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博 士 論 文

新竹科技城自行車使用者之偏好研究

Cyclists' Preferences in Hsinchu Technopolis

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摘要

臺灣經濟高度成長、國民所得增加、汽機車普及，人口約 2300 萬人，擁有 570 萬輛汽車、1200 萬輛機車。其中由於機車具有機動、便捷、停車方便等特性，因此成為台灣最普遍的短程代步及個人交通工具。面對氣候變遷、環境暖化、能源衰竭的問題，全球環境意識覺醒，為朝向永續發展的未來，再加上健康與健身的新趨勢，自行車成為二十一世紀休閒遊憩、觀光旅遊及通勤通學的重要綠色運具。

自行車不只是一種交通工具，更是遊憩的供給，自行車遊憩在台灣已成為新興旅遊與健康活動的代名詞。相對於汽機車的污染，自行車具有安靜、無污染、與環境友善的綠色環保特性，雖然自行車通勤在台灣尚未成為氣候，但利用自行車結合旅遊地區的發展，已成為頗受歡迎的戶外遊憩活動。

面對知識經濟的時代，各國政府為了提升城市競爭力，無不努力營造吸引高科技人才的環境，除了設置科學園區外，更強調生活品質與休閒環境，以健全高科技城市(Technopolis)的內涵。而高科技人士偏好戶外遊憩活動，近年來騎乘自行車的數量成長驚人，其原因為具有創意精神、可以獲得放鬆與探索、並與自然對話，高科技人士也視騎乘自行車為一種社交技能。建構完善的自行車環境已成為創意城市的必要條件；而自行車遊憩在高科技城市的發展與需求也值得探討。

新竹科學城活動人口約 100 萬人、新竹科學園區就業人口達 13 萬人，園區年產值超過 400 億美元。新竹科學城擁有 11 萬輛汽車、22 萬輛機車，汽機車高度普及，也伴隨環境污染與交通擁擠的議題。新竹科學園區所在的新竹縣市，為全台汽車擁有率最高的城市(每千人 342 台)，新竹科學城在發展過程中為了增加高科技人士的通勤效率，不斷增加道路面積與停車供給，造成更大的環境問題。

另一方面，中央與地方政府積極建設自行車道與週邊設施，將有限的資源投入自行車遊憩發展，符合時代潮流。惟政府部門多著眼於實質環境，強調土木與道路建設、或景觀工程，但是未從使用者的角度瞭解自行車騎士的環境偏好與環境設施的適宜性。

因此本研究先從國家級的自行車道與新竹科學城地方級自行車道探討自行車觀光客與自行車遊客環境偏好的差異；再進一步聚焦於新竹科學城，探討高科技人士與非高科技人士對自行車騎乘環境的偏好與評價之差異，上述研究以Ridit模式進行分析。最後擴大自行車之研究方向，利用Rasch模式進行新竹科學城自行車通學騎乘難度之研究，以建構自行車友善環境之發展模式，並建立高科技人士環境偏好的衡量模式，以提供高科技城市環境規劃之參考。

關鍵詞：自行車遊憩、自行車觀光、環境偏好、高科技城市、Ridit 模式、Rasch 模式

Cyclists' Preferences in Hsinchu Technopolis

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ABSTRACT

Climate change and energy consumption, together with the rise of environmentalism and increasing awareness of sustainable development practices, are permanent issues in all political agendas of the new century to both national and international levels. In this context bicycle usage has become a popular travel mode of transportation worldwide.

Taiwan has gained awareness in cycling and is experiencing increasing investment in, and popularity of, recreational cycling and bicycle tourism. Both central and local governments have been trying to stimulate the development of recreational cycling and bicycle tourism. National trends emerged recently to include green mode planning that regards bicycling as an environmentally desirable option for outdoor recreation and as a tourism transportation mode.

While recent development of bicycle lanes in Taiwan merely considers the civil engineering work or landscape design; very little interest has been shown in studying the preferences of cyclists'. Therefore, by applying Ridit and Rasch model, this research focuses on Hsinchu Technopolis to explore cyclists' environmental preferences and to evaluate and analyze the development of recreational cycling and cycling to school in the Technopolis.

This research reflects, from the geographical point of view, the preference and satisfaction of cyclists in two compared levels: National (Taiwan) and local (Hsinchu Technopolis). By using surveys collected in these two levels Ridit analysis is applied to get conclusions about the differences between bicycle tourists in one of the national scenic bikeways and recreational cyclists in one of the local Hsinchu Technopolis' bike lanes.

Regarding the same variable (the preference and satisfaction of cyclists) Ridit analysis is also applied by focusing specifically in the Hsinchu Technopolis area. In this case two different groups of users are compared: High-Tech workers of the Hsinchu Science-Based Industrial Park (HSIP) and Non-High Tech workers.

This study keeps on researching Hsinchu Technopolis area by adding further elements to the study: the obstacles suffered by students cycling to school and the Rasch analysis as measurement method to get conclusions.

This research conclusions including as follows: (1) investigated environmental preferences for, and satisfactions with, cycling facilities for cyclists in Hsinchu Technopolis (2) established a measurement model by appling Ridit and Rasch analysis. (3) examined the efficiency of government resource allocation and provided suggestions for a reasonable cycling policy for cycling facilities in general, and for technopolises in particular. (4) suggested planning and policy implications.

Key words: Recreational Cycling, Bicycle Tourism, Environmental Preference, Technopolis, Ridit Analysis, Rasch Model

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張馨文　謹誌
2008 年 7 月 24 日

Contents

List of Tables

List Of Figures

CHAPTER 1 INTRODUCTION

As Taiwan's national economy is growing and the GNP is increasing, the ownership of cars and motorcycles is popular in every household. There are 23 million people in the population, and 5.7 million cars and 12 million motorcycles. These figures demonstrate that motorcycles, owing to their convenience in parking and traveling, are the most favored travel mode for short distance trips.

Motorcycles are the most common feature of Taiwanese city traffic because of their mobility, convenience, and easy parking, but they are also a huge problem as cities' infrastructures are far from being adequate to cope with such a large number of them. Roads are also jammed with cars and trucks, and peak hours have become an unbearable daily experience for drivers and a very dreadfully risky situation for those who want to ride a bike. In addition, they contribute to environmental problems derived from the chemical aggression produced by those vehicles that is causing severe health issues (throat, lung, and skin problems, as well as cancer) and a burden for the Taiwanese Health Care System.

Climate change and energy consumption, together with the rise of environmentalism and increasing awareness of sustainable development practices, are permanent issues in all political agendas of the new century to both national and international levels. In this context bicycle usage has become a popular travel mode of transportation worldwide, being Taiwan not an exception to that trend. Cycling is an ideal way of traveling from the point of view of energy conservation, environmental friendliness, and social equality, as it is a green mode of transportation (Tolley, 1997).

Cycling has no impacts on the environment and consumes no energy. European countries try to encourage cycling for both recreation and commuting purposes, and they have also profoundly influenced other parts of world.

In the early 18th century, bicycles were fashionable toys for European nobility, and became a worldwide craze by the end of the 19th century. While entering 20th century, people in the world faced a transportation revolution as the new technology brought faster and more comfortable modes of transportation that changed the way people travelled, took their leisure, and worked the land. The new technology changed human behavior in general; however, bicycles were still deeply rooted in the cultural zeitgeist. By the 1930s the British believed

that bicycles gave their country a new kind of outdoor culture and, in the Netherlands, bikes were seen as an indispensable and beloved part of their society.

It is important to integrate the key areas of this study, to establish the principles of planning for the bicycle routes, to analyze strategies for their application, and to examine the state of the art in a variety of approaches and locations, especially to establish a measurement model of cyclist' preference.

1.1 The Origin and Importance of Bicycle Development

It is said that Da Vinci invented bicycle in 1493. However, the drawings are not available from date testing, and most historians regard them as fake (Ballantine, 2001). According to Southworth (1997), due to deterioration of the road system, bicycle became a new and popular mode of travel. The bicycle was invented in 1580 and it reached its peak of popularity in 1877. The new bicycle captured the public's imagination by offering convenience and mobility that was both safe and cheap.

The end of the 19th century, bicycling became a national craze as bicycle design improved in the U.S.A. (ITE, 1994). In the period between 1890 and 1895, it was referred to as the "Bicycle Craze Era" when bicycle clubs in both England and the United States were urging the government for road improvements (Southworth, 1997). It is known that enthusiasm for the healthy outdoor life coincided with the invention of the bicycle, and cycling holidays, aided by promotion from the Cyclists' Touring Club, which was founded in 1878, enjoyed immense popularity (Hollyway, 1989).

When the world entered 20th century, people faced a transportation revolution. New technology brought us faster and more comfortable transportation. It changed our travel modes, human behavior, and demands; including work, living, leisure, and land use. Morphological development of transportation from marine to railway transit and from air transportation to autobahn had profound influences on modes of travel, tourism activities, and changing land use patterns in Taiwan, as well as globally.

In the early 1970s, the global oil crisis stimulated the bicycle revival and led to positive growth. As a matter of fact, the popularity of cycling and walking has steadily increased since 1975, when the advent of the first fuel crisis saw the re-emergence of non-motorized modes of transportation. For example, initiatives advanced in Denmark as a result of the oil crisis were

widely accepted at almost all levels within professional and governmental circles (ITE, 1994). After 1970, environmental concerns and energy efficiency increased around the world. Many countries emphasized the green mode as an alternative type of transportation planning. The history of bicycle development is shown as Table 1-1. The history and lifecycle of bicycles is shown in Figure 1-1.

Table 1-1 The history of bicycle development

Year	Contents	Resource	Position
1493	Drawings said to be from the studio of Da Vinci and attributed to one of his students appear to be of a bicycle with chain drive.	Ballantine, 2001	New develop-ment
1580	The bicycle started to be invented.	Southworth 1997	
1817	Credit for the first workable bicycle goes to Baron Karl Von Drais of Germany, who in 1817 introduced a running machine. The hobby horse was crude and uncomfortable, but it was fast; on a good road, a hobby horse rider could beat a horse. This was news in a world in which hay burners had been the fastest means of personal land transport for thousands of years.	Ballantine, 2001	Toys of royalty
1839	Scottish blacksmith Kirkpatrick Macmillan built a bicycle with rear wheel drive via a treadle transmission. (called Velocipede)		
1842 1860	Alexander Lefebvre of France made technically advanced rear wheel. In 1860 or 1861 Lefebver moved to California, it survives as the world's oldest existing bicycle.		
1861 1866	A French cabinet and locksmith Pierre Michaux and his son organized workshops in Paris and launched a bicycle with pedals and cranks attached directed to the front wheel. In 1866-67, the aristocracy was entranced and played with their new toys in the streets of Pairs, sparking a vogue for velocipedes. In all the best places, cycling was the thing to do.		

1869 1870	Olivier brothers produced 200 bicycles a day in France.		Trans-port Mode
1869	France led the world in bicycle design. While in 1870, the Franco-Prussian War broke out, Paris was besieged, and when the cannon smoke cleared all that was left of the world's first bicycle industry was rubble. The passion for velocipedes had spread throughout Europe and across the Atlantic. Coventry (England) became the epicenter for the continuing evolution of the bicycles.		
1877 1880	The new bicycle captured the public imagination. Bicycle offering convenience and mobility that was both safe and cheap. It reached its peak of popularity.	Southworth 1997	Travel mode
1878	Cyclists' Touring Club founded in Britain.	Ballantine, 2001	
1885	Rover Safety 2 was designed by John Kemp Starley and launched at the Stanley Show in London in 1885. (The fashion of the world)		
1890 1895	Bicycle Craze Era. Bicycle clubs in both England and the U.S.A. were urging the government for road improvement.	Southworth 1997	
1903	Ford Co. produced first car product line.	Bicycle decline because of automobile development	
1914-18 1939-45	Bicycle was affected by two world wars and was profoundly influenced by the rise of the automobile.		
1970s	First global oil crisis.		Green mode
1988	The European Charter of Pedestrian's Rights adopted by the European Parliament in 1988: Vii (b) the provision of facilities for bicycles throughout urban areas.	Tolley 1990	
1989	The Transport Geography Study Group of Institute of British Geographers held a conference and the theme was "managing our environment" and the venue was Coventry, historic home of the British cycle industry and with a place in the pantheon of post-war pedestrianisation in Britain.		
1998	"In towns without my cars" campaign in Paris.		
1998 ~	Bicycle tourism Recreation cycling		Green industry

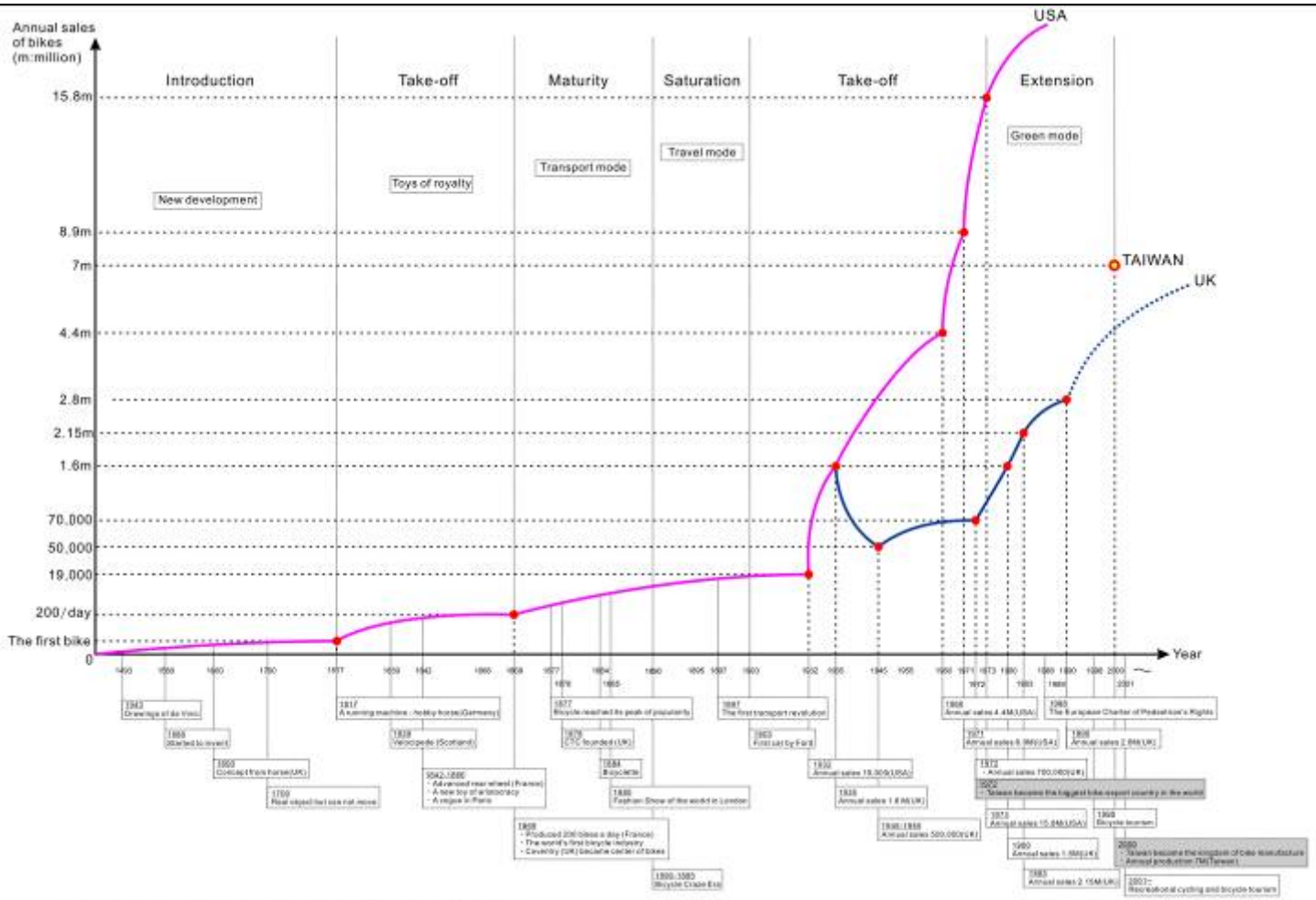


Figure 1-1 The history and life cycle of bicycle

1.2 The Emergence of Bicycle Tourism and Recreational Cycling

Since the 20th century, tourism, and recreation has increasingly gained in importance in the hierarchical order for national development. Tourism has become one of the major sources of income for many cities and townships. The relationship between tourism, recreation, and transportation development is inseparable and affects not only the local economy, but also nationwide and international competitiveness in many countries.

When transportation moved from the navigation era into the aviation era, the modes of travel and tourism also changed. The relationship between the transformation of transportation and tourism development was categorized into six eras. The bicycle itself is the tourism attraction of transportation (see Table 1-2).

Table 1-2 Relationship between transformation of transportation and tourism

Transport Mode	Period	Tourism Development	City pattern
Marine	13-15 century 19-20 century	Sea Adventure Coastal Tourism	Harbor city
Road	16-17 century	Coach Travel	Metropolitan city
Railway	18 century	Railway Tourism	Industrial city
Automobile and Bus	Pre-1900 & Between two World Wars	Mass Tourism	Urban and suburban
Air	Post-1950	International Tourism	Global city
Bicycle	Post-1970	Bicycle Tourism/recreational cycling/ Eco Tourism	Sustainable/ green city/ Technopolis

Usage of the bicycle, an old but new friend, has been associated with tourism and recreational activities since 1970, and has become a popular travel mode worldwide. Under the green trend of thought, the opportunity for bicycle tourism development comes from tourism, transportation planning, and sustainable development dimensions (see Fig 1-2).

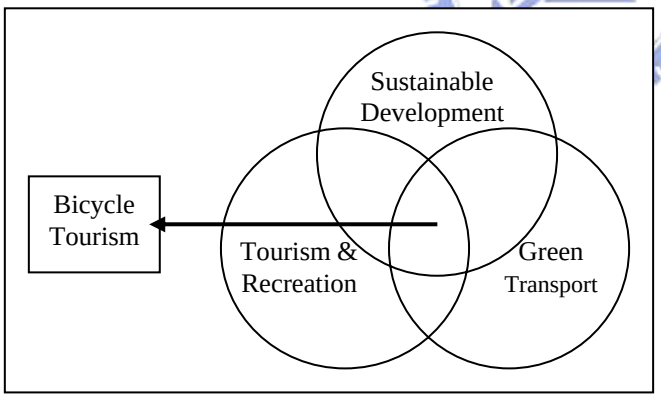
Tourism encompasses all travel with the exception of commuting and it is more than just a service industry. It is a culture of a nation. The characteristics of a bicycle signify quietness, environmental friendliness and a low cost transportation mode. After combining tourism and bicycle transportation, bicycle tourism can be defined as: tourist activities conducted via bicycles that provide cyclists with a good traveling experience. It is a positive activity that includes both transportation and recreation experiences. Bicycle tourists are individuals of any nationality who use bicycles for transportation and for whom cycling comprise an important

part of their holiday experience (Ritchie, 1998). Schuett and Holmes (1996) defined cycling tourists as being similar to numerous other tourists; seeking variety experiences while, overall, seeking more adventure than average tourists .

Recreational cycling can be defined as follows: Ritchie (1998) defined a recreational cyclist as a person involved in any recreational cycling activity, who sees cycling as a positive way of using leisure time, and only rides in good weather. Meanwhile, he defined a cyclist as an individual for whom a bicycle is his or her only mode of transportation and the only way to take a holiday (1998). Lumsdon (2000) defined cycle tourism as recreational cycling activities ranging from a day or part-day casual outing to a long-distance touring holiday.

Countryside Commission of the U.K. (1989) divides category of recreational cycling by: casual cycling (10-20 miles), day touring (30~ miles), cycle tourism (overnight), and cycle hire (car based).

Tourism and recreational cyclists are individuals who use a bicycle for trip enjoyment and usually take relatively short trips at lower speeds (see Fig 1-3).



Fgure1-2 The development of bicycle tourism under the green trend of thought

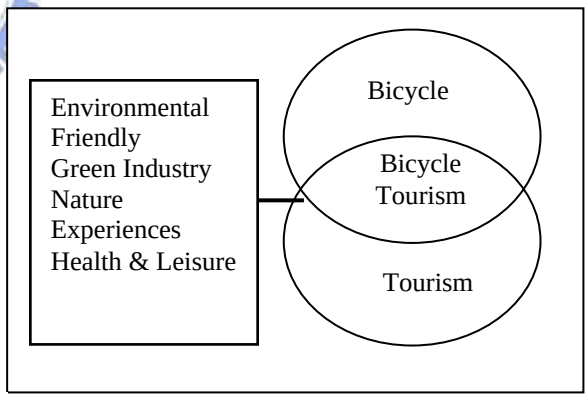


Figure 1-3 Characteristics of bicycle tourism

In England, cycling to work or for commuting has redefined its role not only as a commuting tool but also as an important tourism transportation mode. European and North American countries are actively promoting bicycle tourism. The European Charter of Pedestrian's Rights adopted by the European Parliament in 1988: Vii (b) provides facilities for bicycles throughout urban areas (Tolly, 1990).

European countries have been trying a motivational approach to develop bicycle tourism and expect an increase in countrywide tourism development. Since 1988, thirty-three countries and 263 travel agencies have arranged bicycle touring vacations. This is in contrast to 1997 when there were increasing numbers, with thirty-nine countries and 297 travel agencies (Ritchie, 1998). Cushing estimated that approximately 25 million bicycle tourists visit England annually, yielding annual tourism profits of 5 billion pounds (Ritchie, 1998).

In the U.S., the Maine Department of Transportation developed a report on bicycle tourism in Maine 2001 which found that bicycle tourism benefited Maine business. In 1999, direct spending in Maine by over 2 million bicycle tourists is estimated to have totaled 36.3 million U.S. dollars. Of these 2 million tourists, the vast majority (98%) were day trip cyclists, who together spent 30 million U.S. dollars. Spending was broken down as follows: food and groceries 16.2 million, transportation 9.6 million, retail and services 8.5 million, and lodging 2 million (Maine DoT, 2001).

Tourism and recreation, the green industries, are ideal approaches to development in terms of environmental impact and sustainable concerns. Therefore, under the “greening” issue, the research aims to integrate tourism, recreation, and transportation, and proposes the strategy of bicycle tourism and recreational cycling in Taiwan.

1.3 Bicycle Development in Taiwan and Its Importance in a Technopolis

Currently Taiwan has 23 million residents and one of the highest population densities on Earth, with a growing dependence on motor-driven transportation, evidenced by the presence of 5.7 million cars and 12 million motorcycles. Vehicles with internal combustion engines have, therefore, become an inseparable way of life in Taiwan and a staple of its economy (Chang and Chang, 2006); despite the fact it is also the cradle of the third largest multinational maker of bicycles in the world (these being mainly made for export purposes).

Fortunately, the government of Taiwan has taken notice of this situation and, after neglecting walking, cycling, and public transportation systems for long time, has started promoting these and encouraging citizens to use them.

Taiwan is experiencing increasing investment in, and popularity of, bicycle tourism. Both central and local governments have been trying to stimulate the development of bicycle tourism and recreational cycling. Many argue the island’s topography and climate constraints

may be less conducive for bicycle commuting. Nonetheless, national trends emerged recently to include green mode planning that regards bicycling as an environmentally desirable option for outdoor recreation and as a tourism transportation mode.

The central government (Sports Council) launched the policy of Planning and Establishment of Bikeway Systems in Taiwan in 2002. This program is aimed at encouraging the development of local green industry by elevating tourism and transportation development. Approximately 21 billion New Taiwan Dollars (NTDs) have been invested on such development. The National Development Plan 2008 and the Tourist Double Plan also stress the importance of building a national bikeway system. There is a market of 100 million tourists in Taiwan annually. It is necessary to conduct basic research on recreational cycling and bicycle tourism when the government is building more bikeways.

The evolutionary development of Taiwanese bicycling had its origins in the transport function, then evolved in response to the demand for leisure, and is now in its present state combined with tourism development. The development trend can be divided into three major periods. Because of differential administrative and subsidizing organizations, the development objectives of national policy vary as well.

The development of bicycle lanes in Taiwan originated in Taipei and is based on the purpose of transportation function. In 1991, there were one-meter bicycle lanes in width constructed on both sides of traffic islands. This was a testing operation stage but failed and was not pursued because cyclists still rode pedestrian walkways.

In the late 1990s, the development plan of a bicycle lane between Danshui River and Hsintien Creek became the first bicycle lane with recreational functions in Taiwan. In 1997, bicycle lanes constructed around Kwanshan Town became successful and they promoted a wave of unrest across Taiwanese towns and countryside, where every county and city adopted the development of bicycle lanes. At this stage, the Construction and Planning Agency, Ministry of the Interior is acting as the sponsoring organization in directing the development of bicycle lanes in every country and town, together with a subsidy from the “New Features for Cities and Counties Construction Plan”.

At the same time, National Parks and National Scenic Areas also coordinate with tourist and recreational development and have started to construct bicycle lanes within the parks.

Since 2001, private amusement parks have provided bicycles for rent and relevant facilities for the users. Table1-3 shows the development of bicycle lanes in Taiwan.

Many cities and countries are eager to construct bicycle routes to meet the increasing demand for recreation and tourism purposes. However, there is little research conducted in the field of bicycle tourism that considers the interrelationships of the demand for tourism-induced cyclists and the supply for the tourism industry in Taiwan.

Table 1-3 Bicycle lane development policy evolution in Taiwan

Purposes	Location	Sponsored Organization/ Sources of Subsidy	Location/Planning Characteristics	Note
Commute and Leisure	City center	Maintenance Office of Public Works Dept, Taipei City Government	1 meter in width on each side of traffic island	The first trail lane was being constructed in Taipei in 1991.
Recreation	Danshui River Hsintein Creek	Park and Street Office, Public Works Dept, Taipei City Government	Riverside Area	First recreational use bike lane
Tourism and Recreation	KwanShan	Construction and Administration of Interior Ministry	New features of county and towns	First special lane was completed in 1997
Commute and Leisure	Tamshui MRT Line	Taipei Rapid Transit Corporation	Along the MRT line	Completed in 2000
Tourism and Recreation	National Parks	National Park Headquarters	National top grade	YangMing Mountain, Kenting etc
Tourism and Recreation	National Scenic Areas	National Scenic Area Administration	National top grade	Most are being planned
Sport and Recreation	Circum Island and locality	National Sports Council	Significant national sport construction	Initiated in 2002

Taiwan has been recognized as the kingdom of bicycle manufacturing such that many Europeans are proud of having a bicycle that is made in Taiwan because of its high quality, durability, and innovative design. The bicycle boom restored the role of the bicycle in tourism, recreation, and sport modes. The rising demand for good bicycles led to the creation

of new firms in the USA, Japan, and Taiwan (Ballantine, 2001). Before the late 1970s, Asian manufacturers had already well undercut the prices of the old European and American manufacturers (Ballantine, 2001). Of all quality frames made, more than 50% came from the Taiwanese Giant Company.

However, bicycle usage as a transport mode in Taiwan has always been an issue confronting local transportation and bicycle manufacturing industries. The low popularity of bicycle usage is evident in the rate of bicycle ownership in the affluent capital city, Taipei, which seriously poses a variety of inadequacies in the transit choices for work, leisure, and living. Nevertheless, it appears that bicycle usage, and the associated tourism activities, has become a popular travel mode. Bicycle tourism development in Taiwan can be evaluated from social, environmental, industrial and political aspects, as follows:

Social Aspect: Satisfying the tourists' demand for a surrounding natural environment while riding bikes, and increasing the frequency of use of bicycles.

Environmental Aspects: Planning a safe cycling environment creates an integrated cycling travel system. Due to the numerical advantage of cars and motorcycles in Taiwan, the bicycle environment is safer with implementation of bicycle paths rather than bicycle lanes. Figure 1-4 shows the design of safety a bicycle path and a bicycle lane can provide.

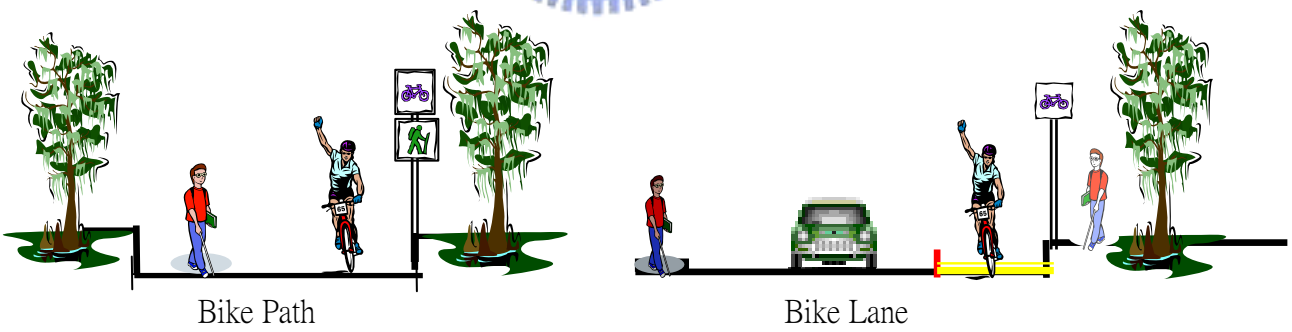


Figure 1-4 The design of safety of a bicycle path and a bicycle lane can provide

Industrial Aspects: Expanding the bicycle sale and renting market and increasing the demand via scheduled activities and marketing strategies.

Political Aspects: Local governments' determination of sustainable development and management; central government's investment in the construction capitals.

Bike touring routes and their distribution in Taiwan were examined. The research investigated the bike routes within 25 cities and counties and measured their length. There are 100 bike routes with a total length of 1294.65km in Taiwan as shown in Table1-4.

Table 1-4 Lists of bike routes in every city and county in Taiwan

City / County	no of bike route	length(km)	City / County	no of bike route	length(km)
KL CITY	1	7	NT COUNTY	51	32
TAIPEI CITY	2	8.17		52	3.72
	3	22		53	8
	4	12		54	2.5
	5	20		55	0.2
	6	20		56	4
	7	7.5		57	4
	8	12	CHANGHUA COUNTY	58	24
	9	12		59	26
	10	12		60	7
TAIPEI COUNTY	11	16		61	5
	12	12		62	4.2
	13	4	YL COUNTY	63	14
	14	4		64	4
	15	14	CE COUNTY	65	6
	16	30		66	20
	17	15		67	86.5
	18	24	TAINAN CITY	68	6.6
	19	15	TAINAN COUNTY	69	10
	20	30		70	20
	21	16	KH COUNTY	71	60
EL COUNTY	22	6.5		72	10
	23	6		73	1.67
	24	10	KH CITY	74	8
	25	3.3		75	5
	26	8		76	8.5
	27	6.7		77	6
TY COUNTY	28	35.7	PT COUNTY	78	6
	29	4		79	27
	30	2.7		80	13
	31	5	HL COUNTY	81	5
HSINCHU COUNTY	32	7		82	7.6
	33	12		83	7.2
	34	8	HL CITY	84	15

	35	4.5	TT CITY	85	12
	36	3.5		86	6
HSINCHU CITY	37	17		87	7.5
ML COUNTY	38	18	TT COUNTY	88	8
	39	29.59		89	7.2
	40	19.7		90	27
TAICHUNG COUNTY	41	4.5		91	2
	42	11.8		92	32
	43	12		93	18
	44	15	KM COUNTY	94	18.5
	45	1.7		95	17
TAICHUNG CITY	46	3.8		96	17
	47	17		97	13.1
	48	15		98	17
	49	3	PH COUNTY	99	8
	50	6		100	7
TOTAL			1294.65		

The advantages of promoting bicycle tourism in Taiwan for its natural and humane environment are evident. It can bring great value to Taiwan in terms of social, environmental, industrial/economical, and political benefits, as summarized in Table 1-5 and discussed as follows.

Social benefits: Bicycle tourism can enhance personal health and well-being and, therefore, create a healthy environment for a healthy society. Bicycle tourism also encourages people to participate in exercising activities whilst at the same time help improve social health and reduce medical expenditures. Promotion of bike riding or walking can reduce dependency on automobiles and achieve the goal of healthy cities. Besides, bicycles are the most efficient transport mode in getting to a destination within 10 km of a city.

Environmental benefits: Reducing dependence on automobiles can reduce the environmental impact on the natural resources and environment in those scenic areas and country towns.

Industrial/economical benefits: In order to cooperate with the government's policy, Giant and Merida bicycle manufacturing industries have their headquarters based in Taiwan. However, Taiwanese bicycle manufacturing industries are facing intensive competition from China as the bike manufacturing numbers and exports are gradually reduced each year.

Promoting the bicycle tourism market can help to reactivate bicycle manufacturing markets and development.

Political benefits: The government's expenditures on bicycle lanes can create job opportunities and promote the national tourist market. The tourism market can also double the value of socio-economic benefits, which helps the numbers of bicycles grow to sustainable levels and promotes local development.

Table 1-5 Benefit model of bicycle tourism development in Taiwan

Bicycle Tourism			
Social Benefits Healthy Cities	Environmental Benefits Sustainable Development	Industrial Benefits Green Transport	Political Benefits Efficient Transport
Universal Bikes Reduce the Medical Cost Health & Well-being Wise Growth Efficient Use of Land	Environmental Friendly Tourism Reduce Environmental Impact Enhance Environmental Conscious Green Products	Planning and Construction of Bicycle Lanes Promote Local Development Increase Income and Job Opportunities Green Transport/Efficient Transportation	

This study focuses on a Technopolis, that is, a metropolitan area with a high concentration of high-tech industry. Particularly in the so-called "knowledge-based economy," city governments everywhere are devoting considerable resources to create an environment with a good quality of life to attract high-tech workers.

Hsinchu Technopolis, with over 25 years of the Science Park existence, has earned a reputation worldwide as "Asia's Silicon Valley". Hsinchu Technopolis area is home to the Hsinchu Science-based Industrial Park (HSIP) and is a regional magnet for high-tech talent. The Hsinchu Technopolis area encloses Hsinchu city and Hsinchu County, which makes up a flourishing high-tech industrial development, and its production value has soared to U.S. 40 billion dollars annually.

The population has also increased in size to 1,000,000 citizens who have the highest average household income in Taiwan. Over one-seventh of the region's population works in the Science Park. Due to this rapid economic growth, car ownership in the region has become the highest among Taiwan's counties (342 cars per thousand people in Hsinchu County) and cities (322 cars per thousand people in Hsinchu city).

Hsinchu Technopolis has the highest cars and motorcycles ownership. With a high population density and facing serious air quality issues. Anything to reduce travel by motor vehicle is of potentially great benefit to the Technopolis and to the island. Since the Kyoto Protocol took effect, the government has started to seriously address controlling the growth of vehicle usage in order to restrict carbon dioxide emissions. In contrast to pollution-causing automobiles, bicycles are quiet, have no emissions, and have limited negative environmental impact.

Recreational cycling is frequently cited by high-tech workers as a preferred method of relaxing and exploring, as well as a logical mode of transportation by which to interact with nature. High-tech workers typically regard cycling as a highly social activity for those preferring to have adventure and challenge in their outdoor activities (Florida, 2002). Given their apparent affinity for cycling, a more thorough understanding of recreational cycling preferences of high-tech workers is essential for environmental planning of 'science cities'. The location of Hsinchu Technopolis can be seen in Figure 1-5 which includes Hsinchu city, Hsinchu county, and HSIP.

A recreational environment may play a critical role in ensuring a good quality of life. In addition to trying to improve the investment environment, Hsinchu city government is also working hard to improve the leisure environment and has established a 17 km Coastal Bike Lane. Starting in 2002 the city government began planning to establish 17 km of dedicated bike lane along Hsinchu's most beautiful coastline.

The project was completed by the end of 2005; with construction costs of about 5.3 billion New Taiwan Dollars over three consecutive years (see Figure 1-6). The Hsinchu County government also planned a 300 km countryside cycling route (see Figure 1-7). On the other hand, commuting and cycling to school have always been an issue in the Hsinchu area. Therefore, it is essential to build a bicycle/environmental friendly development model in a Technopolis.

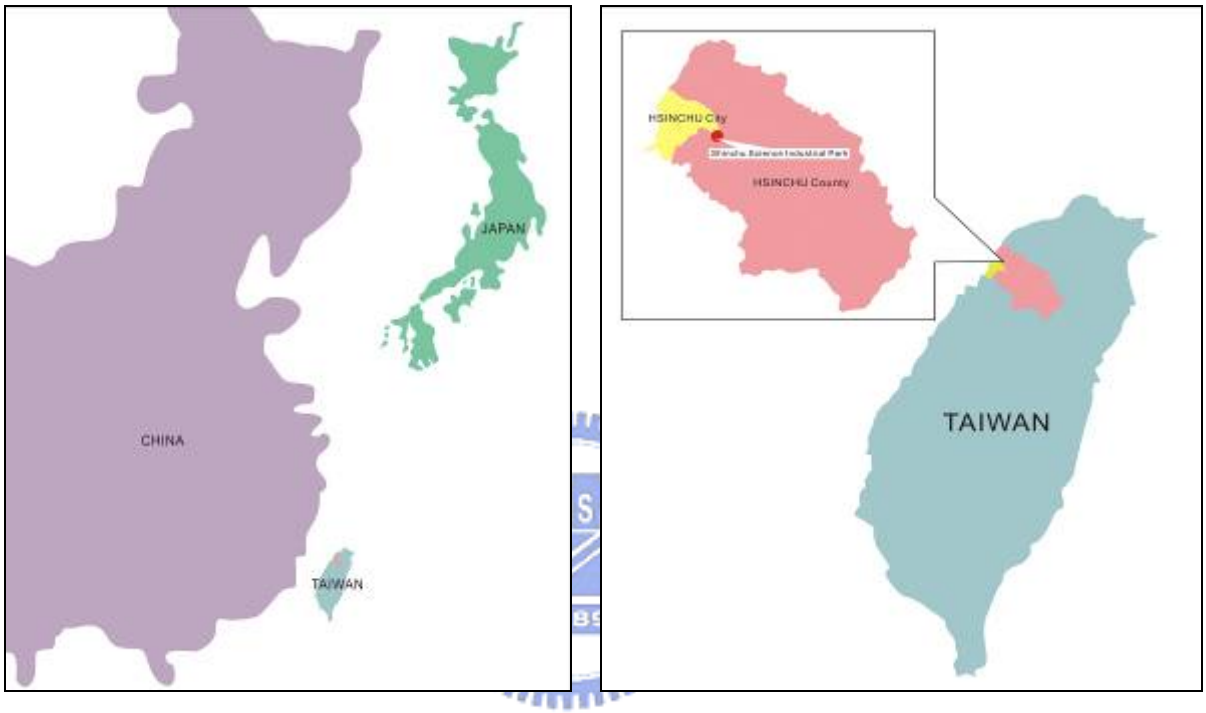


Figure 1-5 The geographic location of Hsinchu Technopolis

Figure 1-6 17 km coastal bike lane in Hsinchu city (source: Hsinchu city government)

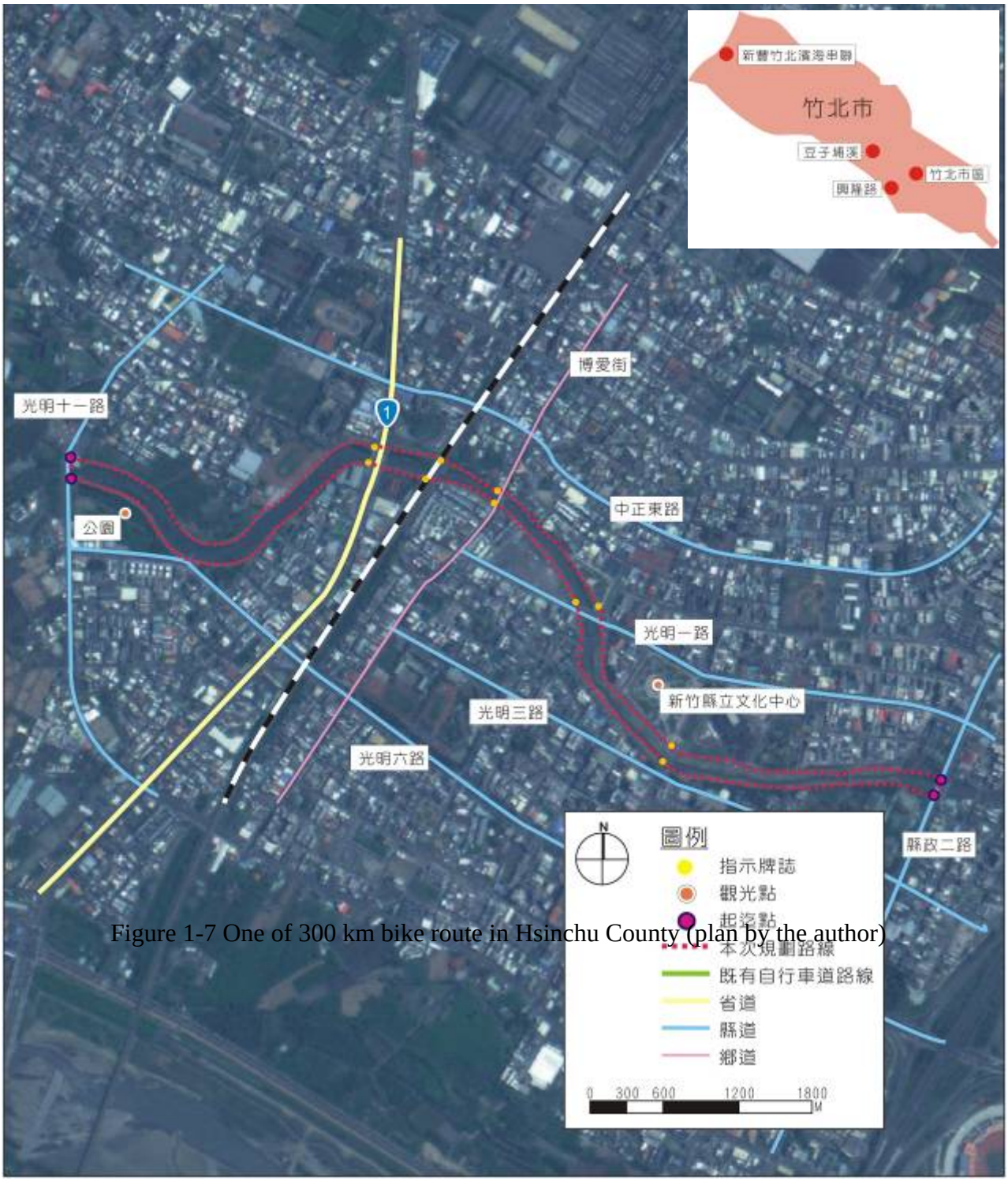


Figure 1-7 One of 300 km bike route in Hsinchu County (plan by the author)

1.4 Research Framework

Recent development of bicycle lanes in Taiwan merely considers the civil engineering work or landscape design; very little interest has been shown in studying the preferences of cyclists'. Therefore, by using questionnaires and interviews, this research selects newly developed cycling areas to explore the recreational cyclists' environmental preferences. This research tries to evaluate and analyze the development of bicycle tourism and recreational cycling in Taiwan.

The research structure is divided into four components: the users, the environment, the policy, and the bike mode itself.

The component "user" includes existing cyclists and potential cyclists. Krizek (2004) considers these two elements in order to increase the probability of potential cyclists taking up cycling, and enhance the experience of existing cyclists.

The component "environment" (and more specifically, the examination of environmental factors) includes two related personal perceptions: whether particular environmental factors are preferred by cyclists and whether they are satisfied with the level of implementation (Antonakos, 1993; 1996).

The component "policy" refers to the cycling regulations and a "safe route to school" policy (G.DoT, 2006; Colwell and Culverwell, 2002). Dill and Carr (2003) and Nelson and Allen (1997) argued that some surveys indicate that providing bicycle lanes and paths may encourage more people to commute by bicycle.

The last component under consideration is "bike mode", which addresses the design and type of bicycles (Mason and Leberman, 2000). The factors affecting bicycle use, as argued by Hudson (1982), are as follows: design of bicycles, human performance, topography, weather, type of area, safety, security of bicycles, social attitudes, costs to user, and ownership. The relationships among the four components are described in Figure 1-8.

This study aims to achieve the following: (1) investigate the different demands of recreational cyclists based on different personal characteristics, levels of cycling experience, and cycling resources; (2) examine cyclists' environmental preferences for, and satisfaction with, existing cycling facilities; (3) compare the importance placed on environmental components with the respondents' levels of satisfaction by using an importance-performance

matrix analysis; and (4) assess the government's allocation of resources to determine whether spending priorities are meeting cyclists' needs.

This study begins from the research motivation and purpose, the origin of bicycle and the importance of bicycle, as in Chapter 1. In Chapter 2, cycling-related literature is reviewed and cases of cycling development in different countries are compared. In Chapter 3, methodologies are examined, and data collection from users and their demands in a Technopolis are explained. Three cases are shown in Chapter 4 by applying the methodologies (in Chapter 3). Finally, conclusions and recommendations of future research and implications of cycling planning and policy are provided. Flow chart of the research steps is shown in Figure 1-9.

From a long-term perspective, increasing the number of recreational cyclists can, hopefully, contribute to efforts to increase the number of commuting cyclists. The relation between recreational cycling and bicycle commuting was studied by Gardner (1998). The report argued that most people cycle purely for leisure purposes such as health, fresh air, relaxation, and social reasons. However, he proposed improving cycling facilities to strengthen the likelihood that recreational cyclists would become bicycle commuters.

Although bicycle commuting has yet to catch on in Taiwan, integrating bicycles with development of recreational areas has already become quite popular. This trend should be encouraged since it has many benefits: health and happiness for the riders, awakening of environmental consciousness, and economic benefits with low negative environmental impact. With current global concerns about sustainable development, recreational cycling must be further studied and encouraged in science cities.

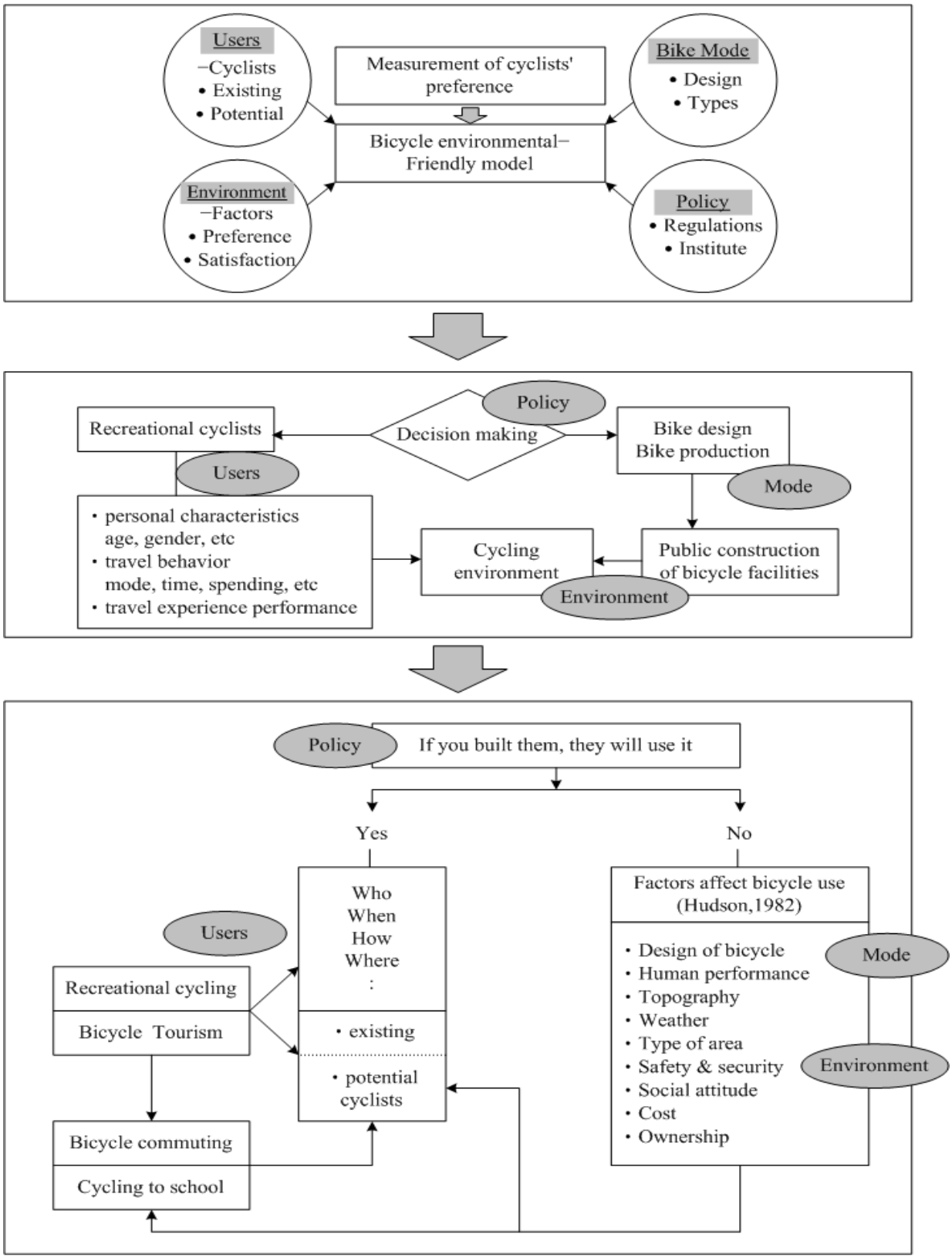


Figure 1-8 Research structure and concept

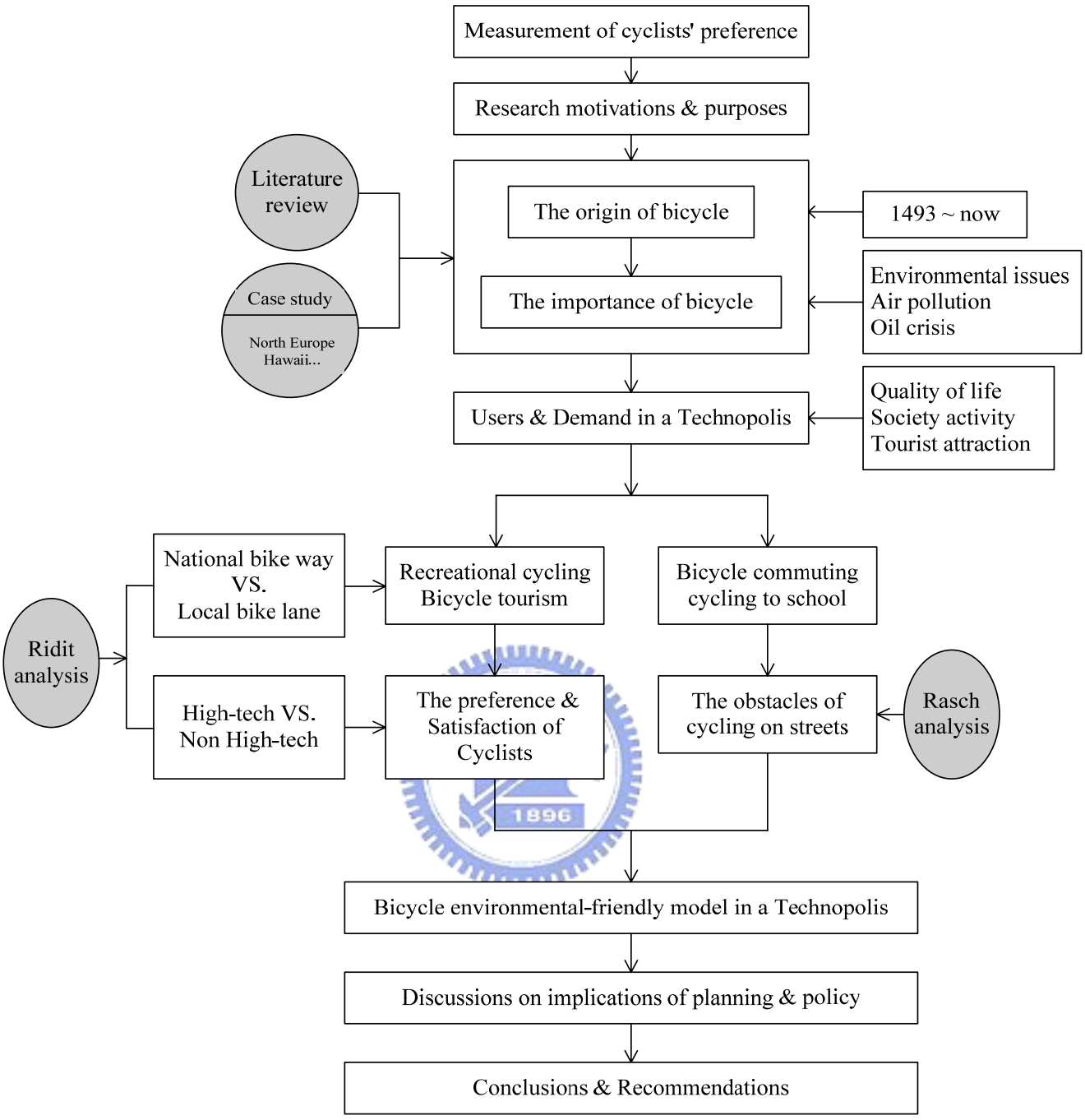


Figure 1-9 Research flow chart