should be developed through application of smart growth principles and effective governance. Another glaring example is the participative city governance (with effective participation from all strata of

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<sup>17</sup> Expert opinion: local governance

the society) of Vancouver in Canada. The smart growth principles advocate that the growth of city is to combine the various discourses of physical and spatial issues into a rational sustainable development that integrates economic, environmental and social equity issues. It also invokes the notions of urbanity, create a sense of coherent community (Calthorpe and Fulton, 2000; Kunstler, 2001; Turner, 2007). It is a strategy that targets the physical development of urban regions having strong social, economic and political components with public participation and is an inclusive multi-actor planning processes (Jailly, 2008; Scot, 2007). However, it is evident from many cases in India multi-actor planning and stakeholders' involvement in planning development is a hugely cumbersome and difficult process. The conventional approaches of stakeholders' participation may not assure successful planning and development. It needs a new paradigm to make the participatory planning more inclusive and effective. The challenge, however, particularly while developing smart cities can be overcome by creating a platform by applying theories of social organisation and governance, such as, cultural theory or theory of refurbishing of Dahl's pluralist democracy (Douglas and Wildavsky 1982; Schwarz, and Thompson, 1990; Thompson, Ellis, and Wildavsky, 1990; Thompson, Rayner, and Ney, 1998; Thompson, 2008; Verweij, and Thompson, 2006}.

The cultural theory maps a fourfold typology of social solidarity- the individualist, hierarchy, fatalist and egalitarian (Douglas and Wildavsky 1982; Thompson, Rayner, and Ney, 1998). For the individualist, man is inherently self-seeking and atomistic. The nature is benign and forgiving, and can able to recover from any exploitation. Trial and error in self-organising, ego-focused networks (markets) is the way to go. Individualist actors trust others until they give them reason not to and then retaliate in kind (Rapoport, 1985). They institute equality of opportunity (symmetrical transactions) and promote competition, which is no accountability. They see it as only fair that those who put most in get most out. The world, in the hierarchicist solidarity, is controllable. Man is malleable- deeply flawed but redeemable by firm, long-lasting and trustworthy institutions. Fair distribution is by rank and station or, in the modern context, by need, with the level of need being determined by an expert and dispassionate. Hierarchies set all sorts of limits on competition. Fatalist actors (the common men here) find neither rhyme nor reason in nature and know that man is fickle and untrustworthy. Fairness, in consequence, is not to be found in this life and there is no possibility of effecting change for the better. The egalitarian solidarity is almost the exact opposite. The natures and society in this case is fragile and intricately interconnected and man is essentially caring and sharing, until corrupted by the coercive and non-egalitarian institutions of markets and hierarchies. It is not enough that people start off equal must end up equal. Trust and leveling go hand in hand, while institutions that distribute unequally are distrusted.

Voluntary simplicity is the only solution to the societal problems. These solidarities suggest that, each generates their own storyline which contradicts those that are generated by other solidarities (Douglas and Wildavsky 1982; Thompson, Rayner, and Ney, 1998) and how the complex dynamics of their interactions can lead things to sometimes destructive and sometimes constructive directions (Beck, Thompson, Ney, Gyawali, and Jeffrey, 2011). Each solidarity distils certain elements of experience and wisdom that are missed by the others, and as each provides a clear expression of the way in which a significant portion of the populace feels we should live with one another and with the society, it is important that some sort of account be taken of all of them in the policy process and the state of affairs in which each of the three active voices – individualism, egalitarianism and hierarchy and the passive voice (fatalist) be heard and become responsive to the other (Verweij, and Thompson, 2006). This approach has been put in practice and observed success. Case studies can be seen from resolving of the water sanitation system in Kathmandu valley, Chattahoochee issue in Atlanta, access to service delivery particularly insanitation and solid waste management by people in Kamapala and ameliorating the problem of hygiene and sanitation in Yaoundé (Beck, et al, 2011; Parrot, Sotamenou, and Dia, 2009; Tukahirwa, Mol, and Oosterveer, 2010). In all cases, the engagement of different solidarities, although brought some clumsy solutions provided some prospect of collectively accepted progress. For example in the case of Kathmandu valley, this cultural theory inspired mechanism has led to the scenario that no (egalitarian) conservationist group can argue for ‘no growth’ in the face of the highly emotive condition of insufficient water for drinking. Similarly, the situation is recognised as beyond any promises the (hierarchical) water agencies might care to make in order to maintain control over their framing of the problem for their way of problem solving. The (individualist) private sector of water-tanker supply although struggles to sell its services found a few crumbs comfort (Beck, et al, 2011).

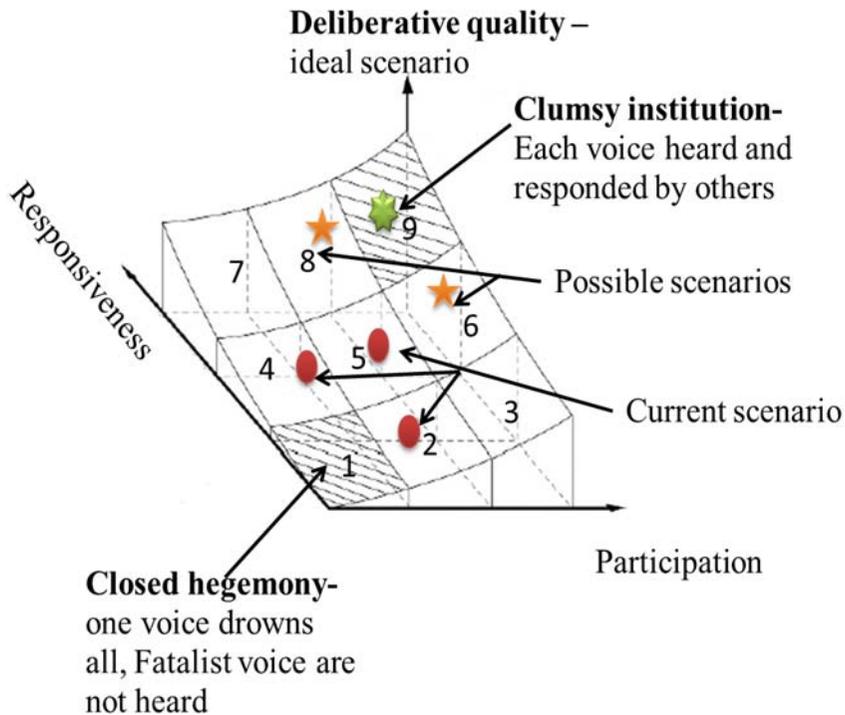
Based on this premise the whole Indian society can be placed in these four solidarities as shown in Figure 1. The common men are the fatalist; the industry, corporate sector and market represent the individualists; the governance system represents the hierarchy and the society as a whole is the egalitarian actor. In the case of urban development in India, as it is evident that the fatalist as are the sufferers and they are not heard. It is only the hierarchist (the political authorities and bureaucracy), and the individualist (the market forces- industry) dominate the process. The market forces decides the functioning of the system- in an unwarranted way and there are significant gaps in the functioning of the hierarchy- the governance system, which should be overseeing and articulating the system for the proper function and results to an non-egalitarian society. The egalitarian voices represented by social or community based organizations (CBOs), Non

Governmental Organisations (NGOs) are handicapped by shortage of resources and patronage and donor dependent and therefore are not always effective and often not heard.

<p style="text-align: center;"><b>Fatalism</b></p> <p>Apathetic Doldrums: Common people, Local community, individual people like professionals, academicians, merchants, students, labourers, etc.: Voices are not heard, apathy and unwillingness to participate in any development process, Lack of trust and confidence in the government, new policy programs- institutional landscape self-focused approach of the past, media focus individual benefit.</p>	<p style="text-align: center;"><b>Hierarchy</b></p> <p>Political parties, political leaders, Government, Bureaucracy, Urban authorities, Municipalities, Believes in rules and regulations, top down approach,</p>
<p style="text-align: center;"><b>Individualism</b></p> <p>Industries, Private companies, entrepreneurs, corporate sector: Don't care about common urban dwellers and higher profit motive,</p>	<p style="text-align: center;"><b>Egalitarianism</b></p> <p>CBOs and NGOs: hampered by shortage of resources, patronage and donor dependencies</p>

*Figure 1* Perceptions of social solidarities in Indian cities

However, the democratic process insight suggests that any planning and/or policy process need to ensure that all the actors need to be involved and their storylines should be fully developed into scenarios that are then engaged with one another, noisily and argumentatively and then bring out a solution.



**Figure 2** Adoption of theory of plural democracy for urban governance (addition of polito-cultural dimensions) to aid development of smart cities in India

As seen from the Figure 2, putting participation and responsiveness, the two pillars of democratic process in a nine provinces (blocks) map, it is apparent that deliberative quality increases with the increase in participation and responsiveness. In the current scenario, although there is no closed hegemony in Indian urban local governance (as shown in block 1) where one voice drowns all and fatalists are not heard because of the democratic governance system; it rests in scenarios with participation and responsiveness varying between low to medium as shown by blocks 2, 4, 5. Essentially such scenarios are not ideal because of either lack of adequate and effective participation and/or adequate responsiveness. However, it is also inappropriate to expect an ideal scenario (as represented by block 9), where each voice is heard and responded equally. However, there is a possibility of increased participation and responsiveness, if all the four solidarities are participated and responded (as represented by Block 6 and 8), which may lead to the ideal scenario further on as the process gains maturity. Perhaps, the interaction of the four solidarities obviously is not to result an elegant solution as many expects. Although, the engagement and socioeconomic trade off among these solidarities could provide a clumsy solution, it could be responsive to each other and acceptable to all. Therefore,

while developing smart cities, it is highly imperative that all these solidarities, which represent common men- citizens including teachers, students, doctors, professors, merchants, labourers, rickshaw pullers, and so on, the industry- entrepreneurs, the corporate sector, bureaucracy, professionals, political leaders, CBOs and NGOs and so on from across the whole society must engage in a constructive, but may be a in clumsy manner. They must be a part of the development process and develop a kind of belongingness so that the development and sustainability of smart cities in India could become a reality. Or else, if the development process is left in the hands of only the hierarchical and individualist actors, they could only bring out short term solutions or may simply use it for some myopic benefits of a few powerful people and / or pressure groups.

#### **4. CONCLUSIONS**

This article analysed the challenges the country has to meet while building smart cities. The first challenge is to clearly understand what is meant by the smart city concept and how it is relevant in context of the country. It is also argued to have clarity about who are the stakeholders of these cities, and who invests for their development, who would get the benefits and what is their implication on the existing cities. Secondly, it examined whether challenges provided by the general, social and morphological characteristics of existing cities are attuned to transform them to smart cities. Besides, the article also explored the challenges in the current urban local governance system and observed that the inadequacies of the system may become a barrier in the development of smart cities in the country.

Further, the article argued for a new politico-cultural perspective based on the cultural theory. It advocated for constructive engagement among the various solidarities of the society, which represent the various stakeholders, such as common people (fatalist), industry and market forces (individualists), governance system (hierarchy) and community based and Non Governmental Organisations (egalitarian). This politico-cultural perspective envisaged to provide a platform for the fruitful engagement among the various stakeholders, although may be in a very clumsy way. Besides, it could able to develop a sense of belongingness among the various solidarities of the society and make them part of the development process, which is highly essential for the long term sustainability of such cities in India.

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NO.38

## Urban Risk Assessment under Climate Change: The Case Study of Thailand

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**Key words:** Climate Change, Urban Risk Profile, Thailand

**Abstract:** This research assesses an urban risk profile under climate change using the case study of Udonthani, one of the largest cities in the Northeastern region of Thailand. The study focuses on urbanization process, and socioeconomic and environmental changes of the city. The goal of this study is to analyze current disaster management policies in order to increase preparedness for a flood disaster.

In addition to the economic center of Northeastern region of Thailand, Udonthani is also expected to be the logistic hub of the Greater Mekong Subregion after the regional integration of ASEAN Economic Community (AEC) in 2015. However, there are many challenges that are exemplified by external and internal pressures. The external factors stems from the impacts of climate change which mainly include draught and flood. On the other hand, the internal factors from rapid urban and population growth intensify the impacts of natural disasters.

In order to comprehend the urban dynamic of socioeconomic development of Udonthani under climate change, this study aims to analyze factors that increase the urban risks of floods by examining the socioeconomic and geographic information systems data over the past decade. The urban dynamic factors are categorized into three groups: (1) a hazard profile of flooded areas and durations, (2) a livelihood profile of demographic and neighborhood characteristics, and (3) an economic profile of employment and economic activities.

In Thailand, little has been done on the interdisciplinary study of climate change adaptation. Studies in the past overemphasized on technical mitigation plans for climate change without the aspect of people and adaptation, which is needed to be addressed holistically. This study is a pilot project to study climate change adaptation policies focusing on urban

areas in Thailand. The result of this study can be used to formulate robust development strategies as well as regional and urban planning toward resilient societies



NO.41

## Emerging E-Commerce Industrial Clusters in Rural China: Multi-scale Embeddedness, ANT Approach and the Case of Dongfeng Village

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**Key words:** Cluster, embeddedness, ANT, furniture industry, e-commerce, the rural, China

**Abstract:** Alternative approaches are needed to struggle against rural economic and societal depression growing with China's rapid economic development and urbanization. With a case study of the emerging e-commerce and furniture manufacturing cluster in a village of North Jiangsu province, this paper examines how new technology and improved informationization contribute to rural economic promotion. Applying the Actor Network Theory (ANT) approach and embeddedness theory, three distinct actor-networks are discovered, to describe the cluster's factors and growth process. Multi-scale embeddedness is recognized as important for rural development, helping rural areas taking advantage of local societal-cultural traits, as well as connecting with the outside and being involved within trans-local economic and social networks. E-commerce brings markets and external resources to rural areas and stimulates reorganization of local elements, making rural economic activities with multi-scale embeddedness possible. The cluster has encountered and fought to overcome crises and challenges, which not only shows the lock-in influence of societal, territorial, or network embeddedness, not necessarily limited to the local, but also reveals the unbalanced power structure, unstable situation, and continuous adjustment of actor-networks. Even though the e-commerce and manufacturing cluster is considered a new form of rural development related to the advanced digital economy, it eventually reflects the rural social-economic structure established since the reform and opening of China, and the influence of traditional culture in rural areas. However, it does bring the benefit of establishing frequent, convenient and tight linkages between the rural and the external under the context of China's rapid urbanization and modernization.



NO.46

## **Landscape Character Assessment for Area Management of National Territory** *—Example Study of Kanto-Koshinetsu Region, Japan—*

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### **Key words:**

**Abstract:** Based on current situations that are entered the aging society and declining of economic growth of Japan, we faced the difficulties to manage all the national land resources just by public body. ‘New Public Body’ which means the collaborated power of private and public body to manage their own land resources that can be maintained its own natural and cultural character, are needed.

This study attempted to identify the landscape unit to manage land resources of Kanto Koshinetsu region through to unify the results of Landscape Character Assessment by Ye and Geographical Characteristics Classification by Koarai. Our attempt is to offer the possibility of the Area Management Unit to comprehensive management by new public power. On this paper, we experimentally tried Landscape Character Assessment of Kanto-koushinetsu area in Japan as a land characterization tool for sustainable management. Landform and Land use/Vegetation data has been used to characterize this area on National level characterization. As a result, 16 Landscape types and 110 landscape areas are revealed.



NO.51

## **The Analysis of Green Innovation Capability In Hubei Province**

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**Key words:** Green innovation, factor analysis, DEA-Malmquist, ESDA

**Abstract:** This paper uses factor analysis to estimate green innovation performance capability in Hubei Province in 2013. With panel data and Malmquist TFP method in DEA, we measure Hubei Province 2008-2013 green innovation performance quantitatively. Finally, we use exploratory spatial data analysis methods to analyze the spatial dependence and spatial association in Hubei green innovation performance. The results show that the green innovation capacity of Hubei is mainly affected by technological innovation factors and energy consumption environmental factors. Cities and states show large differences in green innovation performance overall; TFP growth is driven by technological growth effects. The contribution of efficiency is not significant. Green innovation shows significant positive correlation with space. It also has spatial aggregation tendency and innovation spillovers.



NO.59

## Modular planting containers of innovation

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**Key words:** Design & Green planning, vertical green wall, Environmental symbiosis, Synergy

**Abstract:** In order to water plants on the outer walls of buildings, fences, and sidewalks, the old modular sprinkler system is generally used. This system relies on water from either water pipes or underground water. Either way, water is consumed. From the point of view of conserving water, circulating rainwater in an irrigation system could Cities in high density under the influence of architectural space, Forming urban high density of buildings space heating temperature, added to expand building around growing plants, Evapotranspiration of tropical and shading effects can effectively reduce the ambient temperature, thus forming a green demands, the Green and long-term commercialization are more significant, Researchers looked for materials and systems, and related technology based on green wall environment, long-term green building green wall. This study vertical green wall green planting for the long-term effective system solutions from field survey of existing landscaping system Use chemical production materials, Research Method inventions, green wall planting system, The this Method Enhance the future, Green Symbiosis, recycling, environmental protection, landscape, Formed vertical green walls to form symbiotic method five ring planting system. Meaning of symbiosis in the vertical green wall planting system for sustainable green as the goal, In the coexistence of humans and the environment to enhance the role of green space, Water recycling and green buildings and the common prosperity of mankind, Coexistence of man and the greening of buildings, creating green symbiosis, form a innovation of urban greening and environmental synergies. The is green for creative, constitute innovation feasibility, Use pointer In vertical green wall, greening development and urban construction, Long-term symbiotic synergy and green Achieve Renovation and Achieve long-term contributions of vertical Green and Symbiosis.

## **1. STUDY MOTIVATION AND PURPOSE**

Seeding system consists of a number of studies of vertical green wall man looking for a suitable living environment for thinking, created the regional gathering more people, building height and concentrated buildings of the modern city, the achievements of the high density urban structures, Continued modernization of open architecture with original forest began the destruction of the city, the forest began to grow food to taste, Disaster began To affect the quality of life, affected the alpine forest and soil loss, urban Indoor temperature increases. Trees and green space to reduce and change the green area, recent and ongoing urban construction updates, With high density and very high buildings, making the City Green reducing more serious, leading to urban green ecological environment caused by the city's Temperature continues to rise, each building is made up of indoor air Emissions from outdoor in the summer caused by outdoor temperature affect air quality and people's health.

Modern building caused by gradually created a more green environment Around plant life origins of the green building, green building began a Serious study and discussion and research of physical market enthusiasm of Increased technical or system landscape, most traditional way of hanging Vegetation green wall, has yet to reach high efficiency of natural growth.

This study analyzed hanging draws an external walls of the existing General planting a box body In *Figure 1*, composed of , *Figure 2* box tree planted on the wall outside groups, Other *Figure 3* Place the composition of plants and spray water schematic diagram, *Figure 4*-Hsiao in Taipei City was built and the other new cases have been found in this study, *Figures 1,2,3,4* traditional uses, it can reduce the temperature of the energy saving effect , (Li Chongchen, 2009). Quality construction documentation currently States the kind of pointer to pointer to the kind of in-depth qualitative research found that building maintenance is still the current technology or systems, landscape still not found on system application of new technologies In new buildings, As traditionally used in *Figure 4*, the surrounding area important green space in the urban environment, (Mysore, 2013), Accessible from external walls of buildings to formation of vertical green wall technology green building and landscape, Vertical green wall of vegetation formed by creative technology structure system, Planting green wall green pointer, by general building, training, new development of vertical green walls, form the direction for future construction of a pointer, In application areas to form the vertical green wall planting system to suit all environments and may change the material and technology and viable in the future and the actual implementation of the vertical green walls to produce sustainable synergies.

Achieves the immediacy of the future city and learn new methods to allow the value of creative design for urban planners and policy makers in the research process, Applications used in urban planning and future innovation

facilities, (Dr Young orchids, 2013). After the traditional wall-mounted green planting using the nozzle easily blocked and difficult to maintain, in the traditional wall-mounted Green's innovative continuity after planting, vertical green wall researchers continued to study, Affect the creative nature of this research found that technical inventions in the field of vertical green walls of seeding system is expected to achieve synergies, resulting in the motivation and purpose of the study.

expectations, Study of vertical green walls, As in a traditional wall-mounted plants maintained by the water jet vertical green wall behind the green plant growth, innovative synergy of research, Undiscovered new vertical green wall systems to achieve long-term growth of plants and greening opportunities.

States in the study of literature theories and the practice of States in the literature, research to create a successful case, the States and Asia and Taiwan regions, Vertical green wall of vegetation has been found in this study of patents and published applications to real systems, Therefore on the Built environment and maintain a good building material used, (Engel,H, 2000), And Bio Diversity, (Mysore, 2013), Noticed by creative vertical green wall system, patented technology, On building floors Sustainable applications for exterior wall, In literature and practices and information, Has been found about the same technology, Resulting with the following findings of this study, by creative thinking, might have on vertical green wall of vegetation contributed to the method used by the system. Expectations for the next landscape can create more vertical green wall effect of the seeding system, Appendix Figure and technology Open Expectations for the next landscape can create more vertical green wall effect of the seeding system, Improve overall quality of construction of vertical green wall vegetation greening purposes.

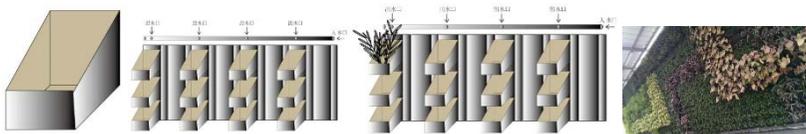


Figure 1. General exterior planting single-hung box body the left Figure

Figure 2. Outside the box tree planted on the wall group the left The second Figure

Figure 3. Schematic diagram of place composed of planting with water jet

The right side of the second Figure

Figure 4. Composed of tradition into the planting diagram the right side of Figure

## 2. LITERATURE REVIEW

This system The Innovative research, Make Technology Can be achieved Sustainable green walls of greening and environmental protection, This study Order Industrial design With vertical green walls Creative thinking, Reach Vertical green walls Green vegetation Innovative purposes, (Han Pao te, 2012).

### 2.1 Page headers

Industrial design And creative thinking of vertical green walls Way of thinking in industrial design with precision and consistency of products manufactured as standard, such as machinery, automobiles, such as early application to wooden house structure material combinations of physical, Suitable for rapid architectural elements are more rational thinking cost product for the purpose built availability, then industrial design to mass production for the element of thought created the corporate earnings results. Creative design ideas, ideas to imagine life in the early bath is used by Wells to draw water buckets and scoop flush, After groundwater extraction using Continuous invented pipe application, Inconvenient to use, Again Invented Faucet With The shower head and, With Water spray all the plants water supply, In life, everyone feeling all kinds of inconveniences and Generate creative thinking, By himself or through another person's design reflects samples which may arise to the appearance of the flexible art form and market commercialization of acceptable or even create their own unique products such as ornaments or pictures, Sculpture, For example, simple animals, such as dogs accompany people, Imagination is the creative composition creates a dog shape shapes or create dog houses or dog shape cloth printing, Even making descriptive stories such as animated films, These creative design thinking by everyday life of Invariance and inconvenient, Even Evolution At present the weather heating up and the living environment of green issues, Life in a vertical green walls of surrounding buildings began to use the insights into the thinking of creative thinking, Creative thinking to the creators and corporate partnership opportunities Or Enterprise creative Create a construction with vertical green wall and green For Creative Thinking A prototype of innovation, Make the environment green Expand Reach Future sex Vertical green walls Building size And increase greening opportunities, Reach Businesses will continue to implement comprehensive social benefits of thinking, *Figure 7* Field Surveys and interviews, (James Lim, 2014), Research methods and processes In *Figure 8*, (Tim Brown, 2012). All seasons, especially in summer in the ocean temperature rises and a decrease in forest and afforestation, the city's higher temperature adjustment, Therefore Global warming and create temperature changes, people have been

constantly changing forests and green spaces to reduce, Adjust the temperature between the Earth and ocean, Make Traumatized by the creative Earth and heating of the exterior walls, indoor temperature rises, (Li Chon Gchen, 2009). Resulting in Tsunami earthquake drought and fires often occur, Marine Rose By Changes our way of life or a deadly threat, Especially in the metropolitan area, Human residence environment most of the concrete building, External walls And Windows, most with tempered glass construction with cement, Make Green is very rare and most of the roads and pavements to asphalt and cement, In recent years, with a vertical green wall of vegetation, mostly external sodded with the platform and part of the sidewalk with brick panels have little green grass was sparse production, In recent years, With a vertical green wall of vegetation, mostly external sodded with the platform and part of the sidewalk with brick panels have little green grass was sparse production, Metropolitan The construction of a new building in, various construction-related technology or technology has been developed and more related research, Reduced The temperature, improving energy efficiency, greening and environmental protection with sustainable green wall as the goal,(Engel, H, 2000), Often Used in construction, Vertical green wall planting system Through research, Innovation Use The invention System technology, Appendix .

## **2.2 Field Investigation study**

Field Investigation study January 5, 2014 ,Visiting the greater Taipei region Tianyi new construction field investigation of the case, Will Rotating building, Site Observation and asking staff and samples found that Construction will not rotate, In a building around the corner balcony space, Upper and lower retaining spatial illusion, In buildings around the corner balcony space of vertical green walls hung outside, spray to spray water directly at the Green Wall plants. surveys and interviews, (Tian Yi Director, 2014), Description possible New technologies Instead of using Spray Green Wall plants Participants expect to have a new system for new buildings, Therefore this research technique has not been found on the market. Left side of *Figure 5*, Indwelling buildings around the corner balcony space office space the illusion of drawings, *Figure 5* in the middle of the second With Third drawing as hanging green plants use cases, *Figure 5* right side Spray use hanging at the scene to enlarge the image.

For older buildings land new construction or reconstruction new construction and promote the Greening of environmental problems and other hardware environments affect the quality of living, La Vista Professors and National Chung Hsing University Department of Environmental engineering Professor Reports, (Zhuang Bingjie, 2013), Published each year from air fine particulate matter such as dust, Coal dust, vehicle exhaust and industrial

pollution sources pollution are striking at human lung, Each year, about 2.1 million deaths. European PM2.15, Beijing, Shanghai, PM7.5, Taiwan PM2.5 concentrations of about 30  $\mu\text{g}/\text{M}^3$  (Microgram/Cubic meter). Based on environmental studies, due to lack of greening of the environment, air quality, Cement House in summer residency, For temperatures up to 34~38c Keep people indoors and turn on air conditioner, Enhanced environment heating, (Liberty times, 2013-9-29), (Eric Taylor, 2014) ° By Increase More Governments, scholars and Business or Architect, On urban greening the built environment, The ongoing More Influence of Research, Applying green wall building green can reduce low temperatures, Reduce air fine particulate matter such as dust, soot, vehicle emission reduction, Increase Building The green wall or Green plants Environment Does Reduced Temperature, (Lee Shung, Chen, 2009)



Figure 5. Tianyi new building in Taipei

### 2.3 To explore the green wall construction Innovation

Explore The green wall construction Innovation With advanced Technology and methods Explore green technology and advanced green building Innovation systems approach to *Figure 8* Documentation for synergy and innovation in green technologies advanced system repair methods, Approach to building construction technology A more complete Process innovation system, Compositions described in the following reinforcement, Diagram of the figure six innovations, Rendering A more complete The innovation process, Making the innovation to achieve viable technological achievements and the future building the green wall systems processes. *Figure 6* Flow chart of system and innovation in terms of technical content innovations found Order, Flow chart of construction of innovation system of circulatory system, device components according to demand, Generate kinetic energy And effectiveness of the process cycle, Creation of new building construction, *Figure 6* technology and process suggested process methods to build innovative new systems concepts, (Chen Shang Jen, 2014). On land, the reduction affected the decrease in Urban architecture is as difficult as in the areas of land built green, to 60% hardware 100% sum, Greenland approximately 5–10%, (Ye Jinjia, 2010), and even less green. Currently in the city's housing needs essential to building creative environment as the main target, Integration with vertical green wall

construction in cities and communities, contributed to the demand for building green area, built around 30%. Planting practice to observe the wall green wall and green papers found to grow hydroponics plants planting walls, Kunshan Science school Department of materials engineering, (Shi Zhongyang, 2013) Issued by Ming exhibition Featuring hollow on the water IN container pressure acrylic boxes, Placed at the bottom of the box body foam recycling fish waste for plant nutrients, Another hanging plant and LED light source irradiation plants, did not cut the power without planting wall planting system to new, worthy of further study. Vertical green wall of vegetation following the innovation flow chart, set the sink's height control switch, when open water to set the sink height automatic control rods, tap water or rain water flows, Automatic water filter and water circulation at proper height, and placed in the wall planting area humidity control rod, lack of humidity automatic water intake to the vertical circulation trough, catchment area at the bottom automatically return set at proper height sink.

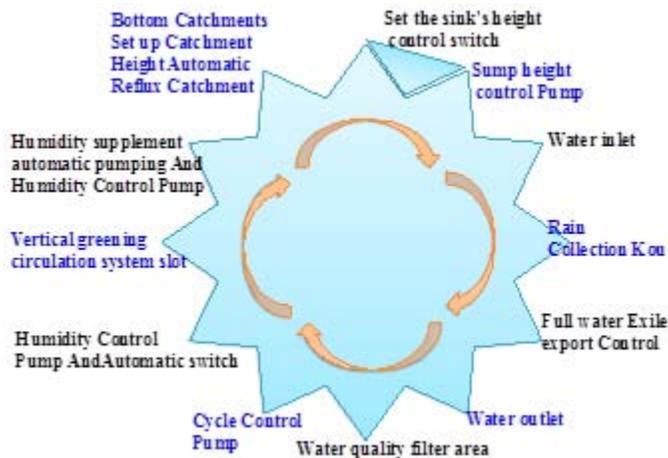


Figure 6. vertical green wall of vegetation the innovation flow chart

## 2.4 Review green construction with vertical green wall systems comparison

Construction practice on new discovery and analysis of the literature, in the University district city visit, the Ministry of (James Lim, 2014-7-31 *Figure 7* construction techniques and suggestions for process of practice, Looking for suitable wall mounting frame and water intake, intake is controlled by faucet-mounted water table further extend toward the top of the pipeline a pipeline installed in 10 cm unit dripping head, Install wall unit 4 layer planting within the framework plate.

1. The bottom surface of the material, Insu Tw Board.
2. The second panel

material, Planter Cell Water Retention Ma.3. The third panel material, H2O-R Foam.4. the four panel material, Insu Tw Felt. Material composition, After you install, and position and size, Use a cutter to cut the 4th layer ,outer layer, and then into the planting using air nails nail fixed plants, Tree planted on the plate above the drip irrigation drip head sheet 4-layer planting, water dripping from bottom there is a collection of returning or release, practices,(James Lim, 2014).

Construction of cement and glass building to use Visual analysis of construction of *Figure 7*,Exterior green more Compare This study Building external wall Greening system In sustainability Is not the, Maintained for permanent residential environment, sheet 4-l ayer planting, maintaining 10-20 aging,(James Lim, 2014).*Figure 6* innovation process of this study, planting system on the architectural practice of vertical green wall green system innovations, outer walls caused by Visual and landscape greening and environmental protection technologies, Green innovations contribute to the environment, because of the resource constraints in adopting this practice, this study found that solid composition and systematic technical description, To future practitioners or leading researchers to implement practices as research purposes. *Figure 7* build using Visual construction. *Figure 7* left 4-layer planting plate, left-2 tree planted on the top plate into the drip tubes, 3 water Outlet Pipe at the bottom-left, right 1 *Figure 4*-layer planting plate, place a plant using a nail gun nails in the roots fixed *Figure 7* system. (Tian Yi Director, 2014) , Tianyi construction with 4-layer planting plate (James Lim, 2014), Vertical green walls and planting the creative flow chart with vertical green wall systems comparison of results and recommendations of this study.



*Figure 7.* Build using Visual construction analysis

In the above comparison theory, creative talent and innovation capacity Executable-backed entrepreneurs. Future implementation of vertical green wall planting system innovation of urban architecture, green technology Projects within the description of the following vertical green wall systems approach feasible. Building applications in the vertical green wall system Method is implemented, environmental landscaping aesthetics after the Implementation and maintenance, does not trust the Feng Shui influence Forming needs. Placed in the authoring application provided new extent in

Inventing and building landscaping wall between inside and outside the Walls of the new building methods and results, Vertical green wall of Vegetation system on urban improvements in building creative and Innovative applications, future scholars put forward new concepts to come together again to create, making innovation cities formed a creation of Sustainability, ( Kenichi Sugihara,2015) .

Application of vertical green wall system for creative cities studied literature, in the green building vertical vegetation greening applied literature on urban rehabilitation and maintenance, Vertical vegetation greening related elements and related influencing factors Table a note, Building Enclosure form factor,( Kuang Hui, Peng,2013) , Case compared with the method of the study on vertical green wall technology, at this table right of this study on the technical feasibility, As *Figure 8* review of vertical green walls and green building technologies And *Figure 9*. Comparison of technical feasibility (Kuang Hui, Peng, 2013) compared with the method of this study into the feasibility of the system, *Figure 10* Comparison of technical feasibility (Kuang Hui, Peng, 2013) *Figure 11* Type vertical greening technologies (Jen Hui, Tsai, 2009) and (Kuang Hui, Peng, 2013) and the vertical green wall systems comparison. *Figure 9*. Comparison of technical feasibility (Kuang Hui, Peng, 2013) compared with the method of this study into the feasibility of the system. *Figure 10* Comparison of technical feasibility (Kuang Hui, Peng, 2013) Compared with the method of this study into the feasibility of the system.

Kuang Hui, Peng. 2010 review of vertical green walls and green building technologies

Literature Study on finishing	Vertical green wall planting System, converted to invention As the present study Figure 6. Vertical green wall of vegetation flow chart of system innovation	This study Vertical Green wall plan ting system Invention Study on the Results
Green building: 1. (art director, 2014) on the left side of Figure 5,Figure 5 styles of buildings around the corner balcony space retained space illusion Figure 5 the second and third images hanging green plants use case, Figure 5 images on the scene hanging on the right side to enlarge use cases 2. by 4-layer planting plates, mounted wall unit plastic pipes and control water pressure gauge, each 10-20 cm planting plate outlet to each device installed (James Lim, 2014)	Planting of vertical green wall systems: Set the sink's height control switch Set water inlet Sink height rod, rainwater collection Exile full of water the export controls, outlet Water filtration zone, cycle control Pump Humidity control rod pumping and automatic switches Vertical water circulation Groove Humidity control rod Inadequate humidity starts pumping Bottom of catchment area Highly automatic back against the water collection tank	Vertical Green Wall Plant Grow System Invention Study on the Results
Select technology and energy goals, Green effect Innovation Technology System Apply Configuration General building	Technical energy objectives, Automatic Reflux Set the sink With Supply again Cycle	Cycle Regeneration Use Water Energy
Legacy System principle And Concept of practice	Simulation The principles and The concept of Practical feasible	Building Feasible Need to experiment
Advantages: Performance practice, suitable for all construction Disadvantages: Plastic material is not for long-term use, Materials aging Recycling or Device Cost A considerable amount of resources	Advantages: Long-term use of materials, Material non-aging recovery or Devices require considerable resources, Performance results for all buildings. Disadvantages: Need to experiment, research funding limits	Advantages: Permanent use of materials and Results suggested. Disadvantages: Experimental architecture requirements, Research funding limits

Figure 8. review of vertical green walls and green building technologies

Plant cutting Factors	Factor Secondary Factor	Comparison of technical feasibility (Kuang Hui, Peng, 2013)	Compared the research In this study, Feasibility Systems approach
Species	Being, flower, foliage, vines		Native species of plants and other
Grow Property	Resistance to wind, drought, moisture, acid, cold, shade, poor resistance, high temperature, salt, anti-dust		Suit
Ecological characteristics	Lure birds, butterflies lure, lure insects		Suit
Planting methods	1. The need to maintain a planting 2. Planting subsequent batches scheduled maintenance		It After Maintenance Regular Maintain
Maintenance mode	Pruning, water supply, drainage, fertilization, pest and disease prevention		Automatic water cycle
Growing	Flowering, fruiting period		For local species
Sensory factors	Visual (color), olfactory (scent), tactile (texture)		For the development of local landscape
Vertical greening system	Climbing: Direct climbing wall type, cage climbing type Hanging : Wall direct pendent, cage hanging type Modular : Grid Full-linked, planting unit sub Groove		Side facades into space
External factors Buildings	Old buildings Must be removed Reconstruction		Steel structure had no effect
Building type	SanGeYuan building, Tou Tianciao, townhouse, apartment, residential elevators		New material Increase
Green site	Roofs, external walls, balconies, door, window, fence		Interior, exterior Middle Hollow Constructivism Automatic Cycle
Space Factor Affect Factor	Facing such as, floor, surrounded by buildings affected (exhaust hole, Water And Additional External Elevator No Or For A mirror, Wind tunnel effect)		Must maintain Fee Less
Climate Factor	Sunshine, wind, temperature, humidity, rainfall		Intermediate hollow interior, Exterior Automatic rain water Automated circulation system
Facades appendages	Air conditioning, awning signs bars, pipes, wall hanging objects		Intermediate hollow interior And Exterior Indwelling space
Community Environment	Plains, coastal, riverside communities, mountainous settlements		Suit All kinds Environment
Exterior Wall Material Disaster	Wood, RC brick tiles, scrubbed, steel reinforced concrete structure Typhoons, earthquakes, fires affect		For a variety of materials  No influence within the external Walls of the hollow middle Indwelling space side facades into space Forming an intermediate vacant interior and exterior facades Space Construction automatic Circulating water system

Figure 9. Comparison of technical feasibility (Kuang Hui, Peng, 2013) compare

Comparison of technical feasibility (Kuang Hui, Peng, 2013)  
Compared with the method of this study into the feasibility of the system

Case Place	The Vertical Green Wall
Taipei University of Technology	Feasibility systems approach
Taipei National Concert Hall	
Tai'an Miaoli Paris, France	
Japan Aichi	
Effective ecological environment	Effective ecological environment
YES	YES
Vertical greening systems	Vertical greening systems
OLD	NEW
Space factor Factors	Space factor Factors
YES	NO
The impact of disasters	The impact of disasters
YES	NO
New material	New material
The need to increase	The need to increase
Facades	Facades
Constructivism	Constructivism
YES	YES
NO	YES
Unable to make	No influence within the external Walls of the hollow middle Indwelling space side facades into space Forming an intermediate vacant interior and exterior facades Space Construction automatic Circulating water system

Figure 10. Comparison of technical feasibility (Kuang Hui, Peng, 2013) Compared

Type vertical greening technologies  
(Jen Hui, Tsai, 2009) and (Kuang Hui, Peng, 2013)  
and the vertical green wall systems comparison

Case Place Taipei University of Technology Taipei National Concert Hall Tai'an Miaoli Paris, France Japan Aichi	The Vertical Green Wall Feasibility systems approach
Technical types Natural climbing wall Soiless Cultivate Carriage Climb	Interior and exterior walls with an additional waterproof hollow walls, Stay mobile sink, Plus wall without water, Planting due to wet wall can absorb moisture, In the composition of the external walls of the hollow left side planting trough, Create shape changes
Use Planting trough Landscape Air Building Purpose Building	Use 1. Green planning 2. Renewable energy sources 3. Yes The symbiotic 4. On Landscape 5. And environmental protection
Cried soil Chemistry Container Material Combination	Environmental protection Material Combination
Drain Versus Water System Old type	Drain Recovery tank and Natural infiltration Automatic cycle and Automatic cycle Water New type

Figure 11. Vertical greening technologies (Jen Hui, Tsai, 2009),(Kuang Hui, Peng, 2013)

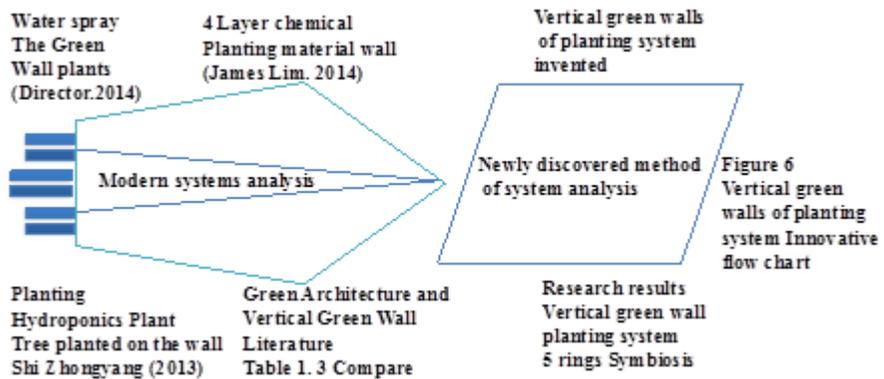


Figure 12. Vertical green wall of vegetation systems application analysis

Example above where the feasibility study system how As *Figure 10* technical feasibility of comparative case studies, this research breakthrough in the original system, making green building exterior wall construction sustainability green space. Constructed in the automatic cycle suitable for various temperature and humidity control installed on external walls of the proper location, proper placement of the outer side of the wall space of local Greens, this building of synergy around the vertical system is suitable for plant growth.

Green building breaks away from the original green carbon reduction targets,(Charles Landry, 2013), Observation of the creative city-types to organize city created by the technology, more humane migration or urban life in the countryside about the area to create a clustering effect, and the supply and demand of urban activities in industrial value increased vitality. Creative cities formed by colonial properties, application of renewable energy does not spread to the contribution of solar energy to reduce consumption of electricity, resources did not reduce the use of high energy sources such as heating and cooling appliances, did not decrease energy use,Unable to regenerate oxygen produces carbon dioxide emissions. Among the new buildings in creative cities, By Today's urban construction has five dimensions of the building,1, land use.2, environmental protection.3, building materials innovation.4, shock.5, prevention,(Charles Landry, 2013). In innovation Use of green Green construction Original Vertical green wall planting system Application analysis, Vertical green wall of vegetation systems, Invention patent application number102148601 Date of application 2013-12-27, Applicant: Chen Shang Jen, and Kuang Hui, Peng. *Figure 8* vertical green wall of vegetation systems application analysis, Analytical methods.

### **3. RESEARCH METHODS**

Visualization and construction of new developments to allow construction on the building, (Tim Brown, 2012),Using new technologies in real-life situations.Therefore vertical green wall of vegetation systems this study to design thinking to transform the world,(Tim Brown,2012). Substantive discussion on vertical green wall system of planting, In Tim Brown Theory Among the Design thinking Import Patent of invention To explore possible methods of practice, Design thinking to change the world,(Tim Brown, 2012),Theoretical research method as shown in *Figure 7* (James Lim,2014) ,In import enterprise resources in kind method of importing innovative vertical green wall green planting, *Figure 7* form of practice, Create benefits, especially in dense urban green spaces are so

scarce that With new technology Create New Vertical green walls System. (James Lim,2014), In the development of regional architecture out of the green wall, increasing multiple green goals. Vertical green wall and green background of the relationship between urban development, the time change from an agricultural village into forming small population becameurbanized, from agriculture into industrialization, Bring the boom, and created a market.

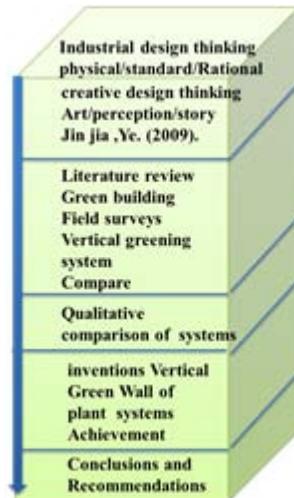
Demand, human functioning and quality of life, such as air, water, and environmental requirements for live life green building and environmental protection. Industrial development, formation of human needs,On the liberalization of the world economy, so that demand for green building and environmental protection in, grew into a global trend, in order to bring green building green economy and urbanization change, in change due to human needs and create a variety of different areas of demand, Updated knowledge of creative composition, such as increased use of solar panels and roof rainwater drainage to water pond or reservoir, flower bed used to ground and roof greening use And the Other Structures, Such as walls, how to shape and guard against theft and obscured the Sun blinds and external use of solar panels and other green technologies, In search of literature has been found in this study to update technology as some use ladder shape the technical.

Area such as Fukuoka Tenjin, Fukuoka International Center, Ministry of the interior architecture, Gao Jialong Fukuoka International Center the vertical green wall is built with platform, Green technology is not widely used, has not yet found that newer technology. The green wall and green urban development, gradually moving from the generally do not have Green thinking to Green thinking, to form wall greening to create new patterns.

Based on qualitative systems practice in field visits to construction sites and the sample room and looking at some of the new technical building, again with qualitative analysis of patented technologies, research notes, such as patents, This study vertical green wall system of planting, with patented technology of the future and creating a vertical green wall planting systematized city village, village green increase or maintain the Earth, if applied in construction of vertical green walls of the city, expecting green increase, creating vertical green walls of urban villages, Make green building a landscape objectives. Looking forward to future development and implementation, with most demand for innovations of philosophy for the occupants.Field studies have found that people living in the city has a handful of green building exterior wall, vertical green walls life patterns in various countries, most of the exterior wall is not green or green and sustainable in an artistic manner, Therefore In Design thinking Changing the world The Inspired by the prototype, (Tim Brown, 2012),The Theory of architecture, To construct this study method as shown in *Figure 7*. New application building long-term symbiosis with humans for the future,

Researchers discover new ideas in physical and field studies and doctoral studies with Professor Kuang Hui, Peng, in creativity and innovation skills, across the spectrum by patent inspired by prototypes, (Tim Brown,2012),The theoretical Among the Discovery to human habitable building exterior wall construction, Preliminary ideas to find exterior wall, you can moderate change of construction method, wall to wall mode to create the invention, Have the opportunity to Create Real physical Can change the appearance part of the exterior wall with partial structure, This research focuses on practical innovation patent technical connotation as discussed for future researchers to exterior landscaping and artistic and environmental protection, further in-depth study of building external wall property view of the practice, Application and practice of expecting more international, future researchers, it will get more advanced technology to reach the opportunity. (Tim Brown, 2012), Explore synergies and innovative green technology advanced the decoration system design methodology and process as shown in *Figure13*, finishing a drawing of this study.

Headings in your paper should be created using the predefined heading styles in the template. Generally, headings 1 to 3 should be used, heading 4 only when you really need it, and headings 5 and further should be avoided. All headings use Times New Roman, bold.Heading 1 is in 13 pt font, using all capitals in bold. For exact details, such as the line-spacing before and after headings, please see *Table 1*.



*Figure13.* methods and processes

#### 4. THE STUDY ACHIEVEMENT

Planting of vertical green wall systems for the future built environment formed symbiotic Figure 14 rings. Green planning, Renewable energy sources, Yes The symbiotic, On Landscape, And environmental protection, By The above, G, R, S,O, A, vertical green walls of planting system results in Figure 14. Long-term sustainability are not found in document technology innovative vertical green wall of vegetation systems use innovative, the results of this study, 1. Green planning,2. Renewable energy sources,3. Yes The symbiotic,4. On Landscape,5. And environmental protection, From the above research framework in Figure 9, figure 60% vegetation of vertical green wall system is formed, following technical illustrations,In the following scope of patent graphics, showing five rings symbiosis research results, as shown in Figure 10. Creative seeding system of vertical green wall greening the built environment makes the city more creative, ( Yu Qun, Den . Jen Hui,Tsai,2009),Considered to form a city with creative content and resources,( Ye Jinjia ,2010) Innovative green elements of the new directions in the built environment.

Pictures should be horizontally centred on the page, with a caption in 9 pt font below the figure, starting with *Figure14*.

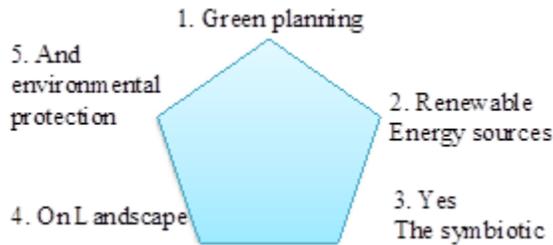


Figure 14. Results

With 3T theory, (Tim Brown, 2012) Tolerance, talent and technology are indispensable. Creative cities to observe innovative environmental management of urban type with spirit guide the city for development of new type, (Tim Brown, 2012). With creative conception of green city with vertical green wall system method produced the city for new formats.

##### 4.1 The integrity of the green concept

1. The integrity of the green concept to technological innovation of urban environmental symbiotic development of new type operation spirit guide city. Literature study on the construct validity of the

issues involved in the construction technology for all research, invention of the physical system, with system content as important in research validity construct viable technology principles In Creative Innovative city,(Hospers,2003)A case study of development-oriented innovation systems, so this study is an important technical constructs to form inclusive and green building, In green building technology and appearance can change shape (outside the scope of this study), in terms of human capital and the inclusion of the three conditions in order to ,inclusive any works are needed, city green building for the future, Order Creative Vertical The Green Wall Planting Systems, In building long-term greening area increased into the wall, technology applications for land construction walls green vegetation output reached a long-term contribution, could not go any further on the issue of future land area, Guided by a new system that can generate ideas vertical green walls to reach green goals, The innovative technologies constitute a pointer system, the following patented technologies such as graphic, in the innovation system to reflect that green construction, facades and application development as the goal, form the green city of the future building symbiotic synergy green achievements. Li Chon Gchen, 2009 Study found low in the arrangement, (Jen Hui, Tsai,2009).(Kuang Hui, Peng,2013). Type vertical greening technologies, case studies and creative application of urban green technology type found in extremely small, we found that new technologies, From green technologies and innovation concepts of literature, probably with additional exterior wall application plants, building related systems have been developed in recent years to improve energy efficiency and reduce energy use, Construction document technology of green wall most of the symbiotic green wall and short-term, applications may lack in long-term sustainability innovation has resulted in research and application of creative ways, (Seunghae Lee, Ph.D, 2012). forming vertical green wall planting system synergy range of patented inventions.

2. Regeneration concept formation After green, to utilize water resources remain in the wall wall to form a loop or recycled water use, achieve its exterior wall plants growing water formation and growth, growth, regeneration of used constructs of form. Innovative ways of building in the city, with exterior wall of building development can grow plants regeneration concept of innovation.
3. water circulation technology Environmental protection between the wall and the wall, so that lowers the temperature of water cycle or to maintain a certain temperature range, and indoors are maintaining a certain temperature reduced the use of heating and cooling, formed to

save the original usage, reduce carbon emissions form the basic requirements of environmental protection.

4. building and landscape change Object view is not confined to styling changes according to the actual needs of landscape change, change modes, such as size, shape, and structure changes in requirements in terms of size can be done on the device, consisting of artistic images of landscape, plants are grown to suit local into principles.
- 5 consists of more than five vertical green wall of vegetation systems

1. Green planning,2. Renewable energy sources,3. Yes The symbiotic,4. On Landscape,5. And environmental protection, Seeding system consists of more than five vertical green walls, Symbiosis formed five rings. Meaning of symbiosis is the formation of the first four, meaning common to mankind and the environment, mankind's role in urban green spaces and add, Air and water, The greening of buildings with a total human companion, quality of the living environment of urban green, Promotes With Greening buildings Compatible goals, Form a innovation City Green, recycling, environmental protection and catch views create synergy achievement rings formed symbiotic mind map as shown in *Figure 15*.

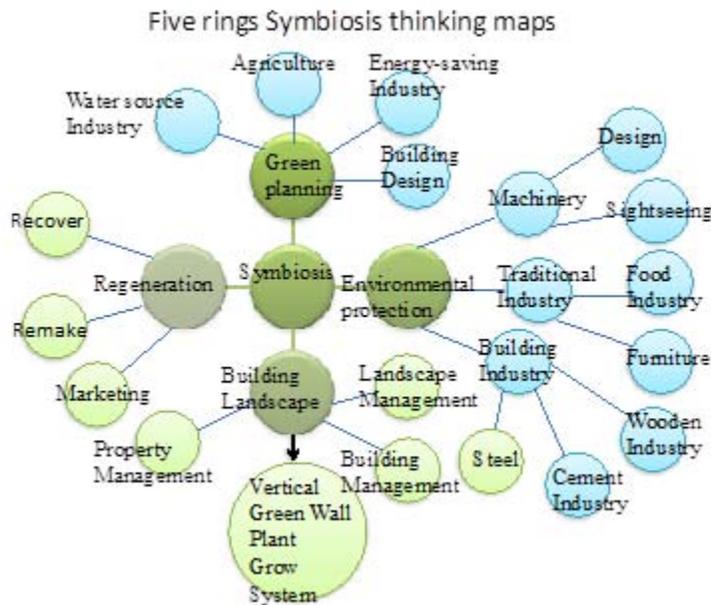


Figure 15 Five rings Symbiosis thinking maps

Design way of thinking in industrial design by creative design thinking of planting lockets form *figure 1-4* formation composed of storytelling, Field research found no advanced innovative construction or green building and advanced technology systems. In Review Green vertical green walls Technology Compared with the construction of vertical green wall system, In the practical application of the system of quality sheet with 4-layer planting in the maintain materials ageing 10-20, James Lim, 2014,

When the plasticizing agent aging of PP materials, 2 pollution hazards to the environment, *Figure 6* this study system flow chart of technical innovation and invention without plasticizer PP material when the backplane, no 2 pollution pollution to the environment .On State, society and people's needs to create the latest building, with vertical green wall of vegetation structure of the living landscape and plant growth and replacement of finishing stretch to create activation function beautifies to form reality.

Greening the city's formation system innovative approaches to green building creates a vertical green walls, formation, training, and innovation results of this study, in an attempt to become technology base, creating a green, Then Five rings Symbiosis Thinking Maps, *Figure 11* form a sustainable symbiosis, recycled and environmentally friendly way to create scenery, Form a symbiosis for activation, Creating the future between physical and biological, sustainable environmental symbiosis between people and objects vertical green walls of the city, get the Green Wall extension landscape, creating green activation extends to the environmental performance of building wall, real and sustainable green building. Vertical green wall planting system The Greening the technical conclusions and recommendations Design way of thinking in industrial design by creative design thinking of planting lockets form *figure 1-4* formation composed of storytelling, field research found no advanced innovative construction or green building and advanced technology systems.

Review of green technology and construction of vertical green wall vertical green wall systems, in the practical application of the system of quality sheet with 4-layer planting in the maintain materials ageing 10-20 (James Lim,2014) ,When the plasticizing agent aging of PP materials, 2 pollution hazards to the environment, *Figure 6* this study system flow chart of technical innovation and invention

without plasticizer PP material when the backplane, no 2 pollution pollution to the environment. On State, society and people's needs to create the latest building, with vertical green wall of vegetation structure of the living landscape and plant growth and replacement of finishing stretch to create activation function beautifies to form reality.

Greening the city's formation system innovative approaches to green building creates a vertical green walls, formation, training, and innovation results of this study, in an attempt to become technology base, Creating a green, then the Five rings Symbiosis *Figure 8* form a sustainable symbiosis, recycled and environmentally friendly way to create scenery, formed a symbiosis for activation, creating the future between physical and biological, between man and the environment symbiotic vertical green walls of the city.

## **4.2 Technology results conclusion**

Technology results conclusion Vertical green wall greening technology of planting system conclusion from fieldwork and the Singapore creative composition practice of *Figure 7*, (James Lim,2014) Vertical green wall of

Vegetation construction systems, 1. Green planning,2. Renewable energy sources,3. Yes The symbiotic,4. On Landscape,5. And environmental protection, Expected future innovators or enterprises could get insufficient physical or continuation of this research study, Create opportunities for practice, the technological achievements of this research, data for future vertical green wall of vegetation that for another researcher to help.

Technology results conclusion Technical advice and technical structures are the original wall greening technology for details. References and citations have not been discovered previously posed by the technology and implementation of the technology and innovation. Be Original exterior walls or concrete or glass or marble that formed the basis for technical.

This creation and raw materials combined with glass or marble composition technology that can be implemented by innovative technologies.

Prior art to solar power to collect rain water for clean water and environmental protection concepts for prior art., Outer walls still shapes, colours and materials, or the use of solar panels, architecture is not a lot of green in the old days, the research for a new era of building for the future a lot of green as the goal, consolidating all the innovation and green technology, such as patents of graphics and text.

Technical advice, planning of green technology, design discussions without having to build, building size does not affect the planning of landscaping system problems.

Vertical The Green Wall Planting Systems, Structure of the original building design as you increase the external wall and part of technical content to external wall, exterior wall greening technology, application to form an outer wall greening, green innovation of urban development. Green Planning Based on the Green, In new buildings by Government legislation and corporate design, form of practice on environmental protection and air quality and landscaping to create a very beautiful city, each green buildings contributed to the international tourist attractions or the formation of building green walls of cultural assets.

## **4.3 Appendix Map**

Vertical green wall of vegetation systems, Invention patent application  
Number102148601 Date of application 2013-12-27, Applicant: Chen

Shang Jen, and . ( Kuang Hui, Peng,2013).Complete data via the intellectual property agency case number 102148601, appendices the following sections refer to.

- 1, perform the pattern description *Fig1-3*.
- 2, simple schema technology notes.

The first figure is the invention of vertical green wall of vegetation structure side view. Second, there is the appearance of water containers in the invention of the chart. Third figure as a preferred embodiment of the invention a vertical green wall planting system using the configuration reference.

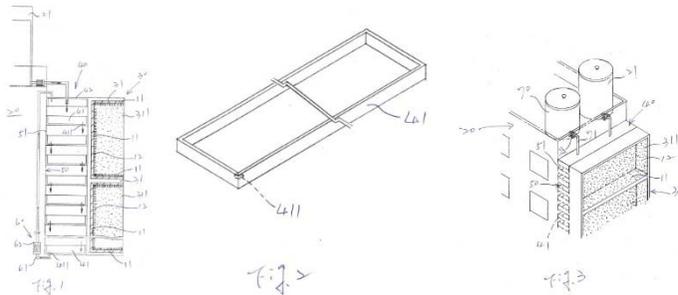


Figure 16. Appendix Map

## 5. INTERVIEW

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- National Chung Hsing University, Professor, *Department of environmental engineering bulletins Zhuang Bingjie,.(2013).* Taiwan, Taipei.



NO.63

## Urban Spatial Strategies for Mitigating Heat Island Effect in Taipei City

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**Key words:** Urban Heat Island, Built Environment, Urban Form, Spatial Strategies

**Abstract:** This research explores into the spatial strategies for urban heat island effect (HIE) of Taipei City in various dimensions and different categories. The main research question is what the urban heat island characters of Taipei City are, and how to mitigate the heat island intensity of Taipei City from the point view of urban form?

To differentiate the factors and to what extent the factors influenced by typology, climatology, land use, and urban built environment are aims of this research. To understand the formation of HIE, especially, in relation to particular urban area of Taipei, macro, mid, and micro scales are set up for mapping the strategic plan. In other words, regional scale, city scale, and district scale respectively are examined to establish the framework of mitigating HIE of Taipei City. Accordingly, a set of heat island isotherms are monitoring, which indicate in what intensity and pattern the radiation distribute over Taipei City. According to isotherms, the formation of heat island pattern and its related location could therefore be qualitatively assessed. Spatial strategies are put forward to modify the cause of formation in categories: topographic particularities (for examples, terrain, river course, as well as air movements), urban planning, and architecture and landscape disciplines.

Based on comprehensive review of climatology statistics of the past ten years, the HIE of Taipei City could be summarized as followed. First, the prevailing wind of Taipei comes from the north-east, which is almost paralleled along the course way of Kee-lung River all through the year. That is considerably unequal to the prevailing wind directions of Taiwan, with north-east in winter while south-west in summer. Such particular wind direction characteristic is a result of the unique basin terrain of Taipei of which is embraced by rolling hills, with valley to the north-east allows airflow introduces. This character might be critical to heat island effect of Taipei city. Second, the predominantly east-westwards urban structures could also enforce the direction of the most-frequent winds (70°-110°).

While the topography and urban form impose influences on HIE, the built environment (building construction, site planning, landscaping) and energy usage style (transportation mode, air-condition reliance) all considerably attribute to Heat Island Effect of Taipei City.

Strategic plans are developed in various categories and scales in planning and design, for example land use, distribution of building mass, urban volumes and voids, open space structure, natural systems. In addition, studies on urban HIE of Taipei are considerably new area. As an growing city like Taipei, how to transform the built-up areas towards less HIE city to conform to the dramatic social changes, for example, elderly-and-fewer-child-ization society and so on will still be challenging.

## **1. THE FRAMEWORK OF THE STUDY**

This study aims to explore spatial strategies for mitigation of the HIE of Taipei, which is part of the tasks in the project 〈The Monitoring and Analysis of UHIE and Improving Planning and Design on UHIE of Taipei〉, the author of this study participated from 2008 to 2009, and is launched by the Taipei City Government during 2008-2009. The goal of this study sets up to propose feasible and practical spatial strategies in various scales for Mitigating UHIE of Taipei City on the basis of the specific attributes and conditions of the UHIE of Taipei.

### **1.1 Research Object**

Theoretically, the formation of UHIE is vitally interrelated with climate systems, ecosystems, hydrology systems. The physical factors include certain conditions of geography, location, topography, terrain, hydrology, solar radiation, humidity and so on. In addition, the result of human behaviors, such as built environment, population and density, land uses, and the ways of energy usage all overall contribute to HIE. Given by these multiple and complex causes, the UHIE patterns of certain area might be quite different from others.

Located at sub-tropical geography, the climate of Taipei City is characterized by high temperature and humidity, while the surrounded basin terrains obstruct ventilating all through the year. As Chuan-Yao Lin stated in 2008 ‘Such a complex geographic structure makes the effect of UHI in Taipei significantly more serious than other cities of similar scale around the world’. Furthermore, relatively considerable high density, and working population swarming into Taipei from metropolitan around intensifies the UHIE, particularly in summer, due to the month temperature in average in July and August, could dramatically be bounced up to the highest among other county, even though the temperature of Taipei in other seasons would

be quite in accord with other cities of Taiwan in terms of latitude and altitude.

How climate, natural and built environments all together interact with existing city forms, and how that interrelates to UHIE of Taipei City would be initially investigated in this study. With synthesizing the city forms and spatial features, such as the patterns of land use, urban activities, transportation areas, and so on, it would therefore be possible that effective spatial strategies for mitigating the UHIE of Taipei City could be put forward.

## **1.2 Research Method**

This study carries out mainly by literature review, climate statistic data analyse and case study on cities developed and testified to be effective on mitigating UHIE. The research also identifies the distribution characteristics of HIE of Taipei City by isotherms which is undertaken in 〈The Monitoring and Analysis of UHIE and Improving Planning and Design on UHIE of Taipei〉, by which differentiating the HIE characteristics of certain area in Taipei through analysis of overlapping the HIE distribution against built environment. Spatial Strategies then could be proposed under mapping the relevant between HIE characteristics and built environment. Finally, the framework is put forwards in various scales and categories of land use, urban design, open space system, landscape system, and so on.

### **1.2.1 UHIE Measurement and Analysis of Taipei City**

Climate data from Central Weather Bureau (CWB) of Taiwan and other climate data essential to the study are all included.

#### **1. Regional Climate Data and Local Climate Data**

Climate data include temperature and wind direction and wind speed: Regional climate data are principally collected from Central Weather Bureau of Taiwan. Additionally, in order to specify the climate character, local climate data from more than thirty elementary schools located dispersedly within Taipei Basin were complementary to data of CWB. Regional climate data and local climate data are together significantly contributed to the understanding of the micro features of Taipei City.

#### **2. HIE Mapping of Taipei City**

Isotherms mapping of Taipei City undertaken through field monitoring implemented during summer of 2009 indicates the tendency of temperature distribution. Mapping is also, to identify the geometry character of UHIE patterns, and how it related to specific areas which would later be analyzed in cooperation with natural geography, terrains, hydrology, and

meteorology on regional scale; land use, population and activity densities, transportation system on urban scale, and landscaping, and building design on construction scale. From the isotherms mapping of Taipei City, the evident HIE areas can be pointed out so that the physical environment of those areas could be examined.

### **1.2.2 Evaluation Method of UHIE**

CASBEE-HI is one of UHIE evaluation method developed by Japan Government in 2005, which is both scientific and objective. This systematic evaluation assumed that building as a micro-entity not only affect micro-climate but also influenced by surroundings. The factors which considered in the process of building design could therefore play a critical role in reducing UHIE. Five dimensions of building design compose the evaluation, that's air ventilation, shade and screen, pavement, building skin materials, and the heat producing from building installation.

### **1.2.3 Case Studies: Cities Testified as Effective in Implementing Spatial Strategies of Mitigating UHIE**

Cities implementing spatial strategies HIE located within sub-tropical climate zone are explored, while projects with other references such as basin terrain influence, systematic strategies of urban design and open space, and etc., which have been realizing and testified that UHIE could be, to some extent, effectively alleviated HIE are also included. On this account, this research respectively explores the spatial strategies of mitigating Urban HIE of Stuttgart City of Germany and Houston City in U.S.A.

## **2. PHENOMENON OF THE HEAT ISLAND EFFECT IN TAIPEI CITY**

First of all, this study carried out synthesized analysis on the basis of the isotherms mapping built up by field monitoring and wind direction mapping of Taipei City. It is assumed that the properties of HIE of Taipei City could be projected on isotherms so that the relation between the patterns of intensity and distribution could be investigated by areas with obvious HIE in Taipei City. At the same time, the overlapping of isotherms and Google Earth Map of Taipei shows in which areas the HIE effect occurs more intensely compared to others. This study then identifies the areas with the major HIE results. According to the HIE theory model, the causes of the HIE of the area could be assessed by reference to micro-climate distinctness

and physical conditions such as land use, population density, activities intensity, open space distribution, ratio of building area, surface materials, water body, and so on (Figure 1).

The isotherms of HIE of Taipei City indicates a number of noticeable HIE distributions as below:

- 1 Strip area along Taipei Main Station and Bade Road displays as a high HIE region: The district approximately located between Nanjing W. Rd. to the north and Chung Hsiao E. Rd. to the south, and the Tamsui River to the west, Keelung Rd. to the East. It's about the area east to Taipei Main Station, and west to Guangfu N. Rd., roughly along to the axis of Civic Boulevard and Bade Rd. with some block width parallel to the axis.
- 2 South-west Taipei, area south to the Taipei Main Station displays as a high HIE district: The area is about west side of Ximending, extends to Zhonghua Rd. and the Wanhua Train Station.
3. District spread from the intersection of Chongqing N. Rd. and Minquan W. Rd. extended south-eastwards to the area between Zhongshan N. Rd. and Xinsheng N. Rd. is classified as a high HIE district.

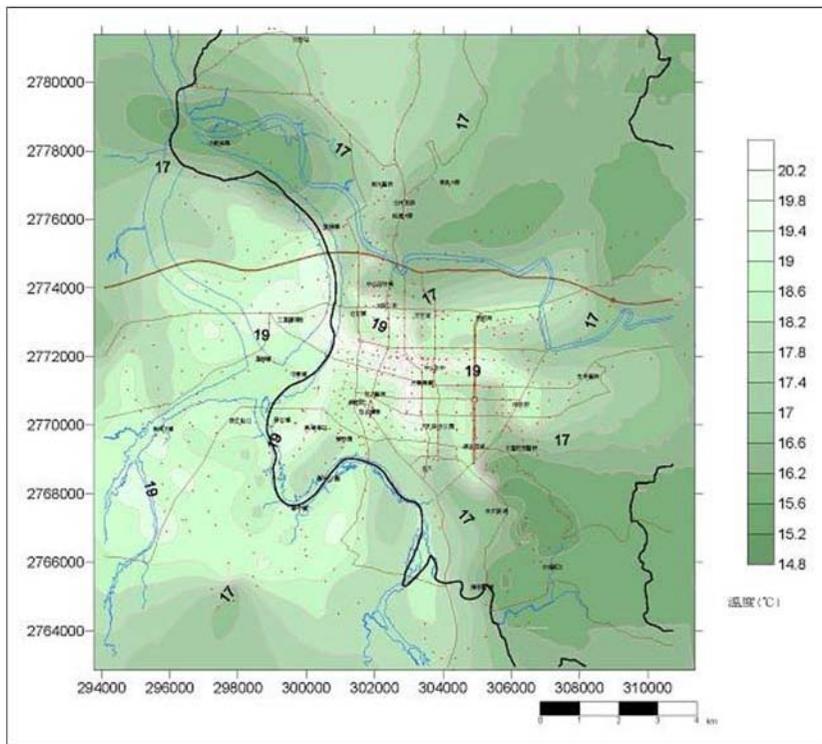


Figure 1 The HIE Mapping of Taipei City(Source: K.P. Lee)

4. From west of the Xinsheng N. Rd. extends southwards to Xinyi Rd. is a high HIE district, the temperature lowers down from the west of the Da-an Forest Park.
5. From north of the Renai Rd. extends to Fuxing S. Rd., east of the Cheng-Kung Public Housing to the east, approximately the district of Jian-an Elementary School and Da-an Junior High School in Da'an Dist, and the north side of Taipei Hsinwei Post Office to the north. The High HIE gradually declines around the Dunhua S. Rd. and Dunhua N. Rd.
6. District south to the intersection of Roosevelt Rd. and Xinyi Rd., where right around the Chiang Kai-shek Memorial Hall and Nanmen Market is considered to be the high HIE area. The causes are assumedly related to the hard pavement and high density of public activities.

Generally speaking, the distribution of heat island effect is mostly consistent with commercial areas. The western district, including Zhongzheng District, Wanhua District, and Datong District are the most recognizable districts that have the evident heat island effect in Taipei City.

### **3. CHARACTERISTICS OF THE CLIMATE IN TAIPEI CITY**

#### **3.1 Data Provided from the Central Weather Bureau**

The primary task of searching for the appropriate strategies for mitigating the HIE in Taipei City is to understand the characteristics of the climate. According to the climate statistics from the Central Weather Bureau, the specific data for temperatures and wind directions show that the HIE in Taipei City is extremely obvious in summer, particularly in July and August.

1. Data of the monthly maximum temperature is accumulated from Central Weather Bureau.
  - (1) Data of monthly maximum temperature observed from 1970 to 2000(*Table 1*) shows the temperatures in other months at other counties and cities in Taiwan almost correspond with latitudes and altitudes. Except for the weather stations in the northern part of Taipei, the temperatures of Taipei City are usually lower than other weather stations outside of the city. However, the temperatures of weather stations in Taipei City are higher than others cities in July and August almost without exception in last 30 year.

- (2) During 1981 to 2010, the temperatures were lower than Tainan and Taitung in June (Table 2).

Table 1: Monthly maximum temperature (1971-2000)

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Taipei	18.9	19.3	21.9	25.9	28.8	<b>31.9</b>	<b>34.1</b>	<b>33.5</b>	31.2	27.8	23.9	20.7
Taipch	22	22	24.6	27.8	30	31.8	33	32.4	<b>31.9</b>	<b>30.1</b>	26.9	23.6
Kaohsi	<b>23.4</b>	<b>24.1</b>	<b>26.5</b>	<b>28.8</b>	<b>30.4</b>	31.5	32.1	31.5	31.2	29.7	<b>27.2</b>	<b>24.6</b>

(資料來源: 交通部氣象局 <http://163.32.129.3/elearning/94weather/001/1001-2.htm>)

Table 2: Monthly maximum temperature (1981-2010)

month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
Taipei	16.1	16.5	18.5	21.9	25.2	27.7	<b>29.6</b>	<b>29.2</b>	27.4	24.5	21.5	17.9	23
Taipch	17.6	18.6	21.2	24.5	27.2	28.5	29.2	28.8	28.1	26.1	22.8	19.1	24.3
Kaohsi	<b>19.3</b>	<b>20.3</b>	<b>22.6</b>	25.4	27.5	28.5	29.2	28.7	28.1	<b>26.7</b>	<b>24.0</b>	<b>20.6</b>	<b>25.1</b>

(資料來源:交通部氣象局 <http://www.cwb.gov.tw/V7/climate/dailyPrecipitation/dP.htm>)

2. Wind direction: According to the data of maximum wind-direction in ten minutes by Central Weather Bureau.

- (1) Data of wind-directions from 2001 to 2008: Table 3 shows the data for maximum wind-directions from 2001 to 2008, all the angles of directions are between 60° to 130° which are north-eastern to south-eastern direction except for July of 2007.

Table 3: Statistics of maximum wind-directions in Taipei city (2001 to 2008)

month	2001	2002	2003	2004	2005	2006	2007	2008
July	130°	90°	120°	90°	50°	100°	280°	60°
August	80°	120°	110°	320°	60°	80°	100°	70°

(by Ching-Chuan Lin. Source: Central Weather Bureau)

- (2) Table 4 shows that slow-wind is another characteristic of the climate in Taipei City. The monthly average wind speeds were all between 2.2 m/s to 3.6 m/s and stayed stable from 1971 to 2000.

Table 4: Statistics of monthly avg. wind-speeds in Taipei city. (1971 to 2000)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Av.
m/s	2.9	2.9	2.9	2.8	2.7	2.2	2.4	2.6	3.0	3.6	3.6	3.2	2.9

(by Ching-Chuan Lin. Source: Central Weather Bureau)

## Conclusion:

Temperatures in Taipei City are higher than other areas in summer during July to August in Taiwan. The north-east to south-east wind-directions are affected by topography. Apart from that, the wind-speeds are usually slow in summer.

However, it is difficult to grasp accurate data for weather statuses and for local characteristics of Taipei City by using the point-type data that is provided from weather stations of the Central Weather Bureau in Taipei.

### **3.2 Data Provided from Weather Monitoring Stations in Elementary Schools in Taipei City**

In order to remedy the defects aforementioned, this article refers to the distribution data from weather monitoring stations collected from a considerable amount of elementary schools, which are also part of the outcome of “Analysis and Monitoring for Heat Island Effect in Taipei City & the Plan for Mitigating the Heat Island Effect in Tested Region”.

#### **1. Topography Influences**

The wind-directions of Taipei City are mostly influenced by topography. However, among the whole Taipei territory, major tendencies of wind directions seem to be obvious among city centre.

1. The wind directions go east-west(about  $40^{\circ}$ - $120^{\circ}$ ) at the south of Chung Hsiao East Road, around the central Taipei, while at the north of Chung Hsiao East Road to Minquan East Road to the north, the wind directions go around  $90^{\circ}$  to  $135^{\circ}$ . It is evident that at the north and the south of Chung Hsiao East Road displays quite different results.
2. North to Ming Sheng East Road and Ming Sheng West Road influenced by the Taipei Song Shan Airport, Keelung River, and Guan Du Plain, with spacious undeveloped areas, in addition the She-Zi District, prohibited to be developed since 1960s, the wind directions drawn by air flows along Tamsui River are forced forward to the course way of Tamsui River and Kee-lung River.

At the southern part of Nanjing East Road, the district within the areas defined by Chung Hsiao East Road, Renai Road, Xinyi Road, Heping East Road, Xinhai Road, and Keelung Road to the east, Roosevelt Road to the west, the wind direction of this areas goes around  $90^{\circ}$ , parallel to the east-west direction of road system and coincides with the directions of southern mountains.

## 2. Influence of Undeveloped District

Figure 2 shows the wind-speeds are mostly higher at wind gaps between mountains in Taipei City, the Taipei Song Shan Airport, and extensive open field districts in She-Zi and Guandu Plain.

## 3. Influence of Embankment Buildings

The wind speeds of west part of Taipei City, especially from Datong District to Wanhua District are all lower than the east areas. However, the speeds increase dramatically at the intersection of Minquan West Road and Tamsui River. This phenomenon is resulted by obstacle of embankment-building barriers. On the contrary, water gate number 6 speeds up the wind because of the air flows through the opening to the river.

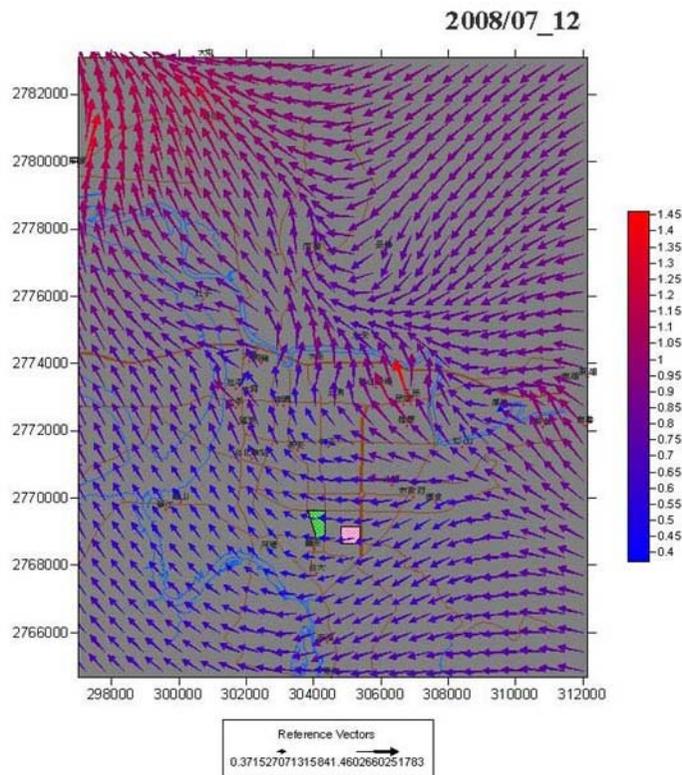


Figure 2: Diagram of wind-directions in Taipei City  
(source: Kui Peng Li, 2009)

## 4. CASE STUDY: SPATIAL STRATEGIES FOR MITIGATING HIE

Cities implementing spatial strategies HIE located within sub-tropical climate zone are explored, while projects with other references such as basin

terrain influence, systematic strategies of urban design and open space, and etc., which have been realizing and testified that UHIE could be, to some extent, effectively alleviated HIE are also included. On this account, this research respectively explores the spatial strategies of mitigating Urban HIE of Stuttgart City of Germany and Houston City in U.S.A. Stuttgart 21 is the plan for alleviating the HIE of Stuttgart, which is influenced by basin topography. Houston located in subtropical climate zone with high building-area ratio in the U.S share the common characteristics of high-temperature and high-humidity in the summer with Taipei City.

#### 4.1 Case Study 1 : Stuttgart 21, Stuttgart, Germany

Stuttgart is located in a continental climate zone with a basin- topography and has a similar climate with Taipei. Basin-topography of Stuttgart causes some problems:

1. The Nesenbach valley provides fresh air for the inner city located between Heslach and Bad Cannstatt. However, the Kriegsberg hill and the Uhlandshöhe at the Nesenbach valley which are nearby the Central Station narrow the width of the valley.
2. In planning area huge mass and high buildings in zones A1, A2, and B block the fresh air run through the Central Station area from the valley.

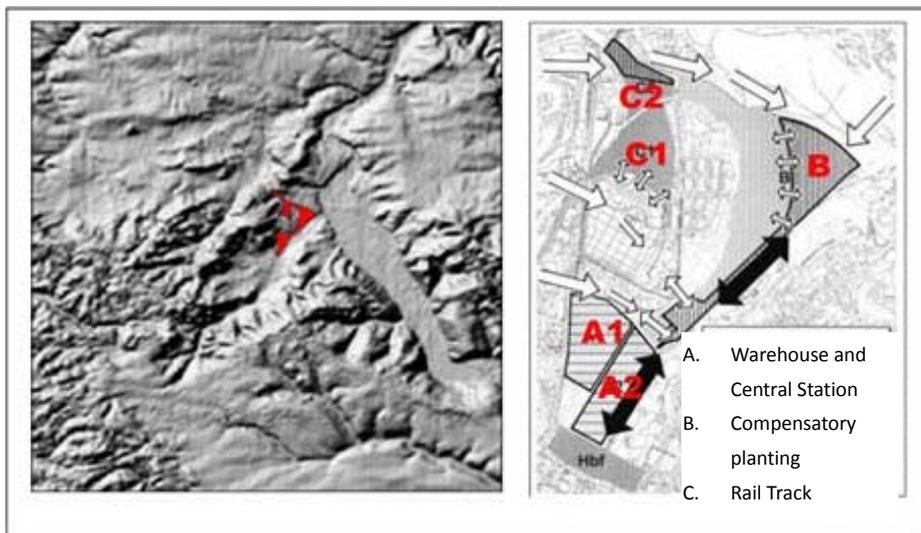


Figure 3 Basin Topography influence in Stuttgart Left: Area of the plan “ Stuttgart 21”.Right: Distributions of the plan “Stuttgart 21”.(Source: [http://www.stadtklima-stuttgart.de/index.php?klima\\_service\\_literatur](http://www.stadtklima-stuttgart.de/index.php?klima_service_literatur) )

### **1.Spatial Strategies for mitigating the HIE of Stuttgart**

The spatial strategies in the plan of “Stuttgart 21” are outlined as follow:

1. Ensuring appropriate development of Stuttgart and guaranteeing the quality accompanied by development by providing compensatory planting.
2. Assuring the urban form and building mass without obstructing wind corridor
3. Permeable pavement
4. Establishing green systems in urban spaces

### **2.“Stuttgart 21” Plan**

The practical spatial strategies of Stuttgart consists of four aspects:

1. Maintaining the wind-gaps for fresh air in three regions at North-western ridges, using downslope wind to increase the air exchange rate at night in the regions.
2. Using permeable pavement of crushed stone: replacing 90% of impermeable pavement at zone A1, A2, and 76% of impermeable pavement at C1 and C2. In addition, replacing 90% of impermeable rail track by permeable pavement to improve the evaporation.
3. Removing the barriers along the wind corridor to improve air flows in the regions

Compensatory green space: In order to reduce the heat flows and facilitating the air circulation, analysing the quantities of green space on the basis of ideal urban development model to satisfy the compensatory amount caused by urban development and construction. The compensatory green space is then well connected to large central city green space (Pragfriedhof Cemetery, Rosensteinpark, IGA Garden Show ) to improve air exchange in the regions.

## **4.2 Case Study 2: Houston, U.S.A.**

Houston is located in a subtropical climate zone. The highest temperature in July is 33°C and the lowest temperature in January is 16°C. Houston City is 50 miles away from the Gulf of Mexico. Prevailing winds from Mexico Gulf help to modify the humid and high temperature climate of Houston. However, temperatures increase by 6 °C to 8 °C along with development of the area.

This environmental issues in Houston can be concluded as follow:

1. Hard surface of the city: almost near 50% of developed areas in Houston are covered by roofs and pavements, the other 50% is consisted of 13% of vegetation, 30% of permeable grasses or grounds, and 7% of others. The temperatures of roof surfaces are higher than 7°C. This phenomenon results in radically high temperature in the city.

The main causes of the HIE in this city are using materials in dark colour on roof top and pavements, and removing large areas of trees and vegetation as well. Solar radiation is absorbed and kept by dark coloured materials on rooftop and pavement and in turn they become the causes of HIE in the city. However, well arranged trees and vegetation provides a complicated and natural process to moderate the HIE.

### **1.Spatial Strategies for mitigating the HIE of Houston**

The Spatial Strategies for moderating the HIE of Houston are summed up as below:

1. Identifying the range of the plan including roofs and pavements need to be replaced or rebuilt and looking for the citizen who is willing to implement the action.
2. Considering the feasibility: Identifying districts with more feasibility for replacing the materials of pavements. For example, public parking lots have the priority to be repaved or repainted than drive ways or lanes within residential areas.
3. Providing extra benefits and diverse techniques for householders such as new planting trees, new roofs, and reducing temperatures. For examples, trees could not only bring down temperatures, elevate the estate values, reduce air-condition cost, offer better living conditions, and help to prevent floods and so on.

### **2.The Targets of Strategies**

On the basis of the spatial strategies, a set of targets of strategies are put forward:

1. Widely using the cooling-pavement technics in planned or existing parking lots, developing areas, and neighbourhood streets, and the maintenance of pavement.
2. Widely using the cooling-roof technics in all buildings with flat roof.
3. Growing ten million of trees in decades and promoting vegetation preservation.
4. Including the HIE measurements into the “Houston-Galveston-Brazoria State Implementation Plan”.
5. By preventing floods in the regions, elevating the aesthetics qualities, welfare and building up natural habitats to improve environment of living.

Improving qualities of water management by applying technics of mitigating HIE.

## **5. SPATIAL STRATEGIES FOR MITIGATING HEAT ISLAND EFFECT IN TAIPEI CITY**

Based on comprehensive review of climatology statistics of the past ten years, the HIE of Taipei City could be summarized as followed. First, the prevailing wind of Taipei comes from the north-east, which is almost paralleled along the course way of Kee-lung River all through the year. That is considerably unequal to the prevailing wind directions of Taiwan, with north-east in winter while south-west in summer. Such particular wind direction characteristic is a result of the unique basin terrain of Taipei of which is embraced by rolling hills, with valley to the north-east allows airflow introduces. This character might be critical to heat island effect of Taipei city. Second, the predominantly east-westwards urban structures could also enforce the direction of the most-frequent winds (70°-110°). While the topography and urban form impose influences on HIE, the built environment (building construction, site planning, landscaping) and energy usage style (transportation mode, air-condition reliance) all considerably attribute to Heat Island Effect of Taipei City.

Strategic plans are developed in various categories and scales in planning and design, for example land use, distribution of building mass, urban volumes and voids, open space structure, natural systems. The framework of practical strategies of mitigating HIE of Taipei City are therefore figured out in four dimensions as practical strategies & control contents, systematic guidelines, public sector and private sectors while categorized into three scales and applied disciplines as well. Spatial strategies are in hierarchical order as natural environment, urban planning, and architecture and landscape categories in each table. Spatial strategies are illustrated respectively as below by practical strategies and control contents strategies (*Table 3-1*), system guidelines (*Table 3-2*), and public sectors (*Table 3-3*).

Table3-1 Practical Strategies and Control Contents (by Ching-Chuan Lin)

Dimension	<b>Practical Strategies &amp; Control Contents</b>			
<b>Natural Environment</b>	<ul style="list-style-type: none"> <li>-Control over wind corridor of Kee-lung river to assure the air flow circulation</li> </ul>			
	<ul style="list-style-type: none"> <li>-Promote cross river basin governance in specific river basins in Taipei and Keelung.</li> </ul>			
<b>Urban Planning</b>	<ul style="list-style-type: none"> <li>- Periodical Overall Review of Urban planning</li> <li>- Appropriate intensity of Land use and zoning</li> <li>- Infrastructure planning</li> </ul>	<ul style="list-style-type: none"> <li>- Urban forms for mitigating HIE</li> <li>- Streets orientations and road planning</li> <li>- Open space systems</li> </ul>	<ul style="list-style-type: none"> <li>-Use and intensity of Architecture</li> <li>- Greenbelt planning</li> <li>- Riverbank and water control</li> </ul>	
	<ul style="list-style-type: none"> <li>-Sustainable transport planning</li> <li>-Energy planning</li> </ul>			
<b>Architecture &amp; Landscape Practice</b>	<ul style="list-style-type: none"> <li>-Ventilation control</li> <li>-Pavement planning</li> <li>-Structure and material and construction</li> <li>-Heat removal technics</li> <li>-Sun-shades</li> </ul>	<ul style="list-style-type: none"> <li>-Site planning</li> <li>-Storm management and water body</li> <li>-Bulding materials and system</li> <li>-Reduce heat direct emission</li> <li>-Vertical greening</li> </ul>	<ul style="list-style-type: none"> <li>-Architectural design</li> <li>- Permeable pavements</li> <li>-Color of facility</li> <li>- Reducing endothermic reaction of building materials</li> <li>-Green roofs</li> </ul>	<ul style="list-style-type: none"> <li>- Landscape planning and design</li> <li>- Sun-shades in parking lots</li> <li>- Architectural equipment improvement</li> </ul>

Table3-2 System Guidelines (by Ching-Chuan Lin)

Dimension	<b>Systematic Guidelines</b>
<b>Natural Environment</b>	<ul style="list-style-type: none"> <li>-Formulate the policies to control over the transfer of floor area and principles of ecological compensatory</li> <li>-Regional governance strategies for mitigating the HIE</li> <li>-Improve the air quality through enhancing the green space</li> <li>-Remove barriers along ventilation paths</li> <li>-Improve fluid velocities of rivers and green areas</li> </ul>
<b>Urban Planning</b>	<ul style="list-style-type: none"> <li>-Manage the industries and activities in high-risk areas of HIE</li> <li>-Fund and compensatory measures to promote the HIE strategies.</li> <li>-Include the measure of wind corridor in urban design review of architectural design</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 5px;"> <ul style="list-style-type: none"> <li>-Compensatory measures for sustainable transportation</li> <li>-Compensatory measures for sustainable energy</li> </ul> </div>
<b>Architecture &amp; Landscape Practice</b>	<ul style="list-style-type: none"> <li>-Implement architectural management</li> <li>-Review of the building restriction of Building Code and Regulations</li> <li>-Use the engineering technologies which could extend the life-cycle of buildings</li> <li>-Raise the usage rate of facilities in buildings</li> <li>- Encourage and provide subsidy for enhancing green space</li> </ul>

Table3-2 Public Sectors (by Ching-Chuan Lin)

<b>Public Sectors</b>	
<b>Natural Environment</b>	<ul style="list-style-type: none"> <li>-Implement architectural management</li> <li>-Review of the building restriction of Building Code and Regulations</li> <li>-Use the engineering technologies which could extend the life-cycle of buildings</li> <li>-Raise the usage rate of facilities in buildings</li> <li>- Encourage and provide subsidv for enhancing green space</li> </ul>
<b>Urban Planning</b>	<ul style="list-style-type: none"> <li>-Review the principles of urban design of land using in wind-gaps controlling areas</li> <li>-Review wind gaps (fields) during urban design review processes.</li> <li>-Review wind gaps in old town areas during urban design reviews processes</li> <li>-Develop the plans for improving wind gaps (fields) in public facilities</li> <li>-Improving plans for roofs, façades, landscapes, and water environment in public facilities.</li> <li>-Controlling plans of pavements, greening, and floods</li> </ul> <ul style="list-style-type: none"> <li>-Plans for improving the sustainable transportations</li> <li>-Spatial plans for bicycle riders</li> <li>-Plans for developing sustainable energies</li> </ul>
<b>Architecture &amp; Landscape Practice</b>	<ul style="list-style-type: none"> <li>-Review the Building Code and Regulations of building cooling.</li> <li>-Rewarding plans for reuse and recycle of materials, and raising usage rate of facilities in buildings</li> <li>-Plans of landscape design for mitigating HIE</li> <li>-Rewarding and compensatory measure plans of site greening.</li> </ul>

## 6. CONCLUSION AND SUGGESTION

The practical strategies of the HIE in Taipei City should be developed according to the unique climate, topography, and urban forms. The urban forms of Taipei are the basis and references for this study. Through this perspective, the specific spatial strategies are developed as the beginning for mitigating the HIE in Taipei city. The most important policies of strategies include:

1. Strategies of implementation.
2. Related control regulations below:

- (1) Area control mechanism
- (2) Air quality control
3. Urban activities improvement.
4. Strategies for energy and transportation modes.
5. Related policies for incentives to lower temperatures.
6. Facilitating review of building laws and production mechanisms.

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NO.66

## The economic activity of cities implied by POI

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**Key words:** Urban fringe, Densi-Graph, spatial analysis, POI

**Abstract:** Regional scientists and planners frequently use the statistics of administrative areas to make out the economic activities of urban areas with fairly vague confinement of the fringe of urban areas. It was revealed that urban fringe can be physically defined with image analysis techniques such as remote sensing, but the results, on the other side, often lacked a clear linkage to the economic activities of cities. Therefore, it is expected to define urban areas from the perspective of economic activities. As one of the new sources of data for urban analysis, POI (Point of Interest) data obtained from online map services well reflect the agglomeration of urban activities and urban structure under certain conditions. Therefore, with POI, we proposed a method to identify the border of urban built-up areas, which is so far . For this aim, a Densi-Graph method was developed based on the contour lines of the kernel density estimation of POI . Then, we discussed how to identify the threshold value of the rural-urban fringe in terms of different urban structures such as mono-center and poly-centric cities, whereby the applicability of the Densi-Graph method using POI data was validated. Based on the results, we used this method to study the borders of urban built-up areas in China's 263 prefecture-level cities. also The correlation was revealed between POI density distribution and the population scale and location of the cities, and the corresponding thresholds of the border of urban built-up areas for different kind of cities were presented.



NO.67

## **Interaction and Integration of Cultural Inheritance, Ecotourism, and Industrial Development.**

*Strategies, Mechanisms and Spatial Practice of The Amis Dietary  
Culture Transformed into Creativity Living Industry.*

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**Key words:** Creativity living industry, ecotourism, dietary culture, Amis, social network analysis (SNA).

**Abstract:** Diet is the important foundation in constructing traditional culture in aboriginal tribes. Because food is usually regarded as the fundamental element of cultural and social interaction, diet carries symbolic information of cultural tradition in the society. In the face of severe challenge in the globalization era, how to conserve aboriginal culture as well as build aboriginal competitiveness in the free market becomes an important issue in enriching plural ethnic culture. Existing research indicates that the traditional economic structure and cultural context of aboriginal tribes may develop a new cultural pattern after tourism development is drawn into aboriginal living territory. Especially the introduction of ecotourism and tourist experience activities can positively support the conservation of local characteristics and contribute to ecological conservation. Moreover, ecotourism also benefits the promotion of local employment and brings natural resources into aboriginal daily life to preserve local characteristics. On the other hand, Creativity Living Industry is the unique type of Cultural and Creative Industries in Taiwan, and it is full of experimental vitality. However, how to develop Amis tribe's dietary culture into promising Creativity Living Industry is still rare in the field of academic research. This research is intended to fill in these academic blanks. Therefore, this project will conduct a field survey and interview with local persons and professionals in Hualien to collect basic data and information. Social network analysis (SNA) is applied to analyze the mechanism which can effectively transform Amis dietary culture into Creativity Living Industry. Finally, some suggestions regarding spatial planning and improvement are also proposed.

## **1. INTRODUCTION**

In recent years, the impact of globalization on local culture has raised public awareness on the importance of localization. In response to globalization, Taiwan's local culture and local industries caused by the impact, the government actively promoting the development of cultural industry, this opportunity makes located in "vulnerable" or "border" of the community through the development of cultural industries, as the resistance mainstream culture of the local forces. Exploring and maintaining local characteristics and creating regional differentiation are the core strategies employed in manifesting the subjectivity of local regions. The government of Taiwan has actively utilized local resources to develop local cultural industries, implying that developing local characteristics has become a key trend for local economic development. Cultural and creative industries are emerging industries that the government of Taiwan has endeavored to develop in recent years. In particular, the creativity living industry is a unique industry in Taiwan. The government of Taiwan is making the agitation of creating industry's intention progressively through joint efforts of assistance and family property of the policy person too (Lai, Hwang, & Lee, 2005). In 2003, a promotion panel organized by the Ministry of Economic Affairs in Taiwan described the categories of cultural and creative industries, defining the creativity living industry as creative or culture-based industry, in which commodities or services for daily life (e.g., food, clothing, accommodation, travel, education, and entertainment) are innovatively managed through composite, creative, regenerative business models, thus offering learning activities to customers. When the creativity living industry was an emerging industry, case studies and academic research have shown that companies operating in the creativity living industry feature the following three elements: core knowledge, quality aesthetics, and in-depth experience; therefore, the creativity living industry was redefined as an industry "providing economy of in-depth experience and quality aesthetics based on the core knowledge of integration of creativity and living aesthetics (e.g., in dietary culture, daily living education, natural ecosystems, fashion, artifacts, and crafts)." (Chang, 2010).

Since the 1980s, with the deterritorialization and time-space compression that comes with advanced modernization, the social, political and aesthetic properties potentially associated with cuisine have come to be immensely significant in modern societies. Against this backdrop, food has gradually become a central focus of socio-cultural forces and gained a key position that reflects socio-cultural power relations (Lai, 2006). In the context of modern development, diet carries the connotation of a cultural code. Food is the clue to memory, a specific food is associated with the memory and the growth experience of an individual which is capable to awake the collective memory of a group. Food sources and cooking methods imply social and cultural

identity (including diet heritage and cultural mosaic) (Lin, 2009). Mak, Lumbers, & Eves (2012) contend that globalization poses a threat to local gastronomic identity and image, there is preliminary evidence suggesting that it can provide an impetus for reinventing local gastronomic products and identity. Beside, a diet of over-refined foods can cause numerous diseases. Because people currently exhibit strong intentions of living a natural primitive lifestyle, natural foods for lifestyles of health and sustainability (LOHAS) have become a popular trend. Incorporating traditional cooking methods and fresh seasonal and local ingredients into dietary habits is generally conducive to good physical health.

Because of globalization, minor traditions have gradually received increasingly more attention and have thus been recreated, reused, redefined, and redeveloped. Herbs and medicinal foods are also used in the creation of a diverse range of delicacies (Liao, 2004). Given the numerous cultures in Taiwan, diets of indigenous peoples have a profound relationship with the natural ecosystem. Indigenous diets not only interact with nature, but also reflect the wisdom of indigenous tribes and the abundance of culture in the mountainous areas of Taiwan (Ju, 1997). Traditionally, indigenous peoples pick edible wild vegetables, which have been a crucial food source for them since ancient times. The Amis people live in the eastern area of Taiwan where natural resources are abundant, and they thus have access to abundant food sources in the rivers, forests, mountains, and the sea (including vegetables, fruits, peat moss, laver, and kelp) (Tian, 2001; Chang & Yang, 2004; Wu, 2006). In the current society where localization is embraced and people advocate natural health, indigenous dietary culture in which local and natural foods with simple seasoning are served and simple cooking methods are used have started to receive increasingly more attention. Matai'an tribe to actively develop Amis cultural industry, and promote community and throughout the Guangfu township to reproduce a manner Amis aboriginal cultural resistance "Marginal spaces" of the position and from the Amis aboriginal culture in the "diet" as a starting point into the development of local cultural industry focus.

In the present study, the Matai'an tribe in Guangfu township, Hualien County, Taiwan served as a research base. Social network analysis (SNA) was adopted to holistically investigate and comprehensively analyze Amis dietary culture of the Matai'an tribe. This study has two main purposes: (1) to explore the development of Amis dietary culture in the Matai'an tribe and the relationship between Amis dietary culture and the Matai'an tribe; and (2) to construct and analyze the interactive network in which the Matai'an Tribe transformed Amis dietary culture into the creativity living industry.

## **2. LITERATURE REVIEW**

### **2.1 Creativity Living Industry**

In 2002, the Taiwanese government proposed the “Challenge 2008 - National Development Plan,” and admitted the creativity living industry into the “Cultural and Creative Industries Development Plan” as one of the categories for the cultural and creative industries. The creativity living industry is a category uniquely created based on the economic situation in Taiwan and practices used in other countries. Unlike other industries that target artists, designers, and cultural workers, the creativity living industry primarily targets traditional industries and is a part of the creative industries (Lin & Lin, 2012).

Business operations in the creativity living industry are focused on developing effective business strategies and interactive commodities along the dimensions of product, promotion, space, and service. These four major items must be interconnected to form a niche for and key characteristics of business management (Chang, 2010). Currently, which types of businesses are entailed in the creativity living industry is not clearly defined; all businesses related to daily life activities and in possession of unique core knowledge, experiences, and aesthetic designs can be included in the creativity living industry (Lin & Lin, 2012). The creativity living industry of the intention is in the cultural intention industries put forward in recent years of Taiwan, act the traditional special role whose industry made the transition, combine and experience and design and create the new industry type attitude with style aesthetic feeling (Lai et al., 2005).

Food is a type of product that depicts local and cultural characteristics and local identification. It provides a special dietary experience for tourists. Canizaresa, S. M. S. & Guzman, T. L. (2012) argue that typical local cuisine, as perceived in the restaurant sector, is an important tourist product that revalorises the culture of a given location. This study explored the concept of diet and investigated how dietary culture can be transformed into the creativity living industry.

### **2.2 Dietary Culture**

Dietary culture represents a lifestyle of a group of people, and it includes previous and current cultural heritage and integrates physical and spiritual concepts (Teng, 2009). Some dietary customs are deemed fundamental, and are incorporated into the cultural practice of an ethnic group; they are endowed with distinctive ethnic cultural connotations, and become symbolic marks that are transmitted and passed down and consolidate group

membership internally and serve to fix boundaries externally (Wang, 2007). A food system integrates and connects various social groups based on characteristics commonly perceived and demonstrated in a region. Such system can be used to differentiate the explicit or implicit differences between societies (Lai, 2006). Although eating is a natural human behavior, there are specific reasons for eating certain foods, and some foods have specific cultural meanings. Dietary culture is integral to a culture on an overall level. Diet can reflect the local characteristics of an area and help people understand certain social and cultural implications. During the modernization of society, food has become an element of social and cultural functioning, reflecting specific social and cultural meanings. The dietary cultures of various countries effectively characterize the national cultures of countries (Lin, 2009).

Local dietary resources are used to satisfy the dietary needs of local people and to develop local dietary cultures. Additionally, local dietary resources have other values and functions such as serving as a carrier of local dietary cultural heritage to embody local traditional culture, and as an option to develop local tourism resources and the local economy (Ju, 2010). A growing demand for distinctive, local produce has encouraged the renewal of traditional festivals, inspired the emergence of educational visitor attractions, reconnected consumers with the countryside, inspired the retention and development of culinary and agricultural skills, and offered dying traditional industries and small businesses a lifeline (Everett & Aitchison, 2008). Thus, tourism destinations can create a strong tourism image by exploiting unique culinary features and cultural assets (Hall & Mitchell, 2002).

Food is one of the essential elements of the tourist experience (Hall & Sharples, 2003). Food tourism is an emerging theme in the international tourism and hospitality business; a significantly growing number of tourists travel to destinations to taste unique and authentic culinary products (Smith & Costello, 2009). Food tourism is clearly able to contribute to the “triple bottom line” of environmental, economic and social sustainability (Everett & Aitchison, 2008). While ecotourism is to promote sustainable development of local communities in the best way, so that community residents with ecological knowledge and awareness of the ecological environment, promoting community consensus through the autonomous communities in the ability to improve the community natural ecological environment, the economy and the preservation of community culture (Sirakaya, Sasidharan, & Sönmez, 1999 and Vincent, & Thompson, 2002). The present study focused on exploring the feasibility of using dietary culture to develop tribal ecotourism by examining the relationship between dietary culture and ecotourism.

### **2.3 Ecotourism**

Hetzer was one of the first scholars to propose the term ecological tourism. He proposed four criteria for ecological tourism: (a) minimizing the impact of the local culture and environment, (b) using local resources or cultures to produce the greatest economic benefit, (c) minimizing the effect of local tourist destinations on the ecosystem, and (d) achieving complete satisfaction of visitors (Hung, Tsauro, & Lu, 2008, Lu, 2006, Wu, 2007 and Yang, 2014). In 1991, the International Ecotourism Society (TIES) defined ecotourism as “responsible travel to natural areas that conserves the environment and improves the well-being of local people” (Wu, 2007).

Regarding the development of ecotourism of Taiwan, to promote ecological education, the United Nations declared 2002 to be the International Year of Ecotourism. The tourism policy-promotion panel at the Executive Yuan requested the Tourism Bureau to publish an ecotourism white paper, develop related promotion policies in recognition of 2002 being designated as the International Year of Ecotourism, thus establishing the Taiwan Ecotourism Association (TEA). In 2005, the Tourism Bureau published the Ecotourism White Paper, defining ecotourism as tourism in natural areas where ecological conservation and sustainable development are valued. Additionally, the Tourism Bureau proposed specific assessment criteria that tourism activities must meet to be classified as a form of ecotourism. For ecotourism, only camping and leisure activities that have a low impact on the environment can be allowed, the number of tourists must be limited (including group size or the number of tourist groups), conservation of local natural resources and cultures must be advocated, services and carriers provided by local people must be used, tourism must focus on a “natural experience,” tour guides must possess an understanding of local natural culture, wild animals and plants must not be disturbed, the environment must not be damaged, and traditional culture and the privacy of local people must be respected.

The meaning of ecotourism can be expressed as a form of tourism in natural areas, emphasizing the concept of ecological conservation and sustainable development as the ultimate goal (Yang, 2014). Thus, ecotourism is based on the sustained conservation of resources in a non-consumptive manner involving nonintrusive exploitation of natural resources through the controlled use and management of cultural and environmental resources for the future (Sirakaya et. al., 1999). To fulfill the spirit of ecotourism, the following five dimensions must be integrated:

1. Natural experience: Travel plans and services are developed according to natural resources, ecological characteristics, and features exhibiting educational values (e.g., local fauna, nature, and culture) to provide tourists with an in-depth experience.

2. Environmental education and interpretation: Tourists are guided to experience, understand, appreciate, and enjoy nature. Professional and in-depth explanations and accurate information about natural areas and cultural assets are provided to tourists as they interact with the environment. Tour guides are employed to guide and provide tourists with correct information before and during the tour. In addition, educational environmental activities are held so that tourists could learn various levels of knowledge, and perceive, appreciate, and experience nature.
3. Sustainable development: Regarding the development and implementation of business operation methods in ecotourism areas, the sustainability of natural resources and conservation of local fauna, diverse resources, and natural habitats must be fulfilled. The impact of human activity on the environment must be reduced as much as possible. Revenues generated through tourism activities must be channeled into protecting and conserving local natural environments and cultural assets.
4. Environmental awareness: A sense of mission toward the natural environment should be integrated with a sense of responsibility toward social morality. These ideas should be promulgated among tourists to gain their recognition. Through interpretive services and environmental education, tourists can be enlightened and encouraged to respect local traditional cultures and lifestyles, establish environmental ethics, and raise awareness on environmental issues.
5. Benefits and feedback: An ecotourism strategy involves using earnings obtained from tourism activities as conservation funds for local areas. In other words, community residents are encouraged to participate in raising environmental conservation, research, and education funds through various mechanisms to help protect and conserve local ecological and cultural resources while developing tourism.

Ecotourism is considered to be a responsible approach of tourist development. It aims to keep the balance between the economic growth and environmental concerns and furthermore, to enhance the cultural integrity of the local residents in order to achieve sustainable living (Huang, & Lo, 2013 and Lu, 2006). The sustainable development of ecology emphasizes the balance between the use of the natural environment and development to maintain the integrity of the ecosystem and the ability to regenerate (Yang, 2014). In summary, ecotourism is a small-scale tourism model that integrates leisure activities, in-depth experience, and intellectual education. The objectives of ecotourism are to protect and conserve ecosystems and to enhance the well-being of local people through tourism activities.

### **3. METHODOLOGY**

#### **3.1 Research Methods**

1. Literature Review: On the basis of related studies and information, historical data were collected from relevant books, research reports, statistical data, and newspapers to explore the origins of Amis dietary culture (including natural and geographic conditions, production and living conditions, and social and cultural factors).
2. Field Study and In-depth Interviews: Field study and in-depth interviews with tribal elders, restaurant owners, and people who have hosted dietary cultural activities were conducted to elucidate the development of Amis dietary culture, thereby bridging the research gaps in previous studies.
3. Observational: Naturalistic observation was undertaken, in which research targets were observed in natural conditions without disturbing their behavior and observations were recorded in writing. Amis dietary culture was observed in dimensions of ecology, culture, and industry.
4. Social Network Analysis (SNA): Social network refers to a specific tie and relationship established among individual nodes of a group in a certain manner. Function and authority is distributed across the nodes and linkages, such that decision-making and implementation are conducted through informal and temporary coalitions of actors and resources (Gilchrist, 2004). SNA is a tool for examining network relationships. After identifying which actors are nodes, network data are collected through questionnaires, interviews, and observations and then input into an analysis software package to calculate various network indicators and depict network graphs representing various types of relationship. Actors are connected to one another through a line, and a social network graph is presented by using dots and lines. The structure of the social network graph is identified, and graph theory, theoretical modeling, and cognitive analysis are employed to understand the social network and interpersonal relationships of the actors in that social network; to examine their influence on people or organizations; and to explain the social behavior of group members (Chen, Lee, Wang, & Sui, 2008; Huang, Chang, Lee, & Lai, 2011). Chen and Tai (2007) indicated that social networks possess the following six crucial features:

Size: The size of a network refers to the number of network members. Larger networks produce a greater amount of useful information, and network members are more likely to obtain information.

**Density:** Density refers to the level of intimacy or connection strength between network members, and it can be assessed on the basis of interaction frequency and the amount of time spent on building a network.

**Content:** Content refers to the relationship between network members.

**Diversity:** The diversity of network members refers to the various background and experiences of network members.

**Purpose:** The purposes of building networks may vary. If building a network is to satisfy a certain purpose, the network will not last long and will provide limited information and interests. If network members have been acquainted with one another for long, they will build a profound affective connection with one another, gain support from one another, and share information with one another.

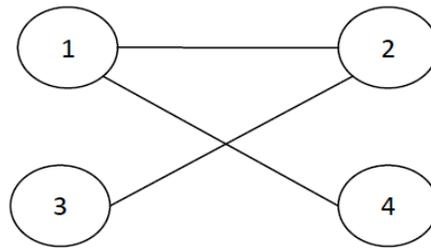
**Social norms:** Considering how network members govern, maintain, and use networks for an extended period, trust and interaction between network members and written and unwritten norms are crucial for governing networks.

The connection framework and interaction model among network members can be verified through SNA. Therefore, group phenomena can be explained using the concept of social networking (Huang et al., 2011). Before performing an SNA, a relation matrix must be established. The main networks are interlinked if the themes are related to one another. According to the relation between actors, an  $n \times n$  actor-by-actor matrix is formulated. Table 1 shows an example of such a matrix; under a theme in one dimension, four main networks exist, and the links between the networks represent the interaction between nodes. A value of “1” indicates that a response relationship exists between nodes, whereas a value of “0” indicates that no response relationship exists. The response relationship is represented by a social-network-relationship matrix.

Actor	1	2	3	4
1	-			
2	1	-		
3	0	1	-	
4	1	0	0	-

*Figure 1. A social-network-relationship matrix*

A social network graph can be constructed as a relationship matrix according to the response relationship between actors. A node represents an actor and a link represents a response of an actor to another actor. Using Node 1 as an example, Node 1 has a response relationship with Nodes 2 and 4, but not with Node 3.



*Figure 2.* A social network graph

A primary function of networks is to facilitate boundary-spanning co-operation, co-ordination and communication. In a network-type organization, members are generally loosely connected through a variety of formal and informal linkages that enable them to share information or to trade with one another (Gilchrist, 2004). In this study, University of California of Irvine Network (UCINET) 6.0 was used to explore individual actions within an overall structure. According to social network theory and an analysis of network centrality, critical actions in the network were identified to understand the role of various action factors in building an interactive network of transforming the Amis dietary culture into the creativity living industry.

### **3.2 Research Design**

The actions of interviewees who transformed Amis dietary culture into the creativity living industry served as nodes; in addition, the social network formed by various actions during the development of the creativity living industry was illustrated. Four main elements that formed the creativity living industry were denoted as A, B, C, and D, and the reasons for the interaction between cooperating bodies were denoted as Reasons x, y, and z. Actions were related to one another on the basis of the aforementioned elements and reasons. Using Node 1 as an example, Node 1 is connected to Node 2 because of Elements A and D and Reasons x, y, and z.

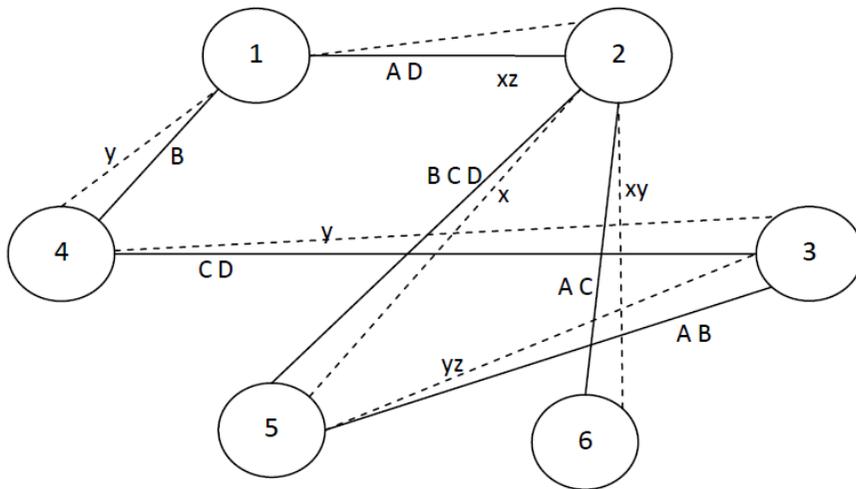


Figure 3. The schematic diagram of a social network graph

## 4. RESULTS

On the basis of the four constituent parts of the creativity living industry, this study adopted interactions between partners involved in ecological conservation, cultural heritage, and industry development as research dimensions, interviewed local tourism businesses, and treated the interviewees' actions as the foundation of a network for analysis. Degree centrality was used to measure the importance of each action in the interactions

### 4.1 Coding and Analysis of the Interview Data

The actions collected through interviews were divided into five categories:

#### 1. Industrial operations:

- (1) (providing traditional meals): The primitive cooking methods of the Amis people were adopted for tourists to experience tasting traditional cuisine (e.g., salted and grilled fish and stone hotpot).
- (2) (developing creative dishes): Creative cooking methods were employed to prepare and promote exotic local foods that tourists would not normally accept (e.g., solanum coagulans, kakorot, okra, pigeon peas, and snails).
- (3) (researching and developing special agricultural products): Through cooperation with the Industrial Development Bureau of the Ministry of Economic Affairs, local crops (e.g., purple rice, pigeon pea, kakorot, roselle, and rice) were incorporated into the

design of souvenirs.

2. Promotion and education:
  - (4) (providing introductions and tours): Through ecological tours, bicycle tours, and interpretive illustrations attraction spots, tourists can learn about the natural ecology and cultural history of the Matai'an Wetland.
  - (5) (engaging visitors in actual operations): The traditional fishing method (Palakau) and cutlery-making method (e.g., betel leaf tableware, stone-hotpot cooking method, and mochi pounding) of the Amis people were demonstrated.
  - (6) (offering performances and demonstrations by local residents): Local residents demonstrated the traditional fishing (fish and shrimps) and cooking methods of the Amis people.
3. Raising animals and cultivating plants:
  - (7) (contract farming and purchasing and cultivating plants and raising animals for personal consumption): Business operators purchased foods from or entered contracts with specific farmers to ensure the origin of food ingredients (organic).
  - (8) (purchasing): Business operators purchased foods from markets or farms, and occasionally obtained free food from relatives or friends.
  - (9) (cultivating plants and raising animals for personal consumption): The ingredients for preparing indigenous dishes (Amis dishes) were cultivated in fields or yards. Accordingly, the freshness of foods can be ensured, and rare wild vegetables could be reproduced to ensure abundance of local specialty foods (water sprite).
4. Social interactions:
  - (10) (providing mutual support among local residents): Local residents were employed to work part-time or full-time in restaurants and parks or to work as tour guides or performers.
  - (11) (attracting tourists from outside the community): Travel agents, government departments, and schools were consulted about itineraries to attract more tourists, generate additional income sources, and promote cultural and ecological education.
5. Spatial development:
  - (12) (preserving the original features of Matai'an): The appearance of the local ecological environment was preserved as much as possible. For example, fences, boardwalks, and signs were used to minimize anthropogenic influences on the environment.
  - (13) (promoting indigenous Amis cultural styles): Culture and history workshops decorated with tools, clothing, totems, and craft works were established to recreate the atmosphere of the Amis tribe

## 4.2 Social Network Analysis

### 4.2.1 Ecological conservation

Element L (preserving the original features of Matai'an) was the most crucial, followed by Elements E (engaging visitors in actual operations) and I (cultivating plants and raising animals for personal consumption). These elements interacted independently with seven other actions.

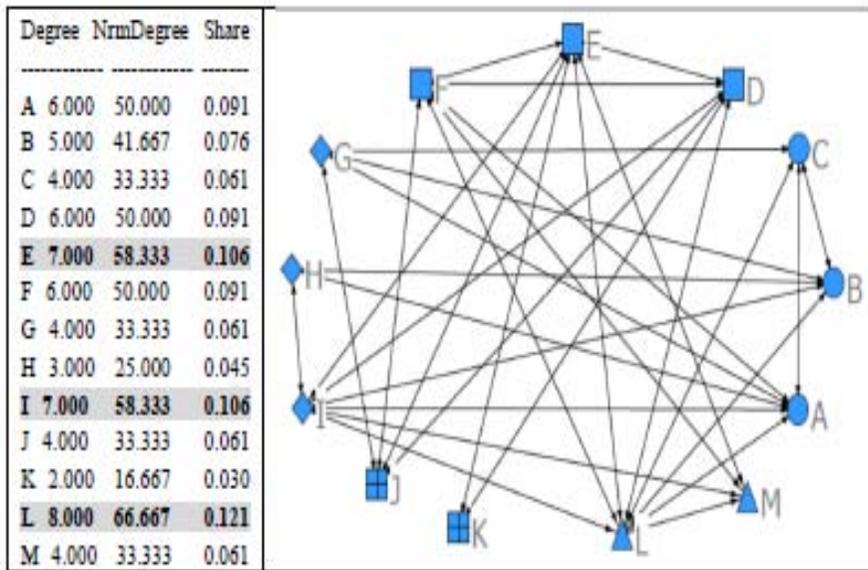


Figure 4. The social network graph of ecological conservation dimensions

### 4.2.2 Cultural inheritance

Elements D (providing introductions and tours), E (engaging visitors in actual operations), L (preserving the original features of Matai'an), and M (promoting indigenous Amis cultural styles) were independently related to eight other actions. The link degree was approximately 67%. Elements D, E, L, and M were equally crucial for cultural inheritance.

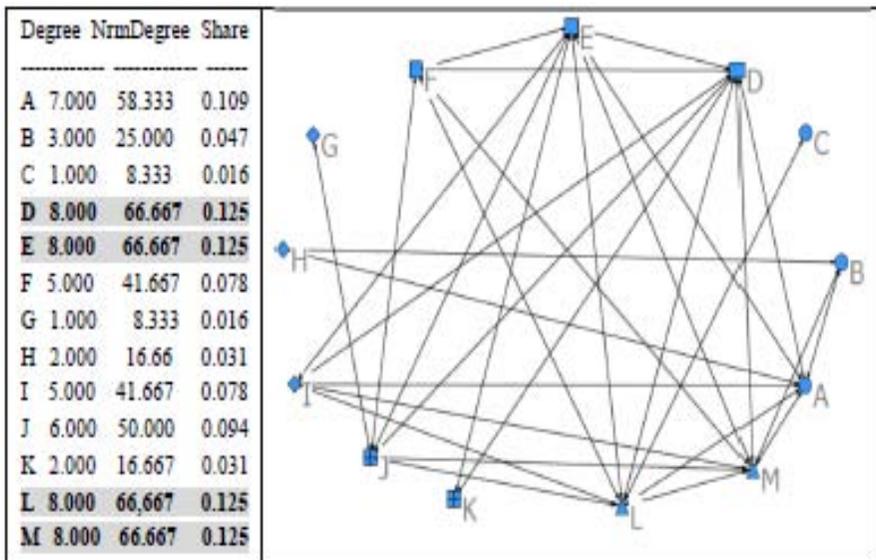


Figure 5. The social network graph of cultural inheritance dimensions

#### 4.2.3 Industry development

Element J (providing mutual support among local residents) was connected with the most number of actions (12 nodes); the link degree reached 100%. Elements A (providing traditional meals), L (preserving the original features of Matai'an), and M (promoting indigenous Amis cultural styles), which were equally crucial, were connected with the second-most number of actions (11 nodes); the link degree reached approximately 92%.

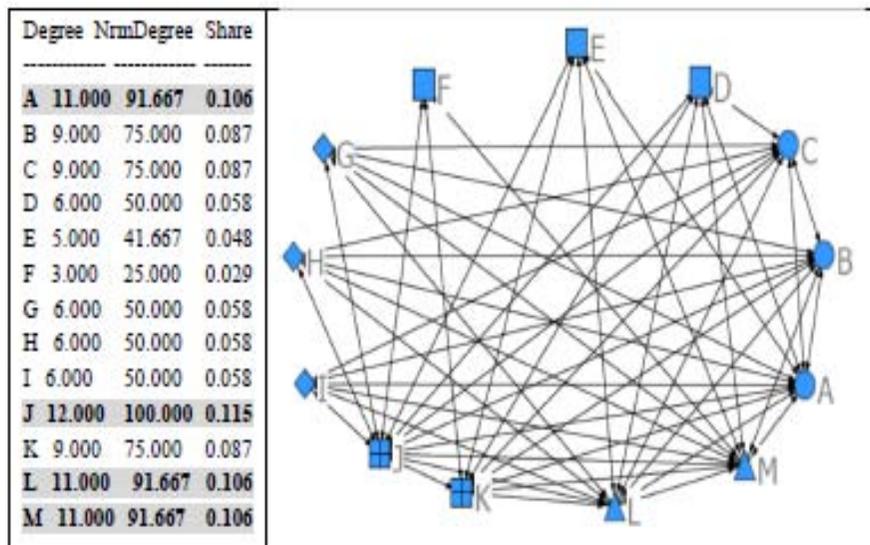


Figure 6. The social network graph of Industry development dimensions

## 5. CONCLUSION

The creativity living industry concept, a key to the transformation of traditional communities, is a channel that the Taiwan government has developed in response to the transformation of small/intermediate traditional industries with the goal of promoting added value to industrial innovation to create new opportunities for traditional industries (Su & Tu, 2009). According to the social network, the Matai'an tribe presented Amis dietary culture in various forms and practiced it in various ways. In the product dimension, local or innovative dietary experiences were provided. The space dimension involving the creation of a dining environment, comprised more links compared to other actions; in other words, creating a dining environment was crucial because it was connected with numerous nodes. Therefore, the Matai'an tribe used space as a medium for promoting traditional culture, which then became the basis for the creativity living industry, as well as for marketing local delicacies, craft works, agricultural products, cultural landscape, and in-depth tourism.

The local food consumption plays an important role not only on enriching the recreation experiences, but also providing an opportunity to extend local culture features (Tang, Wu & Chang, 2007). Tourist consumption of local foods creates a market opportunity that can encourage the development of sustainable agriculture, help conserve traditional farming landscapes and assist the local economy. Through managing traditional Amis cuisines, providing ingredients required for creative Amis delicacies, and constructing

a catering environment, the geographical landscape of Matai'an Wetland and biological habitats are preserved and unique edible plants are reproduced to protect the ecology and ensure biological diversity.

Sutawa (2012) indicated that through ecotourism, community power strengthened as the community became more empowered. Community participation activated the community, preserved the local culture, and maintained the natural ecology, thereby achieving sustainable development objectives. Ecotourism and guided tours can facilitate new experiences and enable people to obtain new cognition regarding wetlands, ecotourism, and sustainable development (Yang, 2014). Production and consumption processes in the creativity living industry increased job opportunities and local incomes. In particular, when local indigenous peoples are employed and trained as tour guides, they gain insight into the precious experiences of tribal elders and the values of traditional culture and ecological wisdom, and subsequently identify with and exhibit a sense of belonging to their culture. Consequently, cultural education and heritages are promoted, thus facilitating the preservation of Amis culture and ecological conservation of the Matai'an Wetland.

Along with the creativity life industry and experience time's oncoming, the consumer takes seriously from the expense activity to obtain the unforgettable happy experience, therefore experiences the marketing to attract the customer is the tidal current tendency (Lin, Wu, & Li, 2010). Sims (2009) suggests that offering visitors a way to experience some form of authenticity through food can assist the development of sustainable tourism in a number of ways. Food is usually regarded as the fundamental element of cultural and social interaction, diet carries symbolic information of cultural tradition in the society. A specific diet is associated with the memory and the growth experience of an individual which is capable to awake the collective memory of a group. Amis dietary culture, in which resources are obtained from nature and efforts are made to conserve nature, continues through the development and promotion of the creativity living industry. In addition, Amis dietary culture promotes the concept of coexistence with the natural environment, becoming a form of Matai'an cultural heritage. Amis dietary culture attracts tourists and stimulates local economic growth. Furthermore, the local economy and industries can be diversified to achieve the prosperity of an ecological environment, social and cultural lifestyles, and a production-based economy. This research found that dietary culture offers an alternative means of local and regional development, with the potential to strengthen identity, enhance appreciation of the environment, encourage the regeneration of local heritage and the economy.

With the increased life quality of Taiwanese, the recreational industry leads to green tourism. To promote indigenous cultural industry, the characteristics of indigenous culture must be considered, rather than merely pursue mass production and economic benefits. The creativity must be

fulfilled in the life and each industrial level. Exotic tribal characteristics of buildings and human resources should be highlighted in the planning of an indigenous the creativity living industry involving gourmet feasts, ecotourism, cultural-workshop visits, and daily living experiences to develop the creativity living industry that embodies the characteristics of tribal people, landscapes, and production activities. Ecological knowledge about means for coexisting with nature is the result of the long-term interaction between the aborigines of Taiwan and the natural environment, and it is an ecological value that should be promoted. Overall, the sustainable development of an indigenous tribal industry can be achieved by focusing on nature-based ecotourism, the creativity living industry based concepts, unique tribal cultural resources and natural landscapes, leisure activities aimed at conserving nature and achieving sustainable development, conventional industrial technologies, the creation of a knowledge economy, and integration of tradition and innovation.

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## Space Consolidation Of Tourism Village Based On Patembayan Concept

*Case Study : Villages Surround Borobudur Temple*

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**Key words:** Space consolidation, borobudur of tourism village, patembayan

**Abstract:** Space Consolidation of tourism village is a process of change in the determination of spatial tourism village. Space consolidation process is highly influenced by the presence of modern social organization or known as *patembayan* organization. The existence of social organization consisted of modern group of community and willing to create a modern village changes that have economic value. There are many kinds of responses from each village social groups toward tourism variable. All responses depend on local variables such as the background of the people that may further color the tourism village changes.

Candirejo village, Karanganyar and Wanurejo that launched as tourism village in Central Java had been neglected for such a long time and not much in demand by tourists because of its condition. Now, the condition become different since they began to be visited by tourists. While the responds of the local people as the host of tourism activity is to run tourism space consolidation activities according to the implementation of *patembayan* concept in their tourism village group. In principle, space consolidation process involving public participation and rural assets as a whole.

To examine in detail the process of space consolidation of tourism village, in this study is used Case Studies Method as offered by Yin. It becomes a strategy to find out the interpretation and meaning in human action. The case study focused on Candirejo Tourism Village, Wanurejo and Karanganyar which have similarity as tourism village but also have significant differences among the three.

The outcome of this study is the concept of *patembayan* groups / *gesselschaft* that has changed the way people think in following tourism activities. One of the reasons is how powerful the social cohesion among the group of people to keep traditional value. Various responses of each tourism village studies have provided learning about the space consolidation of tourism village. It still has to consider not only the active community involvement, but also the role of local leaders that capable of playing as a cultural broker among the communities.

## **1. BACKGROUND**

Tourism is an activity that directly touches and involves the society, so bring a variety of impacts on the local community and the physical aspect of the host area. Even tourism is said to have an incredible energy which are able to make local communities face metamorphosis in its various aspects. The changes that occurred in the tourism destination would not grow without any effort of society. Hence, the availability of facilities and infrastructure are needed to respond tourism.

As well as the world's largest Buddhist temple, Borobudur gain international recognition as a World Cultural Heritage by UNESCO. Along with the enactment of the area of Borobudur as a World Cultural Heritage, the Borobudur began attracted many domestic and foreign tourists to visit. Average visits per year based on data from the PT. Borobudur Tourism Park is about 2-3 million. The number of tourist arrivals is giving a huge influence on both society and the process of metamorphosis of the physical conditions in the villages around Borobudur Temple. People switch professions from farmer to any professions related to tourism industries and some villages space turned into tourism spaces. Moreover, the tourist villages have tourism potentials, unique and different characteristics that can attract tourists as well as offering a variety of options to do besides visited to Borobudur.

Launching of several villages around Borobudur temple as a tourist village by the central government through PNPM Tourism Program has delivered villages that initially overlooked and not much in demand by tourists because of its condition. Rural tourism as stated by Edward Inskeep (1999) is a small group of tourists living in or near the traditional value. Often in remote villages and learn about village life and the local environment. Changing the orientation of tourists to choose back natural tourism is a particularly good opportunity for the village to be more developed.

Increased tourist arrivals to each tourism village, as well as to develop and improve the welfare of the people in the area surrounding Borobudur Temple, in principle this tourism village involve active community participation. The participation of the community in support tourism activities is the consolidation of village spaces that could be used as primary facilities to support tourism activities. As Wearing (2001) said in his book that the long-term success or the success of the tourism industry is highly depend on the level of acceptance and support from the local community.

Taking the understanding of the conveyed land consolidation by Hamid (1998), the tourism village space consolidation that occurred due to tourism activities can be an attempt to reorganize, control, procurement, land ownership / tourism potential by the community through joint efforts to build an environment that ready to get up and prepare plots of land based on the applicable spatial planning.

## **2. RESEARCH METHODE**

The research method used in this study is a multi cases study which has advantages such suitable for comparative studies involving several cases in it, just like this research. Three cases were selected are mostly tourism villages around Borobudur that have different characters. The findings of this study are not to generalize problems downloading of the research but rather to look at the case in detail and depth of the study area. Starting from field studies that have been conducted, initial preposition can be defined as the direction of the next step of the research. By using multi cases study research, researcher can predict the expected results which are similar to the initial preposition that has been determined.. (Yin, 2002).

## **3. THEORETICAL FRAMEWORK**

Haryadi and Setiawan (2010) emphasized the need to understand human's behaviour or society different in every region in the use of space. This is what local leader in Candirejo did. He tried to understand his people to introduce tourism to the people, because not every group of people could accept tourism like in Wanurejo and Karanganyar villages. Asking people to involve in tourism activities is a challenge for local leader. As local leader has to provide spaces to facilitate tourism activities. Tourism spaces in this case are seems to have meaning and value of plural and different, depending on the level of appreciation and cognition of individuals who use the space (Rapoport, 1996). Behavioural and environmental linkages, both will affect individual response to the environmental in this case is tourism village .

As for one of modern forces in the village, tourism has contributes to a wide range of issues of changes. For example: before tourism project implemented in the three villages: Candirejo village, Wanurejo village and Karanganyar village, those three villages are very simple and traditonal. The local community in those three villages have very traditional life and most of them have spirit to keep social cohesion like "guyub"/togetherness and "gotong royong"/hand in hand in every single village activities. People made this social cohesion to be become principle of their life and they believe that "guyub" and "gotong royong" could tighten the relationship among them and it is not easily changed by any influences. But, along with the time changes, that tradisional value is tend to diminish. People are slowly open their mind and tried to except some influences. The makde some changes, not only in their live but also the place where they stay.

Haryadi and Setiawan (2010) in his book described the public appreciation of the environment with emphasis on perception. They told that the perception of the environment or environmental perception is the interpretation of a set by individual, based on cultural background, and

experience a different reason. Every individual people, thus will have a different perception of the environment. In the case of Candirejo village is that every member of people has his own perception of tourism. Some people accepted tourism in their life and some are refused it.

In terms of village changes, the role of local leader is very important especially in directing the village development including village space management for tourism activities. By supporting some group of people who have the same perception and interest, local leader will drive the development that could bring benefit for the people. They are formed in a group so called "Patembayan". "Patembayan" actually is a system of people organization. According to Tönnies (2001), he named "patembayan" with *Gesellschaft* (associational society) and *paguyuban* with *Gemeinschaft* (communal society). In the rural, peasant societies that typify the *Gemeinschaft*, personal relationships are defined and regulated on the basis of traditional social rules. People have simple and direct face-to-face relations with each other that are determined by *Wesenwille* (natural will), i.e., natural and spontaneously arising emotions and expressions of sentiment. The *Gesellschaft*, in contrast, is the creation of *Kürwille* (rational will) and typified by modern, cosmopolitan societies with their government bureaucracies and large industrial organizations. In the *Gesellschaft*, rational self-interest and calculating conduct act to weaken the traditional bonds of family, kinship, and religion that permeate the *Gemeinschaft's* structure. In the *Gesellschaft*, human relations are more impersonal and indirect, rationally constructed in the interest of efficiency or other economic and political considerations.

Based on the above theories, this study developed focused on space consolidation process of tourism village occurred based on public response to tourism in the three villages. The space consolidation process of tourism village of the three villaes affected by a form of social organization called "patembayan" that were professional, business-oriented, clear duties and responsibilities, has a definite purpose, prioritizing economic benefit, and attached to traditional values as a binding relationship, which becomes a strategic cornerstone in the process of planning, structuring, utilization and affirmation of tourism spaces to support tourism activities.

#### **4. RESEARCH RESULT**

Candirejo, Wanurejo and Karanganyar tourism villages are rural urban in Magelang Regency, Central Java, Indonesia. These villagea area are closed to Borobudur Temple the biggest Buddhist Temple in Indonesia. The location of the three villages situated around 3 km from Borobudur Temple. Candirejo is being promoted by local government for tourism since 1996 and has many tourists and visitors visited each year. Candirejo is also completed by many

supporting facilities, such as transportation, telecommunication, medical, and accommodation facilities.

As rural urban, Candirejo and Wanurejo were starting to change into modern. Different condition in Karanganyar village. This village is still remain remote. The people is still very traditional eventhough their village is alredy declared by government as o ne of tourist destination. Before Candirejo, Wanurejo and Karanganyar villages are agriculture area that covered fully with green. Since Candirejo declared as the first tourism village in Central Java, Candirejo has already changed from traditional village into semimodern village. One of the reason is many people are tend to involve in some tourism activities; they changed their mindset by receiving tourism in their life. Response local people at that time toward tourism were preparing their village to become tourism village. Many performances of the village modernized and some were remain including traditional values. Candirejo presently become one of the famous tourism villages that offered any kinds of tourism potentials physically as well as culturally. For examples: it is a unique and total different experience of tourism village trip in Candirejo. Tourist whole holiday trip will spent on Candirejo Village, with local housing accommodation. The accommodations in tourism village are special. Visitors can spend the nights using homes stay provided in the village. It gives visitors a m emorable moment because they can feel a purely village atmosphere. This way, will allow tourist to blend in with the local family and learn their daily routines. Candirejo has over 50 homestays open to visitors and offers several tour packages including cooking classes featuring traditional cuisines and snacks.

The next is Wanurejo tourism village. Following Candirejo tourism village, Wanurejo starting to prepare their village to become the next tourism village. People of Wanurejo tried to learn the success of Candirejo people in designing tourism village. But, different with Candirejo, people in Wanurejo tend to make their own tourism activities individually. They did not involved in Cooperative group as “Patembayan” group like in Candirejo tourism village but the tried to develope Cooperative group as “patembayan” group on behalf of their own bussiness not for accomodating the need of local people. Karanganyar village is known as traditional pottery industries. As tourism village tehy have no tourism Cooperative just like in Candirejo and Wanurejo. They only have Tourism Group so called “POKDARWIS” that consisted of local people who interest in supporting tourism activites.. This group is actualay pottery group, but since their village declared also as tourism village in 2009, this group is then changed to be tourism group. Untill now, this group is not running well and keep in stagnan position.

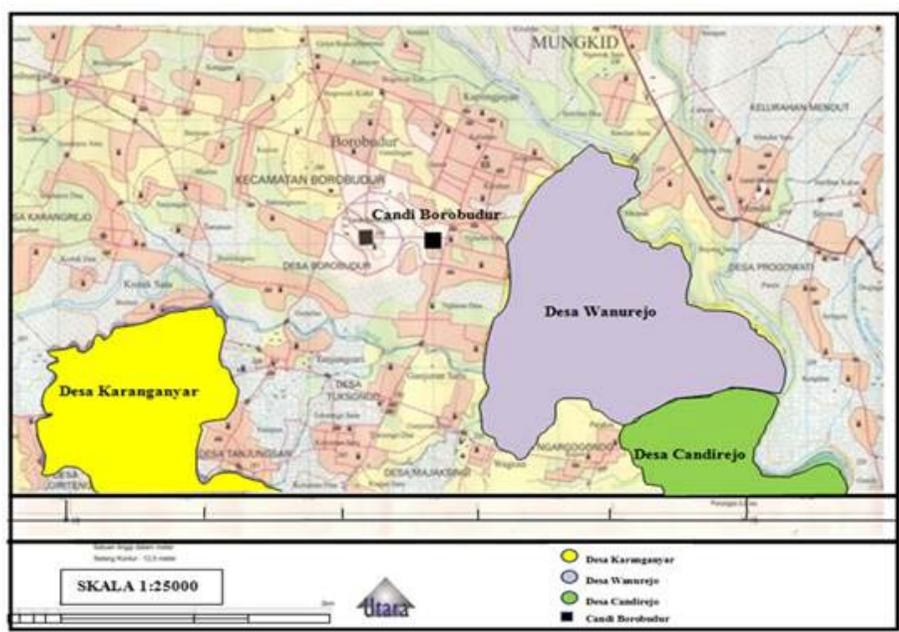


Figure 1. Administrative boundary of the three villages

#### 4.1. The impact of tourism activity towards Space Consolidation of Tourism Village

One of public responses toward tourism activities, there are many changes in both social and physical of the villages. Local people has shift in the social life to the tourism industry. Society that had rejected tourism policy gradually became more receptive to the influences because today's society is more educated, more able to collaborate with external parties, be able to think ahead, and think economically. Even in a society group, people are no longer in a group that always put together but has begun to turn into an organization that more profitable and prefers to support local people in particular interest i.e., managing the tourism village. Thus, society group that is discussed above, is actually known as the "patembayan" / "gesselschaft" as Tonnies (1887) and Soekanto (2009) said.

Based on the analysis results, each of tourism villages has change the society. Having "patembayan" social group that has different colors in the management of tourism village, the three villages has the same goal of improving the welfare of society through tourism village activities. They used "patembayan" group like Tourism Cooperative to bridge them to achieve their better living through tourism village development

Candirejo tourism village is the first village in Borobudur that implement

“patembayan” concept by establishing Candirejo Tourism Cooperative. It has institutional patterns with the implementation of “patembayan” concept professionally, effectively and efficiently by having a clear job description and distributing economic benefit transparently. Their institutional activities embodied by the Candirejo Tourism Village Cooperative, means that all tourism activities managed by Tourism Village Cooperative. The members of Tourism Village Cooperative consisted of local people, local entrepreneur, local social groups, local leader, etc. Through this cooperative Candirejo people utilized their village space to become tourism space. Remembering the number of tourist visited Candirejo is increasing to time, people in Candirejo tried to make tourism packages and offered them to tourists. Without diminishing local value such as “guyub” and gotong royong”, Candirejo people are working together to visualize Candirejo village to become tourism village.

In Wanurejo village consolidation activities managed by an individual basis, so that there are some personal leaders who opened the same business in the field of tourism and they became competitor. Therefore, in this village consolidation process is less successful because there is no agreement and cooperation among members of the community and less people participation in supporting tourism village program. Each tourism village business man is focusing only to get benefit for their own. They even employed their staff from outside the village. Some of local people who involved in that business usually still have blood relationship with the business man. Hence, not many local people involved in tourism village development in Wanurejo tourism village.

While, Karanganyar tourism village, Karanganyar people were trying to visualize their village to become tourism village like in Candirejo tourism village. But, only view of Karanganyar people who interested in tourism activities. Most of the people, presently only focus in traditional pottery making. They believe that by doing this activity, they could earn more rather than involving in tourism activity. View people who concern toward tourism development in their village, they tried to establish tourism cooperative like in Candirejo, but the people not yet ready. Finally, they used traditional social group of pottery makers and changed into POKDARWIS DESA KARANGANYAR. This POKDARWIS, is established through the effort of local people without any technical assistance from government.

From the above description and further analysis of the three tourism villages, it can be concluded that, actually, the implementation of “patembayan” concept in tourism cooperative has directed to each tourism village in consolidating tourism activities and tourism spaces, based on:

**Mutual Consolidation :** all members of the community agreed to consolidate tourism village activities (Candirejo Village). Most of Candirejo people supported tourism development in their village.

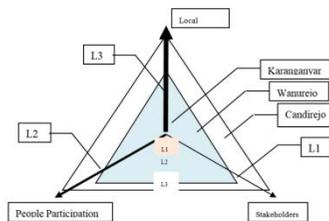
**Business Consolidation :** only the parties / certain people are concerned

about consolidation of the village and agreed to organize tours based on their own business (Wanurejo Village). Only view people who are invited to joint tourism village project of each Wanurejo tourism business man.

Community Tourism Awareness Consolidation : a collection of people who have the same vision and mission agreed to hold a consolidated tourism village activities (Karanganyar Village). Only view local people who really concerned towards tourism development involved in tourism village project.

Based on the three types of consolidation, mutual consolidation is the most successful type of space consolidating process and delivering community in managing the tourism village. Physically, the village, there are plenty of village spaces formed into tourism spots . In this formation society actively involved in determining space consolidation. For example: in Candirejo there are many tourism space created by local people to support tourist's activities, i.e: space for rafting, sightseeing, performing art and culture, cooking, tracing history, ect. All of those spaces were using village lands.

As already mentioned before that tourism village cooperative in those three villages were using "patembayan concept", there are components that affect consolidation of tourism activities and spaces process. These components consisted of local leader as cultural breaker, community participation in supporting the consolidation of village tourism and the role of stakeholders who help in the implementation of the provision of tourist spaces. Local Leader is people who dare to make a change in the village. Therefore, Local Leader is a cultural breaker that has roles as a motivator, facilitator, conflict control and policy makers. As general, patembayan group is a collection of people with different backgrounds : educational, economic and socio-cultural, so that it can be more open to receive the change. The higher the participation, the higher the percentage of the success of consolidation activity.



Note : L1 = Lowest Level

L2 = Middle Level

L3 = Highest Level

Figure 2. The degree of Patembayan's Intensity in the three of tourism villages

Furthermore, the space consolidation process of tourism village cannot be separated from the role of stakeholders who helped process of visualization of tourism spaces and tourism support facilities. Funding, direction and guidance, as well as other technical assistance provided by stakeholders to the community. It has provided stimulus for the community to launch a process of consolidation of tourism space.

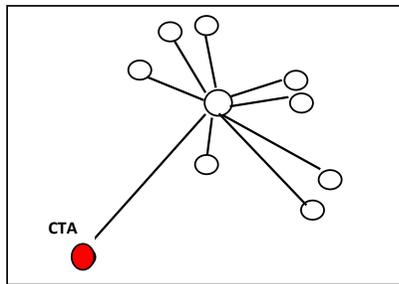
The combination of the three components above, reinforce the existence of a group with activities in realizing the space consolidation based on “patembayan” concept that can be beneficial to people's lives. Of the three components contained levels of consolidation process for the respective tourism spaces. The higher the role of local leaders in the group of “patembayan” would be able to direct people to consolidate tourism spaces to be more effective, efficient, and optimal. In terms of people participation, the respond of community participation in tourism is very dependent on educational, economic and socio-cultural background. The high participation agreement will affect the decision of tourism space that taken up in the tourism village space consolidation activities. Of the three villages, the Candirejo villagers both in terms of quantity and quality have high levels of education and higher economy. While Wanurejo villagers hold the second ranks position followed by Karanganyar villagers.

Another things that colored the intensity of differentiation of tourism village space consolidation is the role of “guyub” as t r aditional social cohesion that underlying system used to achieve “patembayan” group. “Guyub” intensity has led people to design tourism space, function space and even the appearance of space. This is addressed especially to arrange and manage tourism spaces to be more efficient, effective and optimal together in a groups of “patembayan” and reached an agreement. “Patembayan” without “guyub” as a basic for tightning the people relathionsip could not be optimally implemented. With “guyub”, people in the village will hand in hand supporting tourism activities.

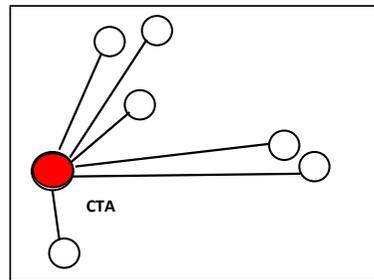
#### **4.1.1 Contributions of Patembayan Concept In Spatial Patterns of Tourism Village**

Looking at the contribution of “patembayan” concept in spatial pattern of tourism spaces, as a results of “patembayan” concensus, it has distribution pattern of tourism spaces spreadly to almost all tourism village, with a centre of tourism activity (CTA) in Kedungombo-Candirejo. CTA itself plays as tourism activities control. CTA in this case also act as tourist arrival gate for tourists visiting tourism village. Wanurejo tourism village developed tourism spaces usually closer to tourist destinations. The pattern of tourism spaces distribution is not as much as Candirejo, because although there are many tourist attraction, but village owned the land and all tourist potentials in the

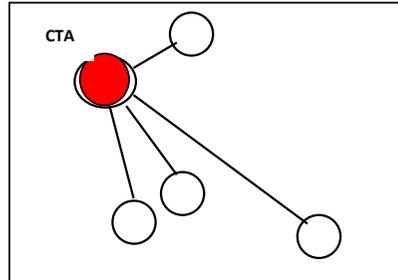
village. Therefore, Wonorejo cooperative that has business on tourism activities only managed some of the potentials of the village. Centre of tourism activity in Wanurejo tourism village is in Jowahan. While Karanganyar village, not many tourist spaces created and managed by the members of Pokdarwis community as a tourist attraction. Pokdarwis is community concerned to tourism. The number of tourist arrivals is not as much as Candirejo or Wanurejo. The Centre of tourism activities in Karanganyar village is Klipoh. The following is the space pattern due to space consolidation process done by implementing patembayan concept:



*Figure 3. Space Pattern of Candirejo*



*Figure 4. Space Pattern of Wanurejo*



*Figure 5. Space Pattern of Karanganyar Tourism Village*

The space pattern distribution of tourism spaces can be seen as the degree of people participation. The higher community involvement to submit their property in the form of land or house to be managed as tourism spaces, the number of tourism spaces increased. Talking about tourism spots, the distribution of tourism spots generally located along the main road of the village. In Wanurejo number of spaces for the private-run tourism village activities not as much as Candirejo. There are only view people who support the tourism village program personally. It means that only certain people are appointed and invited to join in a cooperative of Wanurejo cooperative as private business involved in the provision of tourism spaces. This kind of consolidation process is so called business consolidation which does not involve many members of the public as seen in the following pictures:

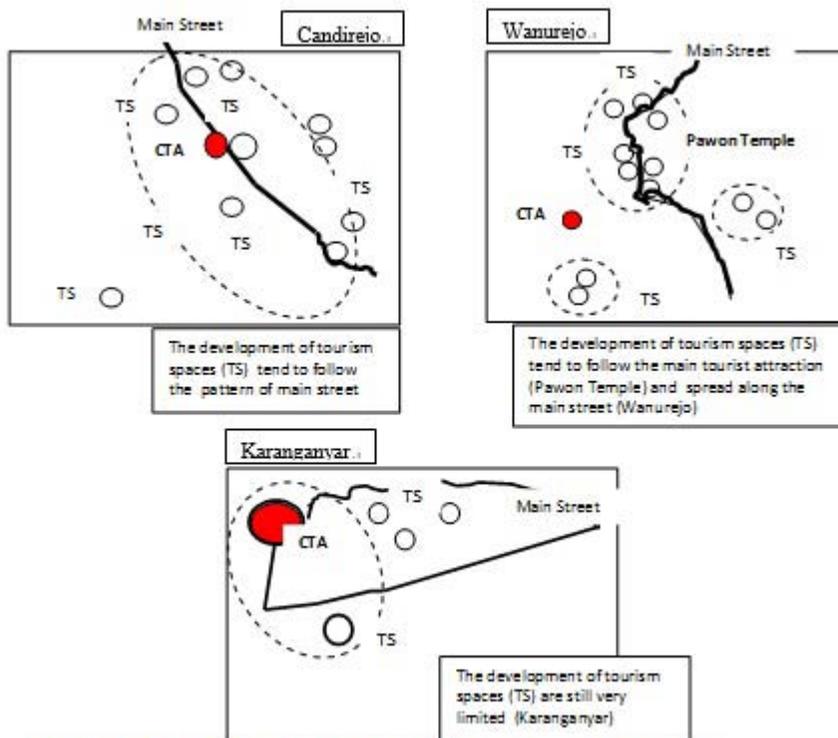


Figure 6. Space Pattern terhadap Jalan Candirejo, Wanurejo dan Karanganyar

Clearly shown in the above figure, from the three cases the distribution pattern of tourism spaces followed the main path of the village. The condition of this distribution pattern indicates that accessibility becomes an important factor for tourist visits in every type of tourism spaces consolidation.

#### **4.1.2. “Patembayan” concepts that underlied the formation of Tourism spaces**

“Patembayan” space concept is needed for space consolidation of tourism village. This concept could easily form the tourism spaces through the process of commercialization of space, re-functionalization of space, restructuring of space and desecration of space, as explain in the following discussion:

##### **4.1.2.1 "Commercialization of Space"**

Basically, tourism spaces were created by all people, because the value (use value) of natural village spaces to become tourism spaces. But this view has shifted, the spaces of the village is changed into production spaces. This production space can be commercialized and have economic exchange (exchange value) as Lefebvre said about production space (1984). For example: In this case, village halls used as production space as well as space for cultural performance offered to tourists. The existence of spaces packed as tourist tour packages and they were sold to tourists. Not only the village spaces that undergoing process of commercialization but also the existing spaces inside the house.

##### **4.1.2.2 "Desecration of Space"**

Desecration of space occurs in some areas of tourism village. This is the act of removing the sacred, magic or sacredness in spaces that have been around since the inception of the rural areas. Examples of space desecration is that occurred in the three villages : there were once believed that some places in the village has "sing mbahu Rekso" meant that there is invisible magical powers in those places. Now, people shifted into the tourism spaces that could be visited by tourist and travelers or even used as a tourist attraction. On the other hand desecration of space encourage people, especially Candirejo and Wanurejo to preserve some spaces for conserving culture and traditions of the village.

##### **4.1.2.3 "Restructuring of Space"**

Restructuring of space is a concept born from “patembayan” activities in order to consolidate spaces in tourism village of Borobudur. Restructuring is

actually how a social group decisions have an impact on changes in the spatial structure of both the village and the house. Restructuring of this area can lead to the breakdown of a culture, customs, and even lifestyle. Indirectly, the government is also doing a shift towards culture's value in the community by allowing tourism as external influence into the village.

Patembayan concept in the context of "Restructuring Space" meant that tourism activities provide a considerable impact on the spatial in Macro and micro scale. The changes in spatial structure to facilitate the growing needs of modern travelers has change the traditional structure into modern structures.

#### **4.1.2.4. "Refungsionalisation of Space"**

Patembayan concept in the context of "refunctionalization of space" means that the activity is carried out by patembayan community to decide which of potential spaces could be refunctionalized for tourism space. People usually used both village space or houses for the benefit of tourism. In general, tourist spaces formed by using spaces that already exist in the villages and selected for sale to potential travelers. For example, the Candirejo, Wanurejo and Karanganyar village use village square for "pasugatan"/perform cultural activities as well as for parking lot. "Makaryo sesarengan" space usually used workplace for travelers who want to work together with society. Other spaces functionalized for tourist spaces are spaces that utilize house for homestay. Almost all the spaces in the house used to accommodate travelers living activities. "Jlajah deso" space used spaces like streets of the village to the tourist path village, etc.

#### **4.2.1. "Patembayan" Concept in the Social Contexts**

##### **4.2.1.1. "Harmonization"**

Patembayan concept in the context of "harmonization" gives meaning to the community as a strategies used to consolidate tourism space as well as a strategy to harmonize among community members. The strategy used to visualize harmonization in the social organization with patembayan concept is by the implementation of traditional value namely "guyub". This concept is built on some issues that arise tourist space as a result of the consensus of the people in tourism village cooperative in response to the need for space travelers. Often conflicts occurred when determining which spaces are used as tourist spaces. Differences of opinion and interests have always been obstacle for people to reach an agreement, and such conditions

would affect the process of verification / consolidation utilization of space itself. The following are the spaces using “guyub” concept :

#### **4.2.1.2 The “patembayan” concept in the context of space utilization consensus**

The next concept appeared is a certain sense of understanding patembayan concept in the context of space utilization consensus. Means that it led to the agreement / consensus for utilization of tourism spaces produced by local people through the patembayan group. If everyone assumes that all member of people participants in patembayan group are families who must be loved, respected, and maintained their rights, then there will be a sense of brotherhood, and help each other. Such condition will address to the deliberation to reach consensus / agreement easily and will foster people's desire to jointly play an active role in supporting tourism activity. In everyday life it is so obvious that Borobudur people always sit together and discuss to convey a problem. They negotiate and look for solutions together. With the media of "Rembug Desa" a kind of community discussion forum can come together to do activities "rembugan"/discuss together, deliberation what happened and work together towards achieving an agreement.

Conflict often lead to inter-community relations with local leaders / change agents in the tourism village became bad. Unfavorable situation arises as a result of the situation that occurred. Therefore, it needs local leader / change agents to take a stand to be able to make use of consensus to diminish the conflict so that will no disputes, quarrels and endless debate. Deliberation and consensus in the spirit of kinship or guyub often used to keep togetherness and hinder the conflict. This conditions is good to implement in patembayan community group to achieve a common goal. Patembayan serves community participation in rural development. With social organizations like this patembayan tangible benefits to the community could be received. Patembayan is to have the concept of a group that is more organized, has a formal organizational structure, as well as plans and programs to be implemented explicitly, the public expects to realize their dream to get something very valuable indeed they need during this time.

Active role of community in activities and the provision of space is an agreement as well as form of high support to the managers of the tourism village and reflects portrait of village togetherness to realize their ideals.

#### **4.2.1.2. “Patembayan” concept in the context of Tourism Village Management**

Patembayan concept in the context of tourism village management means that local people in the three tourism villages have already change their mind to utilize tourism village cooperative to become tourism village management. Through this cooperative local people tried to make tourism activities and tourism package tours, to manage the dollars come from tourists, to manage all tourist supporting facilities, including distribute the guests/tourists to be facilitated by local people (members of cooperative). By implementing “patembayan” concept whis is professional, more organized, clear direction, modern, economic benefit orientation, local people expected to manage tourism village program professionally so that it could drain economic benefit for the local people. Although the way of patembayan cocept implementation in the three villages is different. Patembayan concept that implemented in Candirejo Tourism Village Cooperative is more formal, individualized, contractual, professional, prioritizing profits with clear job descriptions. While at Wanurejo Tourism Village ooperative as already explain in above, is prefer to invite relatives / family to become cooperative members and not inviting local people. In Karanganyar Tourism Village, the community gathered in groups called POKDARWIS that is still strong with paguyuban/traditional concept.

## **5. CONCLUSION**

Tourism policy has brought significant changes to the traditional villages in the area of Borobudur Village. The Changes is moving towards modernization and has led people to think in a modern way by following the pressure of the incoming flow (like tourism). Space consolidation process occured as a result of the openness of society to receive the influences of any pressures and respond positively especially in the consolidation of tourism spaces in their village. The success of consolidation space of tourism village itself, is affected by social groups called patembayan/gessellschaft. The implementation of patembayan concept in the village is always attached traditional values as a binding relationship, which became the foundation in the strategic planning process, structuring, utilization and affirmation of tourism spaces.

Consolidation of space-based patembayan concept in three cases that occurred in the tourist village there are three (3) kinds of consolidation namely:

- Consolidation of mutual cooperation: involving all members of the community

- Consolidation of business: involving the individual business organization
- Consolidation of community tourism awareness: tourism awareness involving groups (Pokdarwis)

The components in patembayan group that also affect the success of space consolidation based on patembayan are:

- The existence of local leader as cultural breaker
- The active participation of the community in supporting tourism activities.
- The role of stakeholders in support of the consolidation process space tourism village.

Tourism spaces consolidation based on patembayan social group concept can be realized through :

- Successful management of tourist spaces depends on the support of the community, as well as the effectiveness of patembayan group creativity.
- Process of changes from the rural spaces into tourism spaces through application of the concept of commercialization, restructuring, desecration and recreation of the spaces available in the village. In addition to these concepts of tourist spaces determination, they are also based on those three social concept, i.e: harmonization of space, consensus and management of tourism spaces.

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NO.76

## Research on Eco-efficiency of Industrial Park in Taiwan with Data Envelopment Analysis

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**Key words:** Space consolidation, borobudur of tourism village, patembayan

**Abstract:** The industrial development not only brings economic benefits, but also consumes a lot of resources and produce environmental impacts. It is the reason that the concept of “Sustainable development” has become the main idea that the industry try to observe. Following this purpose, the development of eco-industrial parks(EIPs) is the effective way to achieve the sustainable development. Therefore, how to evaluate the sustainability of EIPs has become one of the most important topic in the research recently. In Taiwan, the policy of the eco-industrial park has implemented for more than 10 years. Likewise, The result is really achieve the goal of sustainable development that is worthy of our concern.

Under the mainstream, the concept of “Eco-efficiency” which introduced by the World Business Councils on Sustainable Development (WBCSD) in 1992 has been widely applied in the industry. Eco-efficiency is a tool for quantifying the relationship between economic value creation and environmental impacts. In order to evaluate the eco-efficiency of industrial park, there are many kinds of method, such as sustainability indicator, life cycle assessment(LCA), Multi-criteria decision-making(MCDM), substance flow analysis(SFA) and data envelopment analysis(DEA).

By comparing with different methods, we decide to adopt the method of data envelopment analysis (DEA) to evaluate 60 industrial park’s eco-efficiency in Taiwan. According to the research results, most of parks have to adjust scale in order to improve the eco-efficiency. Beyond this observation, the research also provides quantitative suggestions on input items, which could be the information for decision-making in the future.



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## A Study of Intelligent Science Park Strategies

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**Key words:** Intelligent science park, hsinchu science park, innovation strategy, intellectual

**Abstract:** The development of Science Park has brought economic growth accelerates region' construction, simultaneously it is also an important strategic platform for enhancing national competitiveness. Through decades of development with the evolution of the times, some new problems have been occurred gradually in Hsinchu Science Park. These issues are shown at efficiency in management and economic, the size of the park also produced bottlenecks due to the limitation of the investment cost and restrictions on land. If the Science Park could not shape its characteristics and the core competitiveness of the market, it will be replaced by others. In fact, to manage Science Park by executive is rare, Taiwan is the first one, and the other Science Park in Asia are learned from the experience of Taiwan, and legal of Hsinchu Science Park has substantive power of construction management. If it can develop on advantage to implement intellectual administrant, service and explore the boundaries, to develop the construction of Smart Science Park to become a new direction of the development of the Science Park, improving infrastructure of the Science Park to achieve intellectual standards, enhancing the development of information resources to promote innovation industries. At the same time, to construct a highly efficient Smart Science Park through development, operation and management to integrate systemic solution programs, and to provide various industries a service platform for exchange and sharing resources.

However, the construction of Smart Science Park faces many issues on technology, markets, industries, applications, services, business models, massive data storage and processing, intensive computing, and intellectual systems management exist many challenges to conquer. For the new model of innovation industry, there are also faced with new challenges on law, regulatory, security, trust and payment fields. Accordingly, the construction and development of the Smart Science Park has become an important new issue for researchers. In this study, trying to discuss the strategy of the construction of Smart Science Park through literature analysis, interview with authorities and vendors, according to the policy of the Ministry of Science and Technology of the operation of Science Park.

## **1. INTRODUCTION**

Science Park plays an important role as a part of regions and cities in Taiwan, and it also makes contribution to the growth of the national economic, which has become an essential mode of regional industrial development and high-tech industry cluster. Also, it links the industry development and city governance together. However, in the long-term development process, the development of science park is facing the challenge of transformation due to the variation of time and space. Its development is limited by the land space constraints and cost limit, and the scale substantial construction is also under restriction. Whatever the hardware or software construction development, are faced with the competition from other parks. Therefore, it will be a very serious issue if the science park in Taiwan neglects the trend of international future intelligence and is unable to establish its competitive advantages and characteristics.

The science park has planned a complete integrated intelligent system through digitalization in the aspects of development, management and operation. With such system, it provides innovation of management and service and a sustainable high quality green environment of the “intelligent science park”. The construction and promotion of the intelligent science park can be a preliminary result of intelligent city construction and an incubator to promote the intelligent of industry. Under this concept, how to build a genuine intelligent systems rather than in the traditional way of representation that the construction of digital traditional park with a group of buildings is still managed and served in a traditional way and without systematic planning resulting in the waste of resources and repeated construction of facilities, is a difficult problem to the park development in the management aspect. It is an essential for the park management that how to integrate a large number of professional systems through intelligent judgment and management to avoid forming professional information island in order to achieve intelligent efficiency and advantages.

Transformation of the park should focus on innovation. Through innovative thinking, it sets a series targets from aspects of development, operation and management to form a complete service system and build intelligent system of the park. In order to provide a good environmental sustainability, the management goal of the intelligent science park is to provide a green and low carbon environment so that people can work and live in a high quality environment and acquire safety and harmony. The service objective is to provide a fast and convenient and user-friendly high-quality service with well plan. These two goals are the core objective of the intelligent science park in order to establish a park environmental system with advanced technology, high efficiency and benefit. With increasing scale and number of participants, the development of the park has become complicated in space and function, and hence the original concept of

individual construction of the industrial development cannot response the increasingly complex situation. No matter what functional requirements are proposed from managers, users and local government, all can be satisfied with intellectualization method. And only in this way, the complex system can be transformed into systematization. Therefore, the intelligent science park should have the following characteristics:

1. Two-way construction transforms the traditional way of individual construction into a mutual feedback construction process to promote the development both in construction and industry.

2. The developed new technology through the construction is also applied in the construction of the park as well, and the achievements from the practice are promoted to the intelligent city.

3. The public and private sectors jointly promote the development of the systematic construction, in order to achieve the unity of park construction, enterprise development and city governance.

## **2. THE CHARACTERISTICS OF THE INTELLIGENT SCIENCE PARK**

### **2.1 Two-way construction**

For the development of regional economy, all the countries in the world have used the science park as an important tool to increase their economic strength in order to accelerate the regional construction and national economic strength. Therefore, the importance of park economy function can be described in the following four aspects:

1. The park construction provides excellent conditions for the industries inside the park region.

2. The industries in the park develop coordinately to increase profits through industrial cluster.

3. To emphasize park industry characteristics and professional development as the core value of the park.

4. The advanced technology and professional talents have an important influence on the construction and development of the park, such as intelligent management, intelligent transportation, and intelligent logistics, etc.

The intelligent science park has generated interactivity with intelligent industries through long-term systematic engineering; and through digital infrastructure construction and management system engineering construction of public sector, it has improved public service level and then the vendors inside the park whose demand for digitalization are interactively integrated to complete the construction for mutual feedbacks. The set goal as intellectualizing construction which is enough to meet the needs within the

park, and the intellectualization achievements can be extended to the area outside the park through the intelligent products and services. The different key target shall be set from three phases of planning stage, implementation stage and development stage. The planning stage should be adopted the top to bottom design method covering digital content and digital industry content. The implementation phase should establish digital infrastructure and use the existing enterprises' digital resource allocation within the park to draw the external digital resources into the park and assist in their growth in the park. When the completion of the preliminary construction of the park, the key goal shall transfer to the interactive development between the intelligent park and industries. From the entry of the potential and powerful intelligent industries into the park, the park will be developed from the manufacturing to service that can hence be exported to the area outside the park.

## **2.2 Developing new technology via construction**

The intelligent science park has provided motivations to connect industry and urban development, including not only the establishment of the digital facilities, but also the hatching process of intelligent science and technology, intelligent industry, intelligent management and intelligent services within the park. By the platform integration, the construction within the park aggregates the most sophisticated technologies of new generation fields including digital technology, cloud computing, and the Internet of things (IoT)... rather than the evolution of single technology. Based on its own demand, the park builds different new technology R&D service platform where the results of the project will be transformed to intelligent public platform resources within the park, which integrates the fields together including intelligent governance, intelligent transportation, intelligent logistics, intelligent safety, intelligent environmental protection, intelligent architecture, and intelligent finance, etc. The integrated resources have become the framework platform of the intelligent science park to provide the actual technical support for the construction of intelligent city. The cluster effect of intelligent industries is very helpful to the development of the incubator inside the park. And the incubators of each specific projects develop technological innovation of intelligence industries provide space, technical cooperation, and capital and resources support for newly created companies, and develop the industrial contents in the park, such as communications, software, the Internet, electronic, and industrial design, etc. Incubator can provide as a business matching center for foreign investment attraction and talent and training center, and assist in building allied technical service platform. The allied technical platform with credibility will have industrial cooperation with various professional technologies and products in terms of technology importation, testing, and design, and use the platform

mechanism with market leading marketing company to plan product commercializing mechanism. Furthermore, the platform can also integrate academic resources to have industrial cooperation with technology, R&D, design, patent transfer, and so on.

From the management perspective, the intelligent science park is a microcosm of the intelligent city including industrial development management and public administration management. If from the regime's point of view, the park is part of the city which can provide as industrial development space and various supporting resources. However, the park should also be regulated by the city which is that the construction and management of the intelligent science park have to be a part of urban governance. The function of the park will become a comprehensive service to integrate the government, industries and the city into a mutual blending and connection system leaving from the limitation of traditional cluster platform on the business matchmaking, capital investment and personnel training.

### **2.3 Promoting systematic establishment by public and private sectors**

Due to the increasing importance of integration of industrial development and city construction, the public and private sectors should unify the overall development of enterprises, parks and city governance. The park shall be based on the top to bottom design model to make plans in terms of park's digital infrastructure, intelligent sensing platform, intelligent application supporting platform, digital application systems, digital security system, and digital standard system, in order to provide a prospective establishment for park construction. And it will hence effectively connect between the intelligent science park construction and intelligent city construction, which are mainly represented as the following three aspects:

1. To integrate and allocate the infrastructures of park and city. To establish the park infrastructure ahead of the existing city level, and propose the top-bottom forward-looking planning principle.
2. From the aspects of city governance, people livings, and government service, the industrial chain inside park shall overcome the phenomenon of the information island through intelligent application of overall planning, to uniform the application systems of intelligence city and intelligent park.
3. To enhance intelligence level of park industries based on the city perspective, in order to both enhance the synchronization function and improve the quality of park and city development under the framework of sustainable green environment.

The establishment of demonstration of the intelligent science park can be a starting point or promoting the construction of intelligent science park and the concept of trial integration of industries and city. During this period, it can overcome the problem of lack of experience and review the deficiency from the implementation process for further strategy adjustment of future construction. It will first select the current area with good digitalized foundation or local area with easy implementation for planning allocation which will be the preliminary demonstration project for the next stage of park intellectualization, and then gradually integrate the park industries and park management and transfer the successful technology and experience of staged construction into the construction of intelligent city with plans.

### **3. THE PROBLEMS AND PLANNING PRINCIPLE OF THE INTELLIGENT SCIENCE PARK**

#### **3.1 The problems of the intelligent science park**

The park construction needs large amount of investments and resources, a long construction period, high level of requirements and conditions on intelligent system, various involved complex products and professional details. Therefore, the following problems may rise if the top to bottom planning design method of intelligent systems integration is not adopted:

1. Inadequate efficiency problem may occur if the information is not merged: the preliminary planning stage of the intelligent science park is normally considered that more intelligent systems are used the more able to represent the high degree of intelligence. So some park planners just simply used many techniques with lack of unified planning and principle which results in parallel relationship between the systems without merging and forming the information island. In this circumstance, the system integration would cause lack of effectiveness which would lead to the dramatic increased workload on management and operation and hence cannot improve system performance.
2. System integration problem due to long period staged construction: because the park requires a wide range of area in space, usually all construction work cannot be completed at one time and hence it should adopt staged constructions with relative longer construction period. Therefore, if the overall planning principle of intellectualization is not well prepared in the preliminary planning design stage, it will then cause dilemma situation of incompatible system and difficulty to integrate during the process of intellectualizing construction and facilities establishment, and even

be restrained by the original system so that it is possible that the product cannot make independent choice during the later construction stage.

3. The emerged restricted system upgrade problem: in the operating process of the intelligent science park, it has to perform system update, upgrade and patch. Because technology is constantly updated very quickly, if the park functions and management mode cannot be adjusted timely, the development of intelligent park will be constrained and may be eliminated by the latecomers. Therefore, if there is no well preparation and establishment based on the overall plan and principle in the preliminary planning stage, it will face above difficult situations in the future and cause waste of resources and time.

### **3.2 The Planning Principle of the Intelligent Science Park**

In order to ensure the implementation of principle of the construction of the intelligent science park, and to meet the requirement for long-term operation, it is necessary to conduct comprehensive investigation and research on park function, management mode, industrial positioning choice in the early planning stage, and make a well considerate integration planning of intelligent systems according to the results, and hence propose the key planning principles in terms of the following issues in the planning stage:

1. It should make unified standards and hence take strict control and compliance: the establishment of intelligent system should have unified planning and uniform design standard and hence be planned and designed according to the property hierarchy. And also, it should take the techniques and the experience of the original park into account and conduct in-depth investigation on different departments of the enterprises to understand their management requirements in order to eliminate the information gap between different departments and make preparation for mutual information communication. To achieve the above objectives, the whole park should establish an overall management platform for easy allocation of internal management and resources integration. As for the idea of hierarchical decentralization, it should set up hierarchy system according to different users with different authority for hierarchical management which is benefit for the top managers' decision making. And some of them are very crucial, especially it has to master the uniform in the early park planning stage, including network communication protocol, image display standard, every system access protocol standard, intelligent system setup program standard, infrastructure

overall planning principle, whole pipeline routers and number, information facilities access capacity and location, location and size standard of all levels of control center machine rooms, front terminal capacity and quantity standard of individual building, access capacity and quantity standard of every level host control device, capacity standard of database, hardware platform standard of information application system.

2. Implementation principle of staged construction: as the constantly updated technology, the characteristic of the rapid development of intelligent technology becomes conflict to the characteristic of long period construction work. So if there is no enough imagination and development space for the future, the afore said conflict cannot be solved in essence. Construction by stages is a prerequisite and, intelligent and enterprises' innovation needs are all changing over the time. It is essential for the planning stage to have forward-looking and operational characteristics leaving space further development. And according to the urgency of different functions, the process and procedures of intelligent system construction should be designed to ensure the mutual cooperation between industrial needs and intelligent science park construction, which has practicability and expansibility.
3. Pay attention to the application principle and development trend: the intelligent science park has a multi-function environment in which covers different function spaces and different types of buildings, such as office building, conference center, training center, research institution, dormitory, and factory offices, etc. The use of intelligence should pay more attention on the different attributes of applications and integrate the existing technology, advanced technology and standards in the planning stage. And the infrastructure planning is essential that it should consider the combination of requirements and capital so that it should first establish the easy allocation systems in time and location, such as wireless network, information release system, conference system, and information application system, etc. And also, it should give corresponding desired requirements to different types of buildings, e.g. for office buildings and scientific research building, it should focus on high-speed and reliable network requirements, and provide a safe and comfortable environment and, efficient mechanical and electrical equipment control, and so on. For different types of buildings, the unified single layer design during the intellectualizing process should be put into the requirements of function difference of intelligent system.
4. Strengthen and promote technical advantages of industrial contents: one of the construction objectives of the intelligent science park is to strengthen industrial advantages through the park and to provide the

technical development service for industries. As it can develop the existing industrial advantages of the park, it can also use the existing resources to reduce the investment cost and highlight the company competitiveness.

#### **4. THE CONSTRUCTION PRINCIPLE OF THE INTELLIGENT SCIENCE PARK SYSTEM**

Every system inside intelligent science park can be integrated through the construction of intelligent platform in order to avoid the emergence of the information island. The use of perception can be the core of promoting industrial technology integration and resources sharing, using intelligent programs to establish the dominance of management and service perspective and provide an intelligent and close to human environment. Therefore, in the intelligent science park system construction process, it should pay attention to four principles including safety, convenient, efficient, and healthy to achieve the above objectives. In terms of security, the advanced technology is used in security protection system to maintain the park security. For convenience, it should adopt a variety of sensing transmission technology to build intelligent platform into a medium with full convenience. And regarding to efficiency, it can improve the management efficiency of the intelligent science park through high integrated information system and medium of park management platform. For health aspect, it should use management system platform to develop sustainable energy conservation green park through the facilities and function of the intelligent system with considering the sustainable development of environment. Further more, it should set up standards for platform medium of intelligent system in order to connect the further expansion and intelligent city and avoid information island phenomenon, where it shall adopt the sensing technology as the key point and promote a number of technology integration and integrate all resources through intellectualizing method. More over, it should actively merge all kinds of technology based on function and realize the service with people-oriented as the leading business in the park. And it will reuse the system integration and facilities through the integrated application platform to improve the overall effectiveness. The adopted high-tech security protection system can ensure the overall safety of the park. The center concept in the construction process should consider the construction mode of intelligent green buildings. In addition, the overall architecture of the intelligent science park is divided into five levels, including infrastructure level, data collection level, service level, application level and access level. The principle of intelligent technology should take into account the following principles:

1. Apply location-based service (LBS), and provide service to the users with GPS handheld devices which their locations can be sensed.
2. Support adaptive learning, active correction, automatic zoom tracking and intelligent video analysis technology.
3. Heterogeneous sensing information integration and judging mechanism including vibration, electromagnetic, sound and light....
4. Sensing terminal information acquisition and effective control through control equipment, such as environment, temperature and humidity, pressure and air quality, etc.
5. Establish a framework of universal service platform with multi system integration, including logic system, function and technical framework.
6. Uniform model of different information and expansibility and universality of modeling technology are as key development direction.
7. In order to realize the access and management of heterogeneous mass sensing device, it should use business data and network management interface with unified definition and abstract.

Through the perception of Internet of things, the construction of the intelligent science park will improve the existing problems, and establish more intelligent, more energy saving, and more secure environment system. This study has divided different characteristics of technology system into nine types for further discussion on their contents and key pointes of evaluation.

#### **4.1 Energy system control platform technology of the intelligent science park**

The park energy system control platform technology can be divided into three aspects: monitoring and data transmission technology, energy storage and conversion technology, and energy deployment technology.

##### **a. Monitoring and data transmission technology:**

Applying this function for real-time monitoring and control, to learn physical and chemical conditions of various types of energy, and corresponding operation condition of energy equipment, and the collected digitalized information will be transmitted to the control platform. The purpose is to control if the quality and quantity of energy consist with requirements and specifications of planning in production, storage, and transmission stage, and if the belonged equipment is working properly and safely. Besides, sensor network is a network which combines sensor technology and wireless transmission technology and has the advantages such as simple layout, cost reduction and good elasticity of system expansion.

b. Energy storage and conversion technology:

Based on the different regions of space condition, it evaluates the appropriate corresponding energy storage system, and improves the efficiency of energy conversion system, and is set as the core technology of park energy system. In order to avoid rapid energy loss in the transporting process and storage period, it can set up effective insulation material for ice. While the energy conversion efficiency can be improved through methods such as pneumatic electric, high combustion efficiency, boiler system, and heat integration technology, etc.

c. Energy distribution technology:

Due to the changes between park energy demand and energy types, it has to deal with energy changing problem. Energy distribution technology will prevent from occurring problems like excess supply or shortage and then reach the equilibrium of energy supply and demand. Two cores of energy distribution technology are energy demand management and dynamic management. The purposes of energy management are to count the energy usage of terminal and to conduct dynamic analysis and optimization at the same time in order to predict the future real-time demand type and the required flow to provide the appropriate energy. Also, in order to reduce the energy consumption, active energy management demand should be adopted to make integrated planning on energy usage strategy and energy saving strategy. In addition, for the purpose of saving energy, it should enhance optimized dynamic energy distribution technology with support of dynamic energy management and operation decision-making technology.

## **4.2 Park video surveillance system and intrusion detection**

The application of Internet of things technology on the intelligent park can solve the security problem. It is the important development trend through intelligent techniques to seek more extensive monitoring and multifunction management, and to provide whole process automatic monitoring and control and security mechanism with fast seeking integration and rapid real-time respond. The video surveillance system of each security monitoring system location will transmit the video images to the monitoring center altogether, and then the security personnel can monitor and control the park security and entry access management from video surveillance system in order to achieve early detection and active prevention which to assist the security personnel in effectively preventing or high efficiently dealing with threats and emergencies. The most common function of intelligent monitoring technology is intrusion detection as park area is wide range, boundary is dispersed, and the monitoring cannot be done completely by labor. In this circumstance, the video cameras with video analysis

functionary video encoder with full display function can assist the manager to control the safety protection which application layer the auxiliary tool both for management and service to improve the service level.

### **4.3 Intelligent parking guidance system in the park**

The crowds and traffic flow in the park are huge and parking area is wide range, and hence the intelligent parking guidance system can provide helps such as parking guidance, reverse searching cars, toll administration, and parking reservation, etc. which can effectively manage parking and improve service quality. Intelligent parking management system can not only automatically identify and guide the vehicles to enter, but also can let the drivers only make inverse query. It sets up the remaining park space display for each area at the entrance, and hence drivers can learn quickly which area has empty parking space at the intersection of each area which is very convenient for quickly finding parking location. From the vehicle guidance system, it can be convenient for drivers to find parking spaces which can reduce parking pressure and improve traffic congestion and also reduce the cost of personnel management and speed up the flow of vehicle and improve the service image. Moreover, reverse searching function is installed a vehicle positioning card terminal every certain number of parking spaces in the parking lot. When vehicle guidance system detects the vehicle has entered into the position, it will start intelligent vehicle tracking system nearby and display the information at vehicle positioning card terminal, and the driver will locate the vehicle through the card reading of terminal and also find the vehicle from nearest route showed at the terminal between the query position to the vehicle parked position. And automatic payment machine can replace the manual toll collection which saves labor cost. In addition, it can also make parking reservation by telephone, SMS, booking service center, and online booking etc. Therefore, the intelligent parking guidance system can solve the parking management problems and effectively control the quantity and remaining parking spaces.

### **4.4 The Intelligent Building System in the Park**

The intelligent building system can improve the functions inside the buildings including electrical, telecommunications, water supply and drainage, air conditioning, disaster prevention, anti-theft and conveying, to achieve the objectives of safety, health, energy saving, convenience, and comfort. Intelligent building system consists of three basic elements: automation system facilities, usage space of buildings, and operation management system. So the indicators can be set through quantifiable

standards for evaluation in order to inspect the operation and management of buildings inside the park. The evaluation standards can be divided into eight indicators: premises distribution system indicator, information and communication indicator, system integration indicator, facilities management indicator, safety and disaster prevention indicator, health and comfort indicator, care and convenient indicator, and energy saving management indicator.

1. Premises distribution system indicator: it is used to evaluate communication transmission and network connection of buildings, including the integration of language, data and control signals, providing the distribution infrastructure with open, flexibility and expansibility.
2. Information and communication indicator: it provides a communication system with reliability, safe, high efficiency and mass data transmission, and can join wireless sensor networks if necessary.
3. System integration indicator: for the purpose of sustainable management, it integrates management and comprehensive service capability to establish information sharing between application system resources including air conditioning, electric lighting, access intercom, fire safety alarm, and parking management, etc.
4. Facilities management indicator: good facility management and mechanism can ensure reliability, safety and convenience of the intelligent system.
5. Safety and disaster prevention indicator: effectively using automation systems to realize active disaster prevention in three aspects including detection and report, restriction and exclusion, and evacuation guidance and emergency rescue.
6. Health and comfort indicator: it consists of six major projects including space environment, visual environment, thermal environment, air environment, water environment, and health care management system.
7. Care and convenient indicator: from three indicators which are spatial auxiliary system, information service system, and the life service system, to identify if the space of buildings is humanization and intelligence.
8. Energy saving management indicator: from energy management and energy monitoring and energy saving benefits to assess whether the intelligent buildings can reduce energy consumption and use renewable energy.

## **4.5 Intelligent manufacturing system**

The mutual development of integrated hardware and software through the platform will achieve two objectives of energy efficiency enhancement and manufacture cost reduction which is for manufacturers to precisely manage raw materials, process and products. It makes the manufacturers become intelligent factories through manufacturing intellectualization. This transformation is because of the problems that the manufacturing product life cycle is becoming shorter and shorter, the demand of customization is becoming more diverse, customer orders are instable, less quantity but more variety production, good product yield control, and stock inventory pressure, etc. And it can clear understand the production and sale process through intellectualization method and improve controllability of production process, reduce human intervention from production lines, correctly collect production data, as well as make the reasonable production plan and production schedule, and so on, and hence it will enhance enterprises' competitiveness. Therefore, intelligent manufacturing system consists of three aspects: process control visualization, comprehensive system monitoring and control, green manufacturing.

a. Process control visualization: the intelligent manufacturing mode has high degree integration which can display the situation to the managers in a direct instant way, and hence the managers can learn the status of control of raw materials, process and equipment operation, in order to reduce the further problems and loss caused by system failure. All relevant data in the process can be stored as database which is for future planning and maintenance, managers can execute and maintain with this complete information.

b. Comprehensive system monitoring and control: from the accumulated data through system platform, it can establish the database with equipment information and feedback and use the concept of the Internet of things to make manufacturing equipment have sensory ability, and use the connected sensor to make system have functions of identification, analysis, reasoning, decision-making, and control which integrates manufacturing information and intelligent technology to digitalize the process information so that the controllers can make immediate response according to the condition and hence improve the efficiency of industrial production operation.

c. Green manufacturing: the cycle concept of green product life cycle management can solve the pollution problems caused in the process, beginning with the use of environment friendly materials, and through the cooperation between upstream and downstream firms, it processes from resources material design and manufacturing to waste recycle. In addition, the use of green ICT value added application, extending to the green supply chain management, process management and intelligent environment monitoring, can achieve the objective of green manufacturing between park manufacturers, upstream and downstream firms, and customers.

#### **4.6 Intelligent logistics management system**

Due to the globalization, networking and information trend, enterprises have to face the rapid change and fierce competition in the global market. Intelligent logistics can enhance the competitiveness of enterprises and make more intelligent in aspects including product development, raw material supply, production, customer distribution, and after sale service. Companies must intellectualize supply chain to strengthen logistics management system and establish logistics management system with quick response. Currently, every government is also actively promoting internationalization and technicalization of logistics. However, as international logistics service needs to consider the delivery time, cost and quality, technology can provide intelligent service which helps product record management, preservation, quality tracking, and resource integration service. Managers use cloud information platform to establish the whole monitoring and management mechanism, providing diversified high-end cloud service for logistics industry and introducing advanced logistics equipment and developing long-lasting lightweight containers to reduce overall cost of transportation, and combing with RFID and sensing element to logistics identification and tracking technology, so that it can develop innovative logistics service mode and differential advantage. In order to avoid disruption and loss of the supply chain, companies must establish multi-level supplier risk management, including more complex analysis techniques of mass data and trying to improve visibility. Logistics process not only allow managers to see important information, the system must also have the ability to actively inform the management when there is a major incident. Moreover, intelligent warehouse management is helpful to improve storage efficiency technologies, such as intelligent handling storage robot, intelligent conveyor belt, and intelligent picking system combined with voice and wireless identification ability, which techniques were started to be taken seriously. As the supply chain depends on IT and needs elasticity, cloud computing can improve logistics efficiency and intelligent logistics can propose more efficient and flexible operation management for enterprises.

#### **4.7 Intelligent information security protection system**

The companies in the park should deal with information security issues from risk management perspective. When facing the actual operation, information security protection system should be able to help companies determine the risk position, and transfer the machine language into information security intelligence report through system to support companies' decision-making. And also, the intelligent information security protection system integrates business intelligence and information security