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An Application of Geographic Information System for Supporting Tourism Development along the Southeast Asian East-West Economic Corridor

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Abstract

The Southeast Asia (SEA) East-West Economic Corridor (EWEC) is an outstanding land route stretching across four countries; Myanmar, Thailand, Lao PDR and Vietnam. It is also intersected by several corridors and consequently supports interchange nodes and linkage of main hubs in the SEA region. To boost the economic expansion and increase revenue among these EWEC nations, the tourism development on this route has been raised. The EWEC is located in the potential periphery region and have highly scenic values composed of natural and historical resources, traditional cultures and distinctive lifestyles. However many of these sites have not been a priority destination. Some of them are still lack of tourism facility services and attractiveness in terms of potential evaluation to attract visitors.

The present study aims firstly to evaluate tourist attractions' potential along the EWEC region by applying GIS-based multiple models- analytic hierarchy process (AHP), multi-criteria evaluation (MCE) and network analysis. In addition, the study extends the previous results to investigate the influential factors affecting potential tourist attractions. Then, the areas lacking of facility services- mainly in the Savannakhet province, Lao PDR- are displayed and supported for expanding new possible locations of public services and investments of tourism industry. The GIS location-allocation analysis tool was used to support development of neglected tourism attractions including the weak peripheral areas throughout the main route.

Finally, the six EWEC tourist itinerary models are developed - En-route pattern, Radius Destination, Destination Area Loop, Möbius Loop, Open Jaw Itinerary and Complex Touring- to accommodate domestic and international traveling in this region. These models are implemented in ArcGIS Network Analyst for finding practically optimal routes in terms of distance and time saving. The 26 prioritized tourist sites obtained from the first results are selected to run on the EWEC itinerary models.

Our results show that the GIS-based network analysis is a potential tool to tourist initial travelling planning. The total outcomes of this study provide insights into the EWEC current situations of tourism sector and support tourism planning and development on the EWEC region as a whole. These strategies are also flexible to be applied in other regions around the world.

Zusammenfassung

Der Southeast Asia (SEA) East-West Economic Corridor (EWEC) ist ein herausragender Landweg, der vier Länder umfasst: Myanmar, Thailand, Laos und Vietnam. Er wird von mehreren Korridoren gekreuzt und fungiert daher als Anschlussstelle und Verkehrskreuz in der SEA Region. Um die wirtschaftliche Expansion zu steigern und den Umsatz unter den EWEC Nationen zu fördern, wurde die Entwicklung des Tourismus auf dieser Strecke verstärkt. Der EWEC befindet sich in der potenziellen Peripherie-Region und durchquert mehrere Länder. Diese besitzen sehr malerische Werte aus natürlichen und historischen Ressourcen, traditionellen Kulturen und einem unverwechselbaren Lebensstil. Aber viele dieser Orte waren bisher kein vorrangiges Tourismusziel. Einigen von ihnen fehlt noch die nötige Infrastruktur, um Besucher anzuziehen.

Diese Arbeit zielt primär auf die Evaluierung des touristischen Attraktivitätspotenzials entlang des EWEC mittels eines GIS-basiertem analytischen Hierarchieprozesses (AHP), Multi-Kriterien Evaluierung (MCE) und Netzwerk-Analyse. Darüber hinaus erweitert die Studie die früheren Ergebnisse um die einflussreichen Faktoren, die die möglichen Touristenattraktionen untersuchen. Die Bereiche, denen es an der nötigen Infrastruktur fehlt, vor allem in der Provinz Savannakhet, Laos, werden aufgezeigt und für den Ausbau neuer möglicher Standorte der öffentlichen Dienstleistungen und Investitionen der Tourismusindustrie unterstützt. Das GIS Analysetool für Location-Allokation kann dabei die Entwicklung vernachlässigter Sehenswürdigkeiten einschließlich der schwach entwickelten peripheren Regionen entlang des Korridors unterstützen.

Schließlich wurden sechs Reiserouten-Modelle entwickelt für nationale und internationale Reisen in der EWEC Region: Fischgräten- Muster, Radius-Muster, Zielbereich-Schleife, Möbius-Schleife, Gabel-Reiseroute und komplexes Touring. Diese Modelle wurden im ArcGIS Network Analyst für die Suche nach praktischen optimalen Routen in Bezug auf Distanz und Zeit implementiert. Auf die 26 prioritären aus den ersten Ergebnissen gewonnenen Destinationen wurden die EWEC Reiseroute Modelle angewandt.

Unsere Ergebnisse zeigen, dass die GIS-basierten Netzwerk-Analyse ein potenzielles erstes Hilfsmittel für die Tourenplanung ist. Die gesamten Ergebnisse dieser Studie bieten einen Einblick in die derzeitige Situation im Tourismussektor des EWEC und unterstützen dessen Planung und Entwicklung in der ganzen EWEC-Region. Diese Strategien sind auch flexibel, um in anderen Regionen auf der ganzen Welt angewendet zu werden.

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Abbreviations

A	Admission
AC	Accessibility
AGCO	Agro/Eco tourism
AHP	Analytic Hierarchy Process
AS	Arts and Sciences Educational tourist attraction
Att	Attraction
CI	Consistency Index
CR	Consistency Ratio
EWEC	East-West Economic Corridor
F	Facility
GIS	Geographic Information systems
GPS	Global Positioning System
GMS	The Greater Mekong Subregion
HC	Cultural/Religious and Historical tourist attraction
LNTA	LAO National Tourism Administration
LSCP	Location Set Covering Problem
MCLP	Maximize Covering Location Problem
NBT	Nature-based treatment/Spa/Spiritual services
NT	Natural Tourist Attraction
P	Popularity
Phy	Physical Aspect
RD	Risk of Endemic Diseases
REC	Recreation/Entertainment tourist attraction
RI	Ratio Index
S	Seasonality
SoE	Socio-Economic Aspect
SNV	Stiching Nederlandse Vrijwilligers (Netherlands Development Organization)
SP	Tourism shopping site/Market
TA	Tourism Activity
VP	Viewpoint/Landmark/Monument
VU	Value/Uniqueness
WGS84	World Geodetic System 1984

Chapter 1

Introduction

1.1 Background

While the tourism sector plays an important role in the economic development of many countries, it is particularly significant to the Greater Mekong Subregion (GMS). The region encompasses six countries including Cambodia, Lao People's Democratic Republic (Lao PDR), Myanmar, Viet Nam, Yunnan Province and Guangxi Zhuang Autonomous Region of the People's Republic of China (PRC) and Thailand. In 2006, the revenues achieved by the tourist sector were as much as 20% of the overall GDP in Cambodia, 14 % in Thailand, 11 % in Vietnam and 9% in Lao PDR (Asian Development Bank, 2008). These numbers clearly indicate the great economic importance of tourism for the national economies and underlie the aim to derive additional benefits from regional cooperation with regard to tourist development.

One of the strategic frameworks of the cooperation has been the expansion of nine transport corridors. There are three main corridors: the North-South Corridor, the East-West Economic Corridor (EWEC) and the Southern Corridor of the GMS corridors, the most advanced development is EWEC (Guina, 2008: 84-85). To be precise, when almost all borders and border areas of the GMS were opened for foreign trade, investment, information and travel in the early 1990s, it brought about the increase of travelers and tourists using the transport corridor. While the EWEC has thus already contributed considerably to greater wealth in this area, it still offers tremendous opportunities for development, providing local people along the corridor with a number of possibilities to increase their income, new tourism options and new tourism infrastructure. As a result of the new tourism investments, private sector hotels, resorts, guest houses, and souvenir shops have been gradually built along the corridor.

The length of EWEC is approximately 1,320 kilometers connecting Da Nang in Viet Nam at the eastern-end and Mawlamyine in Myanmar at the western-end. The route passes through four countries: Vietnam, the central Lao PDR, North and Northeastern Thailand and Myanmar. Whilst it serves as a land link connecting the Indian Ocean (Andaman Sea) to the Pacific (the South China Sea), it also provides a new significant route not only for the transport of goods and services, but also for itinerants who desire to cross the continent (Asian Development Bank, 2009: 1). Besides which enormous natural, cultural, and historical resources have been unfolded along the corridor, representing noticeable potentials for developing tourism.

However, this trail is still neither well-known nor intensively used in any segment of the corridor. This assessment is supported by the economic growth rate of the GMS countries in 2006, which shows an increase of only 5.5%. Moreover, the total exchanges of exports between GMS countries, taken as a percentage of the sum of GMS countries' total exports was 6.5% in 2006. This share is rather low when compared to the 52%, 59% and 52% intraregional trade shares of Asian, European Union, and North American countries, respectively (International Monetary Fund Direction of Trade Statistic, 2000-2006 cited by Asian Development Bank (2008).

In terms of the quality of transport along the EWEC, the region still suffers from a lack of logistical facilities at the border, poor road conditions in some areas due to depressions and damage from rain as well as a lack of service facilities along some portions of the corridor (Lord, 2009). The inadequate communication systems and inefficient public sector operations, including the lack of infrastructure, are an obstacle for development. Deficiencies in tourism-related business along the corridor have to be compensated by additional investments supporting the construction of hotels, restaurants, souvenir shops, petrol stations, car parks and garages especially in Savannakhet (Lao PDR) (Wisuthakul, 2008). Many tourist attractions within the catchment area of the corridor are rarely visited due to the difficulty in reaching these areas and the lack of specific tourism products and services to attract travelers. In addition, the targets of overall development plans have not yet been converted into tangible results. Furthermore, tourists cannot expect any support from specific information centers and the itinerary maps along this route have not been completed yet.

Despite the fact that no supporting case study based on available reports has been published, the Asian Development Bank has tried to support modernization strategies that should reduce the critical bottlenecks that impede tourism. At present there are several suggestions, such as focusing on improving tourism related infrastructure, providing support to pro-poor community-based tourism projects, boosting sub-regional cooperation through private sector participation in tourism marketing, and promoting or establishing a mechanism to increase and facilitate the movement of tourists across borders (Asian Development Bank, 2008).

Lord (2009) also reported new GMS strategies for tourism in the EWEC zone that are focused on a program of overland EWEC tours, attention of tourism centers in Lao and the route between Thailand and Vietnam, and a development of zonal tourism (especially agro-tourism, ecotourism and cultural tourism). In addition, ASEAN (Association of Southeast Asia Nations) has encouraged activities and action plans to support transport linkages and tourism investments across the member states for instance the workshop on "ASEAN Tourism Development Corridor" held in 2009 (ASEAN Secretariat, 2011).

According to the problems and targets of EWEC development mentioned above, the proposed research deals with the development of tourism along the Southeast Asian East-West Economic Corridor by applying Geographic Information System technology.

Geographic Information Systems (GIS) are computer systems for capturing, storing, querying, analyzing, and displaying geospatial data that is called geographically referenced data. GIS is also defined as including the procedures, operating personnel, and spatial data that go into the system (Chang, 2008). With GIS facilities, it is possible to integrate multi-criteria decision support systems with mathematical models and other spatial techniques for finding the potential solutions of tourism development in multiple dimensions. As far as the literature reviewed, there is no implementation plan to develop the tourism sector in the EWEC region by using GIS. In this study, GIS therefore served as a major framework and basic analysis tool which was combined using Analytic Hierarchy Process (AHP), a technique of decision support systems for evaluation of potential tourist attractions. Then, the GIS-based network analysis will be applied to optimize initial travelling plans for tourists to the EWEC region.

A network is a set of linear features which are interconnected in GIS. General examples of networks are highways, railways and rivers, transportation routes like those developed for school buses, garbage collection and utility distribution systems (e.g., telephone, water supply and electricity) (Haggett and Chorley, 1969). The network data model is the most advanced conceptual model to show a network within a GIS environment. The model, which is a special type of the node-arc-polygon data model that underlies many basic vector GIS databases, is built around two core entities: the node (a zero-dimensional entity) and arc (a one-dimensional entity) (Fischer, 2003).

Network analysis is useful for many organizations which manage or use networks of facilities. For example, municipal public work departments use networks to analyse bus and trash routes, businesses use them to plan and optimize the delivery of goods and services. Network analysis can be applied for retail store planning which requires the finding of trade areas, the shortest routes, and minimum costs to deliver products. Beyond the above-mentioned uses, GIS and the application of network analysis can also visualize tourist movement within destination areas and consequently support optimum planning of tourism services (Türk and Gumusay, 2004, Lau and Mckercher, 2006).

The Network Analyst in ArcGIS 10 has proven a powerful software to determine the optimal path along a linear network. It is based on numerous criteria such as Best Route, Closest Facility, Service Areas and Original-destination Cost Matrix. Besides, it is able to show driving destinations in both text and map explanation.

In conclusion, we hypothesize that the use of this technique can facilitate sustainable improvement of EWEC tourism in adequate ways. GIS techniques could be used to investigate the spatial distribution characteristics of tourism resources and facilities. The eminent tourist attractions were evaluated by integration of the AHP techniques and spatial GIS functions. By using the Best Route function of the network analysis, practical itinerary patterns were optimized to develop tourism routes for time and cost saving. In addition, the physical problems and weak areas of facility structure were investigated by using the Service Area analysis. Therefore, the final results obtained by these techniques will be displayed as applicable strategies for tourism development along the EWEC and Southeast Asia region.

1.2 Research questions

According to the background and problems mentioned previously, the research questions that will be addressed are as follows:

1) Which are the relevant contents for mapping the track of the corridor including the adjacent transport routes with regard to potential tourism resources and activities along the East West Economic Corridor?

2) What is the database concerning topical tourism attractions along the road and which ones are outstanding places to be offered to tourists?

3) How to create a reliable guidebook for tourists' travelling along this corridor?

4) What is the current situation with tourism development and what are the weaknesses of facility services?

5) How can the application of the result of the present study be utilized in specific areas in order to improve tourism marketing and make recommendations for possible future investments?

From these points of view, it is necessary to provide insights into the various patterns of tourism development regarding specific locations, resources and infrastructure. Despite the fact that the Thai government has attempted to modernize and decentralize the tourism industry in the GMS region, it is worth mentioning that regional cities will need to be intensively developed in order to create new centers of tourist attractions. For example, the regional cities along the EWEC in particular Phitsanulok, Sukhothai and Khon Kaen could become potential tourism centers and thus be a pivotal efficient tourism network in this region. Furthermore, in order to attract more tourists, some cities will need to invest more to improve accessibility to unique tourism resources and products. At present, there is still an enormous lack of information regarding important data of relevance including present situations of tourist attractions in each boundary. No intensive research work has been carried out and therefore I suggest that the application of GIS and Decision Support System (i.e. Analytical Hierarchy Process) could contribute to achieving an evaluation model for tourist attractions'

potential. The outcomes of the analysis could also be used to investigate the weakness of tourism development in attraction, physical and socio-economic aspects. Therefore, some particular areas would be suggested to be improved and extend tourism facility services in the EWEC region. In addition, tourist itinerary models were generated and implemented on the existing EWEC road networks via ArcGIS Network Analyst Module. An overall output visualization could be used as a reliable guidebook for tourists' travelling in this area. To complete these outcomes, there is a clear need to integrate multi-disciplinary (e.g. Geography, Tourism management, Marketing and Planning) with Geographic Information Systems to support tourist resources and development across the route.

1.3 Objectives

1. To establish a GIS database of tourism structures along the roads of EWEC.
2. To analyze and classify the tourist attractions' potential along the EWEC.
3. To develop itinerary models for tourist routes and implement the models for multiple destination routes along the EWEC by means of network analysis in ArcGIS.
4. To investigate main weaknesses of the lowest potential tourist attractions to be boosted for expanding tourism investments and services including offering alternative solutions in particular areas.

1.4 Expected Results

Concepts of geography of tourism and GIS including Network analysis extension in the ArcGIS package can contribute to support analysis of tourist attractions' potential and to optimize the EWEC tourism routes and implementation plans for tourism development along the East-West Economic Corridor.

1.5 Conceptual framework

The present study is briefly described by the conceptual framework (Figure 1.1). The first task is an exploration of tourism related data both attribute and graphic data. Then, the relevant factors and criteria are defined from literature reviews, in particular concepts of geography and tourism including techniques of spatial analysis. From this process, the database of tourism information along the EWEC is designed and recorded in the GIS database for further analysis. Next, the analysis process is divided into 3 steps. First is the evaluation of the potential tourist attractions by using AHP techniques and mathematic models such as Dijkstra's algorithm and location-allocation analysis. To continue the following analysis processes, the functions of the network analyst are implemented. In the second step, the EWEC itinerary models are developed and then the Best Route analysis is applied to find the optimal tourism routes regarding each model. By determining the

weak factors of potential touring sites, the initial results are investigated using a scatterplot matrix and Service Area function of network analysis. The result presents the physical problems and particular areas for expanding tourism investment and services for future development plans. In addition, the study offers the possible options of basic solutions for potential improvements in attractiveness and tourism facilities. By using GIS-based spatial statistics tools and location-allocation analysis, the optimal alternative installations of new tourism facilities are located to service tourists throughout the region. Most outputs visualized in maps from data collection process to conclusion.

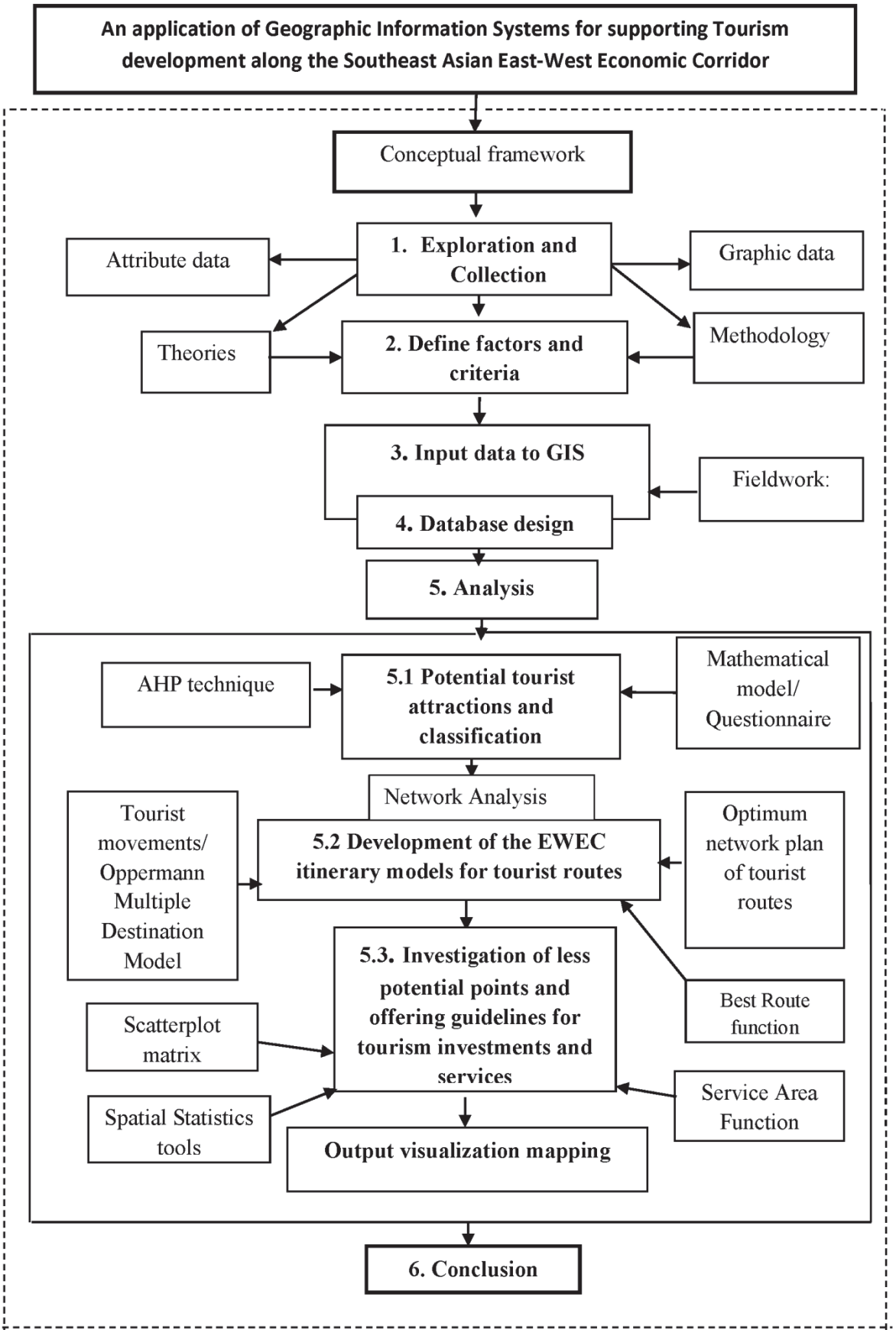


Figure 1.1 Conceptual framework of dissertation

1.6 Structure of Dissertation

The outline of the dissertation is managed by following a conceptual framework. It is logically divided into eight chapters to achieve the objectives of the present study as follows:

Chapter 1: Introduction: outlines the background and problems, existing situations of the study area and the scientific process including hypotheses, research questions and objectives.

Chapter 2: Literature Review: this chapter contains the scientific view of related information used in the study for example geography of tourism and geographic techniques including methodologies, various functions of GIS extensions and AHP. In addition, the previous studies related to tourism geography and present ideas of the study are included.

Chapter 3: Study area: this chapter gives an overview of the study area, tourism facilities and infrastructure, network of roads, and the locations of tourist attractions along the EWEC.

Chapter 4: Materials and Methods*:* the descriptions of data gathering and applied methods are presented to suggest ways to develop the tourism sector along the route. This chapter also highlights the various techniques integrated in the GIS framework for supporting the objectives. Analytical procedures are described systematically.

Chapter 5: Development of Analytic Hierarchy Process under GIS Framework: this chapter provides a detailed explanation of the process of evaluating potential tourist attractions using the major concept of AHP technique combined with spatial mathematical models to determine the potential tourism sites along the EWEC route. The result is also managed and displayed in GIS.

Chapter 6: Itinerary models for the East-West Economic Corridor: this chapter describes the development of the EWEC itinerary models including an implementation of these models by applying network analysis in ArcGIS for practical uses.

Chapter 7: Investigation of weak points and offering guidelines for tourism investments and services: the first results of the analysis are used to investigate the major signs of weaknesses in potential tourist sites. Combining the capabilities of spatial statistic tools in GIS and tourism planning related information, the chapter explores specific problems in particular areas that require further development. The study thus focuses on the areas that were evaluated as having a disparity of service facilities, although they were

potential areas to promote tourism resources sites. This chapter aims to offer guidelines on possible ways on investing in facilities and services for tourism stakeholders.

Chapter 8: Discussion and Conclusion: the last chapter includes a general discussion and summarizes the research processes, significant findings, and some ideas that are relevant and useful to both the academic world and tourist industry. Recommendations for future plans and the solutions of emerging problems during the period of research are also described.

Chapter 2

Concepts, Theories and Literature Review

To support tourism development, the GIS technology was applied using a multi-disciplinary approach. This chapter reviews the fundamental concepts, theories and methods relevant to developing key factors and provides a conceptual framework to answer the study objectives and to produce manageable outcomes. By integrating mixed social and scientific models, GIS is a powerful tool that is able to assist in implementing tourism development functions along the Southeast Asia East-West Economic Corridor (EWEC).

2.1 Definition of tourism

Tourism is a complex phenomenon and the study of tourism has integrated concepts, approaches and understanding from many disciplines (Echtner and Jamal, 1997). The definition of tourism has varied depending on the study purposes and points of view. It has traditionally been defined both in terms of the tourist/visitor activities and in terms of business activities that either supply or are demanded by tourists/visitors. Demand was the adopted approach in this study, which refers to traveling activities and staying in destinations. On the other hand, supply refers to the tourism industry as a group of business enterprises that is basically involved in the final consumption of any tourism product (World Tourism Organization, 1995).

2.1.1 Definition of tourism and travel

Tourism is defined as the set of relationships and processes that are connected with the movement of human beings from their habitual place of residence to another site. This movement is not for the purpose of changing residence or engaging in commerce or other paid occupations (Reviewed works, 1984). Tourism comprises many activities of persons traveling from and staying outside their usual environment (United Nations and World Tourism Organization, 1994) and therefore, involves both local and global organizations. Through time, tourism has been defined in various ways.

Regarding the International Conference on Travel and Tourism Statistics, the definition of tourism stated in June 1991 is the most commonly accepted and frequently used. This definition was also accepted by the United Nations Statistical Commission at their 27th meeting in 1993. Here they agreed on the term of “Tourism” as being (Beaver, 2002):

"Tourism composes of the activities of people travelling to and staying in places outside their usual environment which is not more than 1 consecutive year for leisure, business, and other purposes".

The encyclopedia of tourism expanded the definition in recent years so that it includes the study of man (tourist) away from his habitat, of the touristic apparatus and networks responding to his various needs, and of the ordinary (where the tourist is coming from) and non-ordinary (where the tourist goes to) worlds and their dialectic relationships. The definition has extended to encompass the study of tourism as a whole (tourist arrivals, departures, expenditures and so on), with interconnected structures and functions, as well as how it is influenced and how it influences other forms and forces relating to it (Jafari, 2003).

Significantly, definitions of tourism typically involve concepts of space (i.e. travel away from a usual place of residence/home), time (i.e. the time spent away from place of origin/home) and temporary and short-term travel (Hall, 2005).

According to United Nations Statistics Division , the World Tourism Organization (WTO)(2010) refers to tourism as the activities of travelers who move between different geographic locations for any purpose and any duration. Travel is classified into two groups - domestic and international. Domestic travel refers to residents traveling to/within their countries, whereas international travel indicates residents or non-residents traveling outside their countries of origin. In addition, travel to a country by non-residents is called inbound travel, while the travel outside a country by residents is called outbound travel.

In terms of the national division, tourism has been categorized into three main types of travel (United Nations and World Tourism Organization, 1994):

1) Internal tourism, which comprises domestic tourism and inbound tourism;
2) National tourism, which comprises domestic tourism and outbound tourism; and
3) International tourism, which consists of inbound tourism and outbound tourism.

In this thesis, tourism refers to the phenomenon of humans traveling to different geographic locations and environments for the purpose of participating in new experiences and undertaking activities, mostly leisure activities. The length of the trip, which is determined by the departure date and return date, is no more than one year. Also, the travel itinerary along the EWEC focuses on multiple destination trips that require at least one stop-over with an overnight stay at the destination area. In addition, a tourism trip in this thesis refers to a person's visits to different places, from the time of departure away from his/her usual residence until he/she returns to the usual place. It is thus

called a round trip. The average length of a trip based on trends over the last ten years up until 2009 is about two weeks (Reinhardt, 2011).

On the other hand, Boniface and Cooper (2005) also classified tourism into three groups based on the travel distance by air:

1) Long-haul tourism is generally taken to mean journeys of over 3,000 kilometers.
2) Medium-haul tourism means journeys between 1,000 and 3,000 kilometers.
3) Short-haul tourism comprises journeys of less than 1,000 kilometers.

In this research, we extend the journey by not only focusing on air transport, but also on overland transport by automobiles. If tourists started their trips from other continents by air, such as Europe and America, they definitely belong to the long-haul journey group. However, domestic or national neighboring tourists who travel by other modes of transport to destination areas, such as bus or train, are considered as short-haul travel, but may possibly move into medium or long-haul categories if they continue their visits and cover a long-distance route such as the Southeast Asian East-West Economic Corridor.

2.1.2 Definition of tourist

The definition of a tourist is consistent with that of the World Tourism Organization which defines a tourist as any person who stays away from home overnight for a limited time (World Tourism Organization, 1995). The previous definition of visitor accepted by UN Statistical Commission (1969) in all its publications for statistical purposes is "*any person visiting a country other than that in which he has his usual place of residence, for any reason other than following an occupation remunerated from within the country visited*."

In this definition, there are two categories of visitors. First, ***tourists*** mean temporary visitors staying at least 24 hours in the country visited for one of the following purposes:

1) Leisure, including recreation, holiday, health, study/education, religion or sport
2) Business, family, mission or meeting;

The latter is classified as ***excursionists,*** who stay less than 24 hours in the country visited (including travelers on cruises). Excursionists are sometimes referred to as same-day visitors whose visits are outside their usual place of residence, either domestic, inbound or outbound (Statistics Division: United Nations, 2010). However, they do not include residents (nationals and aliens) returning after a stay abroad of no more than one year, permanent and temporary immigrants

intending to stay more than one year, and foreign diplomats and military personnel stationed in the country.

In addition, the WTO (United Nations and World Tourism Organization, 1994) classified an international tourist as "*a visitor who travels to a country other than that in which he/she has his/her usual environment of residence for at least one night but not exceeding one year and whose main purpose of visit is other than the exercise of an activity remunerated from within the country visited"*. A domestic tourist is described similarly to an international tourist, except that he/she is "*any person residing in a country, who travels to a place within the country, outside his/her usual environment*".

With respect to the scope of this study, groups of visitors are considered as both international and domestic tourists who travel in the EWEC area, outside their usual residence, for at least one night, but not exceeding a year, in collective or private accommodation.

2.2 Geography of tourism

Geographers traditionally study the spatial phenomena experienced by both natural and human actions (Pattison, 1964). With reference to tourism, they study the spatial expression of human activity, focusing on tourist-generating and receiving places, as well as the connection between them. Williams (2009) defined tourism geography as part of human geography, in which place and space are at the core of where tourism occurs. Additionally, Erik Cohen referred to tourist space as a physically or socially demarcated area arranged for touristic visits as mentioned in the Encyclopedia of tourism. The literature emphasizes the covertly staged nature of such spaces as a manifestation of staged authenticity. A covert tourist space is made to appear as part of people's normal lives, although it is in fact fabricated for tourists, such as performing "real" tribal rituals. An overt tourist space is explicitly marked off from the host's everyday reality, as in an environmental museum (Jafari, 2003).

A geographical approach in tourism contributes to the understanding of tourism phenomena in relation to social, cultural and economic activities on different spatial scales. It can be undertaken from global, regional as well as local scales. On a local scale, tourism research mainly focuses on developing a generating area or destination to be pleasurable. Regarding the regional scale, tourism development aims to increase in volume through heightened demand and expanded supply in an entire region. The demand goal is to improve tourists' ease and ability to travel to the destination region, meaning that they should have adequate time, money, transportation and basic equipment. For improving supply, present physical facilities should be enhanced to assist tourists, such as lodging, food, service, transportation and local system service (Gunn and Var, 2002).

As far as tourism geography is concerned, it emerged in the 1920s in the United States. Then, many scholars in other regions steadily became interested since the 1930s through article publications related to tourism (Mitchell and Murphy, 1991). In Europe, it has been rapidly growing within academia since at least the 1980's. It brought about the formation of a branch of geography in its own right. Geography of tourism is still perfecting the theoretical instruments needed to analyze the implications of tourism as a spatial phenomenon. However, it has developed from many different schools of thought, resulting in a variety of perspectives that reflect the leading groups' scientific background (Minca, 1993).

It is a fact that the study of tourism geography is wide-open and dynamic. It initially examined tourism behavior significant to place identity and spatial interaction, based on general models of tourism space. Later, geographers began turning their synthesizing approach to develop more applied planning models which comprise various components (Mitchell and Murphy, 1991).

The study of tourism as applied geography falls within the scope of geography as it has often been intensively studied by geographers. The tourism related study applies the application of geographical methods of survey, investigation, analysis, evaluation and future development to practical purposes (Robinson, 1976). Thus, the geography of tourism embraces diverse studies on the role of tourists' demands in specific areas, the complexity of tourist sites, the characteristic forms of tourist movements, and transportation networks, including analyses of impact, tourism planning and spatial modeling (Williams, 1998). In China, applied tourism research has been more dominant than fundamental research over the last two decades because it has contributed to the national, regional and local economies, and supported the national policy on practical tourism planning. Therefore, this research easily received financial support. However, it is still important to adequately publish on tourism development frameworks, including theoretical and conceptual interpretations based on space, place and man-land relationships (Bao and Ma, 2010). In practical terms, tourism geography can benefit further applications to improve the attractiveness of tourist sites, to develop tourism services to support tourist arrivals, as well as to evaluate potential use of tourism resources based on geographic and environmental factors.

Computer-aided spatial technologies, in particular Geographic Information Systems, have allowed a number of researchers to intensively and rapidly study tourism development from a marketing and sustainable management perspective (Jovanović and Njeguš, 2008, Oppermann, 1997, van der Knaap, 1999). Boers and Cottrell (2007) developed a plan for natural and cultural tourist opportunity trails through a GIS-supported approach integrated with sustainability criteria on the Sinharaja Forest Reserve in Sri Lanka. In addition, GIS has been extended to develop a model of potential site decisions for tourist facilities (i.e. hotel) (Shoval et al., 2011), and recreational destinations (Chhetri and Arrowsmith, 2008), and even for monitoring and simulating visitor's

traveling patterns as human-environmental interaction (Wolf et al., 2012, Roberts et al., 2002). Recently, Web-based GIS has been used to examine tourist trips, tasks, and perceptions on different travel situations, as well as interactions between tourists and targeted practical information on tourism WebGIS (Chang and Caneday, 2011).

In this research, the study area is a connected land route among four countries, Myanmar, Thailand, Lao PDR and Vietnam, which is known as the EWEC. It was constructed to connect many provincial cities in more rural areas in order to become a new peripheral regional route of Southeast Asia. Tourism development along the EWEC not only affects each individual country's income, but also benefits all EWEC member states as a whole. Therefore, regional planning will be a significant aspect of tourism development in this region. Tourism trends in the future cannot be developed by just one country, but will require nations to come together as one. In the present study, geography-based development was applied to support tourism along the EWEC area, particularly to develop the main criteria for assessing the potential of tourist attractions, as well as to study tourist movement plans. We intend to bring benefits not only to tourists, but also to the local communities of this region.

In summary, geography has the fundamental knowledge to support the ideas of tourism development. In order to achieve the overall objectives of the present study, the geography of tourism and technical geography were included in the study plan, such as GIS, Global Positioning System (GPS) and the model of multi-criteria decision analysis.

2.3 Tourism elements

The geographical makeup of the tourism system includes three major components. Firstly, the tourist generating zones represent the place where tourists begin and end their journeys. Secondly, the tourist destination zones are destination areas with features and attractions for tourists to visit, and other related tourism service functions such as accommodation, retailing, entertainment and recreation. The last component is the transport of tourist industries, which also shows the volume and direction of tourist flows (Boniface and Cooper, 2005).

2.3.1 Tourism generating zone

The spatial system of tourism encompasses the origin (demand zone), the destination (supply zone) and the transit zone, which is the network of travel between the origin and destination. The originating zone refers to the generating area of the starting journey, for example home or public transportation stations. This zone serves as a demand zone of tourism elements and is directly influenced by tourists or the person who makes the journey. This element can vary depending on

many factors. Boniface and Cooper (2005) claimed that there are many potential variables dictating the demands of travel, such as occupation, life cycle stage, mobility level, education and general personal environment. In addition, income, personal purposes and interests and attractiveness of destinations or tourism products also influence the decisions of traveling.

2.3.2 Tourism destination zone

Destination zone refers to the supply zone of tourism, which combines with diverse major elements, mainly tourist attractions, tourism facilities, tourism organization and marketing. The destination area hosts the main attractions or tourism products and facility services. Additionally, it can comprise a single destination or multiple destinations, depending on the tourists' traveling plans. However, the present study focuses on multiple destinations journeys during which tourists intend to visit many primary tourist attractions within the destination area. These areas are located to support tourism, which includes: basic infrastructure, such as public transportation, communication systems, water and electricity supply and waste disposal (Mieczkowski, 1990, p145-146), as well as tourism facilities, such as accommodation, public transport, petrol stations, restaurants etc., and includes tourism-related activities that are a part of the geographic characteristics of tourist sites, such as winter sports, rafting and cruising.

Additionally, Robinson (1976) suggested that the geographical components of tourism are very important considerations for tourism activities. If there were no geographic differences between places, tourism would not exist. According to Robinson, the geographical components of tourism in destinations include the following:

1) Accessibility and location
2) Space
3) Scenery; topographic phenomena such as mountains, canyons cliffs and beaches
4) Climate
5) Animal life
6) Settlement features: cities, villages, historical and archaeological remains including monuments
7) Culture: way of life, traditions, folklore, arts, crafts and so on

Moreover, the amenities and miscellaneous factors, such as hospitality of local people, information services on destinations and political policies, should be embraced in the tourism sector. Tourist places should be able to offer both outstanding natural and manmade amenities. Natural activities include the opportunity to climb, to bathe at fine sandy beaches and to cruise, whereas manmade activities comprise various types of entertainment and necessary facilities, such as tour

guides, rental cars and special shows. Tourists' interest in destinations may be encouraged by the friendliness and hospitality of local people. However, the essential point is the host country's political situation. Countries that have many political and military conflicts are less attractive to visit. These components will be included in order to define the factors for the analysis of potential tourism attractions.

Beyond the above-mentioned elements in the supply zone, tourism is involved in many business and non-business activities, such as hotels, restaurants, travel agencies, car rentals, museums and libraries, public tourist boards and offices, pleasure ports and others. At present, technology has been critical to tourism sectors. Information and communication technology (ICT) may be held responsible for the global drive towards mass tourism. The introduction of ICT in recent decades has opened up new opportunities for the tourist attractiveness of remote and peripheral areas. Besides, it has also led to service competition among tourist facilities in areas of destinations and SME businesses (Giaoutzi, 2007). ICT has been responsible for updated transportation networks, infrastructure and modern telecommunication systems, as well as for attaching geographic technologies to give fast and clear information to tourists all over the world.

In the study area, the collaboration of the Association of Southeast Asian Nations (ASEAN) member nations is also a key element for the supply side of tourism. This intergovernmental collaboration creates significant policy among ASEAN nations to facilitate and promote the tourism sector across the region. Two prior objectives of the policy framework set out in the 2002 ASEAN Tourism Agreement have been clearly implemented. First, travel facilitation allows ASEAN nationals to travel within the region without a visa for two weeks. This agreement of visa exemption was signed among the members in 2006 (Wong et al., 2011). However, ASEAN has attempted to achieve an advanced visa agreement on a single tourist visa over the next five years (ASEAN Secretariat, 2011). This achievement will substantially benefit liberalizing the flow of money and international tourists who are able to visit more than one ASEAN country during a trip. The second implemented agreement is human resources development, which was started as a project to develop common competency standards. In 2008, a system was developed to standardize the vocational competency requirements for skills and qualifications among the member states, facilitating the movement of tourism workers in the region (Wong et al., 2011). In addition, the agreement has been extended to many other projects to train and develop skills and knowledge of tourist staff on the job, such as housekeeping, reception services, food production and travel planners (ASEAN Secretariat, 2011).

2.3.3 Tourism transit zone and transport

The transit zone refers to the region tourists must travel through to reach or depart his/her destination. This involves transport, service stations, information services, and transit route

infrastructure, such as motels, highway cafes and restaurants on a tourist's journey (Hall, 2005). Thus, transit zones provide the convenient facility services for staying and connecting modes of transport. Some transit places can also act as destinations or hubs during the trip, mainly with multi-destination tourism. Tourists are able to take a rest or prepare themselves before entering a new unfamiliar destination area.

In addition, the transport sector provides the essential link between markets and destinations, with travel also occurring within each of these zones. Transportation of the tourism industry therefore supports tourists' travel. Many market sectors, both wholesale and retail travel, are found in places where tour operators and retail travel agencies come together. They also develop and promote different tourist experiences as individual or packaged items (Pearce, 1995).

2.4 Geography and tourist transport

Geography related to the spatial expression of tourist transport is a vital link between tourist-generating and tourist-receiving areas. What's more, geographers are interested in the patterns of human activities associated with traveling and how different processes lead to the formation of geographical patterns of tourist movement on different scales, from global to local levels. Besides, geographers also study the analysis of transport systems in response to the human desire for movement and the spatial outcome of journeys (Page, 2009). In addition, the GIS and Network Analysis have been applied to explore and develop transport systems for travelers in order to save time and money in social and economic aspects. According to Page (2009), geographers have taken three viewpoints concerning the analysis of transport systems:

1) The linkages and flows within a transport system;
2) The location and places connected by these linkages;
3) The system of catchments and relationships between places within the network.

To analyze tourist movements based on the transport systems, modes of transportation should be initially understood.

2.4.1 Mode of tourist transport

Transportation plays an essential role for tourism. It is used to transport tourists to tourism attractions or destinations, which are immobile products. Individual movement can differ in various types of transportation in a journey. In addition, tourists may use mixed modes of transports during their journeys. Modes of transportation are divided into six distinct primary modes: automobiles (both private and rental cars), commercial company transportation (such as coaches, vans), public means (buses, trams, trains, ferries and taxis), airplane, bicycle, and walking. Both air and car

transports have provided new opportunities for more flexible patterns of travel (Page, 2009). However, the major types of transportation addressed in this study were grouped into three modes.

Air transport

Sealy (1992) suggested that air travel and the expansion of international tourism is largely a nodal transport system dependent upon the airport (node) and the flights (networks) serving them. Air transport and tourism have stimulated each other. The increase of air travel affected the expansion of the number of tourism journeys which appeared elsewhere, and supported the opening of new destinations (Turton and Mutambirwa, 1996, Bieger and Wittmer, 2006). Particularly, the low-cost airline services have considerably supported transport quality to many tourism destinations (Bieger and Wittmer, 2006). For instance, a large number of tourists traveling with low-cost airlines to Spanish destinations increased during the first decade of the 21st century. This has been associated with short-haul journeys within fifteen EU countries, with the majority of tourists coming from Ireland and the UK via Ryanair and EasyJet (Rey et al., 2011).

In addition, the expansion of airport capacity, such as runways, size of aircraft, flight frequencies and improvement of services at hub airports, has greatly benefited passenger demands and supported a growth of travel (Wei and Hansen, 2006, Wei, 2008).

Land transport

Tourists are able to use a variety of transport modes on land transportation networks. Road transport has major advantages in terms of door-to-door flexibility, and many nodes and major hubs use road transportation. Since the Second World War, the private car has become the dominant transport mode for most types of tourism. The popularity of the car is due to the fact that it can provide comfort and flexibility in timing, routes and destinations. Current trends suggest that there will be 1 billion cars worldwide by 2030, with the largest increase taking place in China and other Third World countries (Boniface and Cooper, 2005).

In addition, the private car has been the world's most important mode for transporting people in the last few decades, contributing to an increase in mobility and flexibility for tourists to visit greater areas (Mieczkowski, 1990). Domestic tourism in most of the developed world is based on the private automobile, which sometimes is referred to as "Rubber-tire tourism". In many destination areas, the automobile provides the greatest flexibility in route choice, tourist attractions, and time use.

However, tourists who are typically unfamiliar with and intimidated by the nuances of public transportation and transit systems in destination areas may decide to use other modes of travel (Lew and Mckercher, 2006).

The second mode is the coach, an essential type of transportation that accounts for a much smaller percentage than scheduled bus services. Coaches are normally used by tour companies for the tourism industry and provide higher standards, comfort and service. Besides, coach travel not only provides a transfer service to and from airports and other terminates, but is also used for excursions from accommodation to destinations and for holiday tours (Boniface and Cooper, 2005).

Even though rail transport is not widely provided like other modes of land transport, it enables large numbers of people to travel long distances relatively cheaply. After the Second World War, the railway came under increasing competition from the airlines for long distance traffic and from the private car for short journeys. Although the decrease of passenger rail transport has been the greatest in the Americas, Western Europe, China and Japan, there has been considerable government investment in applying new technology for the development of high- speed trains. The development of the Channel tunnel between England and France has encouraged the development of rail-based tourism products, for example, the "Eurostar" network between London and Paris, including Brussels (Boniface and Cooper, 2005). What's more, The Deutsche Bundesbahn (DB) or German Federal Railway, Österreichische Bundesbahnen (ÖBB, Austrian Federal Railways) and Switzerland's Schweizerische Bundesbahnen (SBB, Swiss Federal Railways) support travel throughout Europe (Flippo, 1997-2009). However, rail transport in Southeast Asian countries has not been popular like in Europe. The tracks have expanded mostly in main cities, but are rare in remote areas.

Sea transport

Although sea transport for long-haul routes has declined , the short sea route, cruise ships and ferries are used mainly by holiday motorists (Boniface and Cooper, 2005). In particular, ferries and cruise ships are much more interesting for this study area because they are possible ways which tourists can change modes of transportation while crossing national borders among the EWEC member countries. In addition, the ASEAN Cruise Working Group was established by the collaboration between the officials of cruise tourism and maritime transport to improve sea connectivity and support cruise tourism in The Association of Southeast Asian Nations ASEAN. Accordingly, cruise tourism is promoted via the website www.cruiseasean.com (ASEAN-Secretariat, 2010).

Besides the transportation mentioned above, there are other specific modes that are involved in tourism, such as bicycle, tram, sailing and so on. However, the selection of the mode of transport is based on two elements: 1) practicality in terms of the forms of transport available and 2) perception in terms of the perceived costs and benefits of traveling with different forms of transportation (Lew and Mckercher, 2006).

In addition, the most significant function of transport relates to accessibility. Generally, accessibility means the degree of access to a particular place in terms of distance, time and cost. Thus, it is a factor affecting the rise and growth of many tourist places and also accommodation (Robinson, 1976).

In this case, Switzerland is a clear example. It is located in the geographical center of Europe, which is relatively easily accessible from parts of the continent, so we can see a high amount of tourism revenue for many years. Domestic and international tourism are essential factors to generate income in the Swiss economy. With a total revenue of CHF 21.6 billion in 2004, 9.7 billion (44%) was obtained by domestic tourism, and 11.9 billion by the expenditure of foreign tourists in Switzerland (Federal Statistical Office (FSO), 2007).

In Southeast Asian countries, transport infrastructure includes many modes of transport. In particular, the following projects of the Asian Development Bank (ADB) have developed transportation in the Greater Mekong Subregion: 1) the East-West transport corridor or the EWEC; 2) water transport development; 3) railway development; 4) air transport development; 5) cross-border facilitation in the movement of goods and people; and 6) human resource development for the transport sector (Lord, 2009). Therefore, they support an increase in transporting the number of goods, services and tourists across the region. Particularly, the EWEC serves as a central route in the entire region, which supports interchange nodes on other intersect routes for traveling such as the North-South Economic corridor and the Hanoi-Phanom Penh route.

2.4.2 Spatial interaction of tourist movement

Spatial interaction means the movement of people, commodities, things, capital and/or information over geographic space, which results from a decision process. This term therefore refers to tourist traveling patterns and behaviors of individuals and groups over time, including a prediction of spatial alternatives reflected in flows of people between origins and destinations (Hall, 2005). The study explains common models used to explain spatial interaction between locations of geographical tourism elements (i.e. generating area, transit, destination area), including the gravity model, distance decay, and space-time prism.

Gravity model is the most basic type used for examining the spatial interactions between locations that are directly proportional to their masses and inversely proportional to their squared distances (Hall, 2005, Grosche et al., 2007). This model was originally presented by Sir Isaac Newton in the Law of Gravitation and was then applied to many fields of study, including geography and tourism. A simple formula of a gravity model for spatial interaction used for predicting travel demand or passenger flows between two locations *i* and *j* is (Grosche et al., 2007):

$$V_{ij} = \mathrm{k} \times \frac{(A_i A_j)^{\alpha}}{d_{ij}^{y}} ,$$

where V_{ij} is the passenger volume between i and j (V_{ij}= $V_{ij}$and $i \neq j$), A_i and A_j are attraction factors of i and j, $d_{ij} = d_{ji}$ is the distance between the locations, and k is a constant value. y is a parameter that controls the influence of the distance on travel demand and α controls the influence of the attraction factors. Practically, these attraction factors can be combined with multiple variables in the passenger flow model. In addition, this undirected gravity model can be modified to measure a directed way from i to j by separating variables into push factors P_i^{β} (the originating location) and pull factors A_i^{α} (the destination location).

Similarly**, distance decay** is used to display interactions between any two places, which will be directly proportional to the products of two populations and inversely proportional to some power of the distance between them. The principle of the models can explain travel behaviors and patterns in space and time. Generally, tourists prefer to spend minimum time and cost. Travel and location decisions are normally taken in order to minimize the frictional effects of distance.

Space-time prism relates to time and distance from a point of origin to a destination. According to Miller (1991), the space-time prism determines a feasible set of locations for travel and activity participation within spatial and time constraints. This concept can be represented on planar space, with the x- and y-axes defining geographical space and the z-axis representing time (Figure 2.1). The frame of prism delimits people's mobility in all locations in space-time that can be reached by an individual based on the location of the origin of travel and destination and duration of the journey. In addition, this model is used to measure potential path space (PPS), which shows the portions of space to be reached at specified times. Thus, the PPS is determined by an individual's time budget for travel and active participation, potential travel velocities, any stop time (time that must be spent at particular activities) and spatial constraints (origin and destination points). An individual is assumed to be located at time t_1 at the point of origin (X_0, Y_0). If the individual has to be back at the origin at time t_2 , then the available time for all activities is given by $T = t_2 - t_1$ (Hall, 2005, Miller, 1991). However, the time budget affecting travelers depends on modes of transport and speed, which are influenced by traffic and transportation systems in particular urban areas.

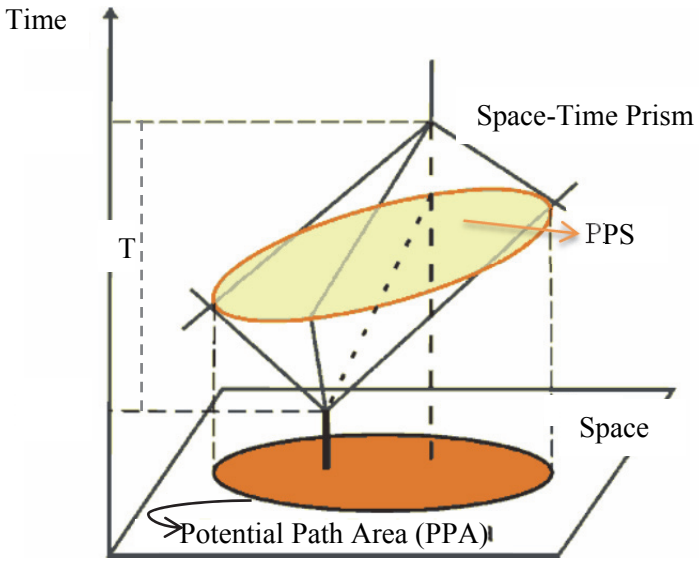


Figure 2.1 The modified graph of the space-time prism model (Shanxin et al., 2010)

Referring to Miller (1991), and Shanxin et al. (2010), the concept of the space-time prism was widely applied for modeling accessibility between locations through GIS, particularly network analysis. To examine accessibility patterns based on the required time and other variables on the transportation network, the Potential Path Area (Figure 2.1) identifies all possible routes contained in this area. Other routes outside of this area are forbidden in reality. The PPA is defined as a collection of arcs (routes) in the network that are feasible for travel and nodes (intersections) which are feasible to reach. To implement the generic PPA procedure with a GIS-based application, the GIS network analyst facilitates operational functions to operate on more complex transportation network systems as reality, which combines attributes of travel times, turn times, one-way streets and turn restrictions. The particular functions integrated for the PPA-based network analysis are a shortest path analysis and service area operation (Kim and Kwan, 2003).

Moreover, the principle of spatial interaction can be extended to solve competitive location problems in location-allocation models in ArcGIS. These models can investigate existing tourism facility structures surrounded by tourist attractions. In addition, they can locate new optimal locations in primary terms of time and distance boundary to serve tourists' demands in the areas, which lack facility services. Location-allocation models will be mentioned in detail in the ArcGIS Network Analyst section.

2.5 Typology of tourism

In terms of typology, there are different types of tourism. The following reviews provide outstanding examples, which cover the wide range of tourism.

Types of tourist attractions

Pearce (1995) has classified the typologies of tourism into five types: tourism in coastal areas, ski-field development, rural tourism and urban tourism in both developed and developing countries. Alternatively, Lew (1987) classified tourist attraction typologies based on an ideographic perspective, which refers to the concrete uniqueness of a site. He arranged them into general attraction categories and divided them into nine categories based on a matrix of Nature, Human and Nature-Human Interface (columns) and General Environments, Specific Features, and Inclusive Environments (rows), as can be seen in Table 2.1.

Table 2.1 The classification of the tourist attraction typologies

Nature	Human	Nature-Human Interface
General Environment:		
1. Panoramas Mountain/Plateau Sea Coast Plain Arid Island	7. *Settlement Infrastructure* Utility types Settlement Morphology Settlement Functions -Commerce (Retail/Finance) -Institutions -Government -Education & Science -Religion People -Way of life -Ethnicity	4. *Observational* Rural/ Agriculture Scientific Gardens -Animals (Zoo) -Plants -Rocks and Archaeology
Specific Features:		
2. Landmarks Geological Biological (Flora and Fauna) Hydrological	8. *Tourist Infrastructure* Forms of Access -To and from a Destination -Destination Tour Routes Information & Receptivity Basic Needs -Accommodation -Restaurants/shops	5. *Leisure Nature* Trails Parks Beaches Urban Resorts Other
Inclusive Environments		
3. Ecological Climate Sanctuaries National Parks Nature Reserves	*9. Leisure Superstructure* Recreation/Entertainment -Performances -Sporting Events -Amusements Culture, History & Art -Museums and Monuments -Performances -Festivals -Cuisine	*6. Participatory* Mountain Activities (Summer/Winter) Water Activities Other Outdoor Activities

Other types of tourist attractions

Besides the groups of tourist attractions above, some alternative tourist attractions can support tourist experiences.

1) Heritage tourism

The National Trust's definition (2011) refers to cultural heritage tourism as "*travelling to experience the places, artefacts and activities that authentically represent the stories and people of the past and present. It includes historic, cultural and natural resources.*" Linking tourism with heritage and culture can do more for local economies than promoting them separately. In addition, the National Trust team developed five principles of sustainable heritage tourism (National Trust, 2011): 1) Collaboration 2) Finding the fit between a community and tourism 3) Bringing the heritage sites and programs to life 4) Focusing on quality and authenticity of the attractions 5) Preservation and Protection of heritage resources.

2) Niche tourism

Niche attractions are commonly defined as types of specially organized tourism programs that cater to particular tourist interests. They are very popular among tour operators. The U.S. Tour Operators Association (online) claimed 50 kinds of special tourism products, such as Alumni, Archaeology, Bicycling, Bird watching, Farm, Fishing, Gardens, Golf, Heritage, Hiking, Honeymoons/weddings, Nature/wildlife/safaris, Spa and Shopping (Biederman, 2008).

3) Ecotourism

Ecotourism could be explained as a form of tourism which focuses on the non-consumptive appreciation of natural attractions, undertaken within the socio-economic carrying capacities of local communities (Fennell and Weaver, 1997). Ecotourism has rapidly grown over the past decade (Boyd and Butler, 2000). It can be applied in many kinds of tourism contexts: urban ecotourism (Wu et al., 2010), farm-based tourism which represents rural diversifications (Fennell and Weaver, 1997) and coastal ecotourism (Zeng et al., 2010). To develop ecotourism destinations, an appropriated management framework is required, which is beneficial and harmless to destination areas. However, the framework can be modified over time depending on agreements between local communities and the public sector (Boyd and Butler, 2000). In addition, the International Ecotourism Society (TIES) (1990) suggested that those who implement or manage ecotourism activities should pay attention to the conservation of local culture and environment so that it is a positive experience for both visitors and hosts, benefiting local communities.

4) Health tourism

Health tourism is a subset of nature-based health tourism which is most closely associated with spas and other facilities that depend upon a supply of purportedly therapeutic water or mud (Faulkner, 2001). Recently, it has been related to spirituality and spiritual vacations, which extend a wide range of offers for spiritual products and services, such as meditation and physical exercise, music therapy, and counseling. This also includes all kinds of massage and spas to fulfil physical, mental and spiritual well-being (Graf, 2011).

In addition, health tourism associated with medical tourism is also connected to medical services, which is defined as "the act of traveling abroad to obtain medical care" (Keckley, 2008). Such medical treatment includes cosmetic enhancements, dental treatments, and cardio, orthopedic and bariatric surgery and tissue transplantation (Lunt and Carrera, 2010, Cormany and Baloglu, 2011). Several ASEAN countries (e.g., India, Thailand and Malaysia) have dominated health tourism markets over the last decade because of new medical technology, reduced transport costs, short waiting time, reduced treatment expense compared to Western countries, and online marketing (Connell, 2006).

5) Agro tourism

Agro tourism is "a direct expansion of ecotourism, which encourages visitors to experience agricultural life at first hand" and it is "gathering strong support from small communities as rural people have realized the benefits of sustainable development brought about by similar forms of green tourism. Visitors have the opportunity to work in the fields alongside real farmers and wade knee-deep in the sea with fishermen hauling in their nets"(ECOTOUR, 2007).

According to the definition, Agro Tourism or Agricultural tourism is when a native person or local of the area offers tours to his/her agricultural farm and allows a person to participate in diversified agriculture activities such as growing, harvesting, and processing locally grown foods, such as coconuts, pineapple, durian, corn, rambutan and so on. Chemnasiri and Kaewoung (2008) found that there were several types of ago-tourism activities based on tourists' requirements in the Saraburi province, Thailand, such as visiting farms, cooking and fruit tasting, demonstrating the processing of agricultural products and the practice of preserving fruit. In addition, farm owners may provide a homestay opportunity for long stays in agricultural areas and teach tourists about their lifestyle. The essential benefit of agro tourism is for local people to earn, not tour operators or hotels.

Besides, there has also recently been a growth in wineries as tourist attractions. Activities related to wine tourism include wine-tasting and cellar door sales, the proliferation of wine festivals and events, the synergy between food and wine, wine touring (traveling around a region of wine

trails) and recognizing the need for the formalized planning of wine regions or precincts (Faulkner, 2001).

6) Religious tourism

Although religious attractions were more well-known from the advent of Christianity until the eighteenth century than today, they have still been important. For example, the monuments of the Greek Orthodox religion, as well as Byzantine and Post-Byzantine churches, are an integral part of the national heritage and attract a considerable number of visitors with their important iconography, mosaics, murals and rare icons, and the imposing cathedrals, chapels and shrines in the countryside. Raj (2007) claimed that the significance between religion and tourism should intersect, with tourism being the central articulation of religious tourism and pilgrimage.

Furthermore, religious healing attractions located at mineral or hot springs have received interest. They are usually associated with a religious miracle of healing (Rafferty, 1993).

7) Tourism shopping villages

Many places around the world have been developed into well-known tourist shopping destinations, including small tourist villages that base their appeal on retail. It can be an essential tool for regional development and much research on shopping villages has tried to analyze and evaluate this type of tourism. Accessibility and seasonality appear to have a minor influence on the success of shopping villages (Murphy et al., 2008). Therefore, the shopping sites are normally visited year-round. In some areas, local communities produce goods or products made from available local resources. This is sometimes called *One Village One Product,* and was originally started in Oita Prefecture in Japan for improving and promoting local products internationally. In Thailand, the government has supported the local industry of each village through the manufacturing of attractive specialty products based on the abundant native culture, tradition and natural material (Thai-OTOP City, 2003). This campaign is called *One Tambon One Product (OTOP).* Some local products of high quality and unique local materials have been exported and accepted internationally, mainly Thai silk weaving and skillfully crafted products. These serve as potential attractions to bring in large income and a high number of tourists to local regions. Not only are tourists able to go shopping, they also have the chance to engage with local people and reflect on the ancient heritage, local inspiration and unique lifestyles.

According to the above-mentioned divisions, types of tourism can be classified into various groups depending upon the geographic and cultural characteristics of each specific type of tourism, including individual perceptions. In this study, the classification of tourist attractions was a useful tool for researching the assessment of potential levels of tourist attractions along the EWEC. The

types of attractions were influenced by generating a set of criteria for considering the value/uniqueness or importance of attractions, which have different standard assessments in each class. Regarding the 30-kilometer strip along the EWEC, the area is covered by a spectacular range of tourism as listed below.

1) Natural tourist attractions (natural places with and without management)
2) Cultural tourist attractions (historical sites/ heritage and religious places)
3) Viewpoints/Landmarks (monuments/bombing areas)
4) Tourism Shopping sites (urban shopping centers, shopping village centers, casinos, and local markets)
5) Relaxation / Entertainment tourist attractions (dams, man-made beaches)
6) Arts and Sciences tourist attractions (city hall towers, science museums)
7) Agro tourism (wineries) and Eco-tourism

2.6 Influential factors for tourism development

To develop the tourism sector, basic influential factors to consider are the physical and socio-economic environment. These include the physical constraints (accessibility, topography, and availability of land), characteristics of tourism resources and attractions, planning, marketing, and spatial integration of all key elements (Williams, 1998). In addition, availability of public utilities, development purposes, government policies, and financial support also affect patterns of tourism development elsewhere. This study reviews some factors that influence tourist places in terms of their potential evaluation and improvement.

2.6.1 General influential factors

In geography, there are many aspects affecting tourism development, such as physical factors (the nature of tourist resources and attractions), planning and investment conditions, tourism market, promotion, infrastructure and so on. Similarly, the Encyclopedia of Tourism by Jafari (2003) identifies the major determinants of, and influences on, international tourism activity for 1995 - 2020 as:

1) Economic: includes the view of the spread of harmonization of currencies and global economic growth.
2) Technology: both information technology development and transport technology advances.
3) Political: the removal of barriers to international travel for transportation and other forms of deregulation.

4) Demographic: the increase of an aging population and contraction of workforces in industrialized countries.
5) Globalization: growing power of international economic and market forces and consequent reduced control of individual states and non-global corporations.
6) Localization: the demand from groups to create the social structures recognized in their own rights.
7) Living and Working Environments: the growth of urban congestion, particularly in the developing world, motivates people to take a rest and travel to other places.
8) Social-Environment Awareness: boosts public awareness of socio-cultural and environmental issues.
9) Change from "Service" to "Experience" Economy: focuses on switching to delivering unique experience that personally engages the consumer.
10) Marketing: the use of electronic technology to identify and communicate with market segments and niches.

Furthermore, Mieczkowski (1990) described other influential market factors on tourism planning and development:

1) Demographic
   a. Age/stage in life cycle
   b. Sex
   c. Household size
   d. Marital status
2) Socio-economic
3) Geographical section (location, regional sub-market)
4) Lifestyle/behavioral variables

The age segmentation research indicated that 18-45 year-olds is the dominant range in tourism markets. Particularly, young people (15 to 29 year-olds) show a higher degree and mobility, especially for adventure tourist activities. Young people are mostly single and relatively free of professional and family obligations, and want to see the world and gain exciting experiences in their life. However, this group usually looks for the cheaper form of recreation and tourism, including transport and accommodation. The middle age market (about 40-46 years of age) is the most important demand volume in spite of the lower participation rates compared to the younger group. The middle-aged group has the highest earning power and tends to spend more than the younger group. These people are more interested in cultural and educational tourism. Another essential group in recent trends is the elderly, which includes retired people (60-65 years) and self-compensators (65-70 years). They are full-time in leisure and have more financial support from pension and insurance.

Therefore, this group tends to travel farther and stay longer than the younger group Mieczkowski (1990). Moreover, Hyde's research revealed that age is related to the type of travel style. The older tourists search for information, plan and pre-book their touring itinerary, and usually rent a coach or car for short duration vacations. Likewise, the younger tourists use campers or go backpacking on extended vacations (Hyde, 2008).

Sex and marital status influence the tourist market. The large number of unmarried and married women with no children also means more customers for tourism. By analyzing specific tourism and recreational activities, some different results can be seen. Men overwhelmingly prevail in traditional masculine recreational activities like hunting, fishing, hockey and other high-risk activities. Women seem to be more interested in educational and cultural tourism. However, sex is probably the least important than other demographic variables for determining participation rates. Both men and women are able to join in some sports or activities even though if they require more physical strength. In particular, the gender-equalizing trends characteristic for modern times helps decrease this division.

Moreover, the household size may also play a role. Small families in metropolitan areas tend to be outside and more mobile. Large families with many children, especially in rural areas, may prove to have additional constraints. Socioeconomic variables used for market planning include income, education and occupation. Some of them overlap with one another and with demographic factors. The different social status of families affects tourism decisions in different ways. In addition, the choice of recreational activities may be influenced by education.

Furthermore, geographical section considers different characteristics of earth surface, location, seasonality, and local and regional sub-market. These affect the appearance of the tourism market on both demand and supply sides. Varieties of geographic characteristics offer many options in destinations for groups of interests in both natural and cultural (man-made) phenomena. In addition to the size of community, the bigger the urban community is, the greater the participation in recreation in tourism. Urban people who work in congested and unhealthy natural environments are eager to escape from dull depersonalized daily routines during the weekend and holidays.

Many factors above provided guidelines for identifying tourism markets. They assist in making general participation rates in leisure activities and variable factors more understandable. However, they are not enough for predicting leisure time behavior. Therefore, Mieczkowski (1990) presented a final sector, lifestyle or psychographic research. Psychographic research combines measurable interaction and integrates multi-variables. The lifestyle variables are better predictions of tourist demands, preferences and behavior because they explain the frequently different leisure time patterns of individuals from various demographics such as age, sex, profession, education etc.

2.6.2. Place competition

Tourism does not occur in every place. Although tourism elements mentioned in previous subjects have supported existing tourism, place competition area is also importanct for the destinations' success. The comprehensive overview of basic spatial interactions of tourist movement mentioned above provides substantial insights into how destinations become powerful (Hall, 2005). Many tourism destinations encourage tourists to spend time and money in their areas. There are many offers, which attract tourists to stay longer and visit multiple tourist sites within destination regions.

To consider what factors influence place competition, it is explained not only by spatial interaction, but also by other contemporary ideas such as decisions on overnight stays, the time to undertake leisure-oriented activities and amenity values.

Pearce and Elliot 1983 presented a further statistical technique of the Trip Index to examine which tourist attractions visited by tourists were major destinations or just a stopover. The Trip Index was calculated as a formula below (Hall, 2005):

$$\text{Trip Index} = \frac{Nights\ spent\ to\ the\ destination}{Total\ \ of\ nights\ spent\ on\ the\ trip} \times 100$$

According to the formula, a Trip Index means the percentage of the entire trip, which was spent at one destination, and a value of zero would mean that no overnight stay was made on the entire journey.

The zone of overnight stay refers to an area where the travelers stop overnight. This zone tends to increase and the likelihood of same day return trips decreases as a result of the following (Hall, 2005):

- Availability of time to travel (time budget) and involvement with tourist-related activities
- Limitations related to the need for rest during travel
- Time/distance trade-offs between returning home to sleep and travel time involved versus stopping overnight.

In addition, the cluster of overnight stay density can be displayed by using a simplified model of the isolated central tourism generating location surrounded by a uniform plane (Figure 2.2).

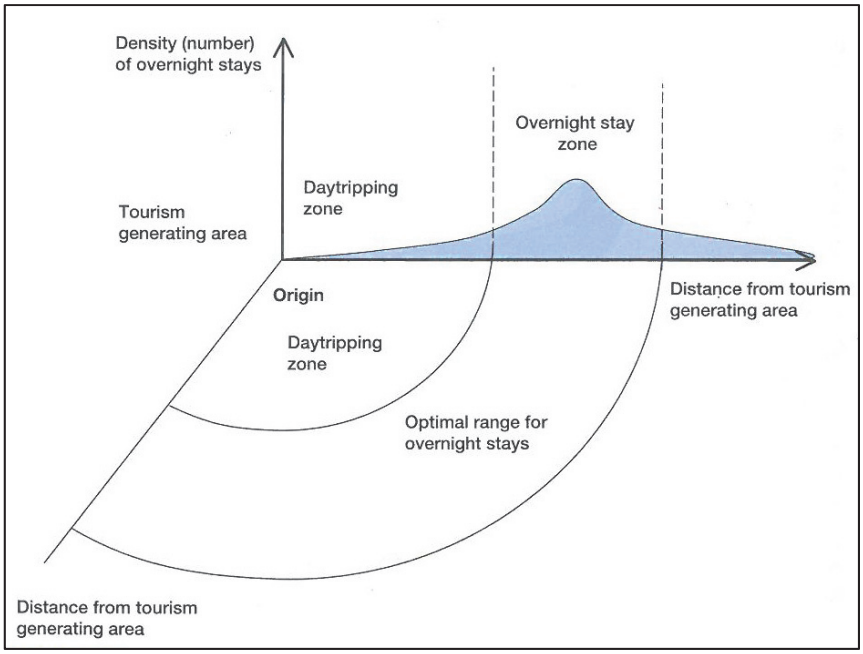


Figure 2.2 Location of overnight stays in relation to the point of origin (Hall, 2005)

Furthermore, a set of leisure-oriented activities can be designed through a series of peaks and troughs as a route/trip behavior model (Figure 2.3) (Hall, 2005). The leisure trip model starts from the city center and is related to car-based mobility. The model indicates both the nature of the distance decay effects of leisure travel and a zone of overnight stay within the hinterland of the urban center.

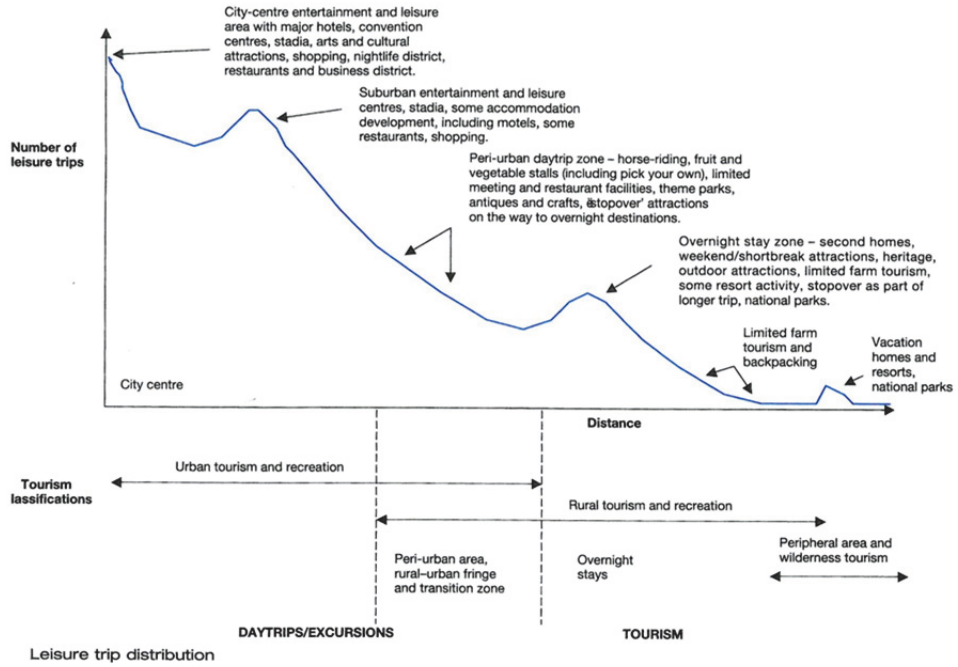


Figure 2.3 The route behavior model (Hall, 2005)

Basically, a tourism generating area will be a large city, but a gateway may also act as a point of origin. Tourists may use the gateway for overnight stays and they start the journey again. However, competitive factors mentioned above could be extended by other external factors, such as seasonal activity, political situations and holiday periods.

2.7 Basic criteria for evaluating the tourist resources

Tourists usually travel to visit attractions because of their motivations and their physiological needs, e.g. fresh air, food, rest, comfort and service. The physiological needs of human beings motivate people to maintain general bodily well-being. People prefer a particular place simply because of the guarantee of good attractions, food, people and comfortable infrastructure and environment (Robinson, 1976). It therefore is important to design measurements to investigate how tourist places are going to meet their needs by exploration of tourists' expectations. Rowe and others (2002) presented a model of travel and tourism components comprising: 1) Attraction, 2) Tourism facilities which include transport, accommodation, tourist information, and 3) Marketing and tourism business.

Evaluating tourism products which have potential for tourist destinations should be composed of five elements, according to the reviews by Boniface and Cooper (2005):

1) There is at least one attraction that can be promoted as a unique selling proposition (USP).
2) Support of tourism-related facilities and activities
3) Accessibility to major tour-generating countries
4) Favorable pre-conditions for tourism development such as basic infrastructure and political stability (external factor supports).
5) Support of destination products by other tourism stakeholders.

Beyond the above-mentioned components, the tourism staff and local residents are also primary keys for successful tourism management (Teye et al., 2002). Tourism staff and authorities are a part of tourism providers who are responsible for tourists' needs and satisfaction. Simultaneously, they have to maintain and conserve attractions under the local resident collaboration. However, to understand how to manage and develop tourism resources in a compatible way, tourism resources should be evaluated based on the existing situation and attraction appearance to support tourism.

Ferrario (1978) conducted a set of six qualifying criteria in a case study on South Africa, indicating some of the most essential aspects and requirements necessary for any tourist resources. These were *seasonality, accessibility, admission, importance, conservation and popularity*. These criteria were not directly measurable. The degree of accessibility or importance of each feature could

not be stated in measureable units, but could be adequately assessed based on experience, observation and common sense by using a rating scale of nominal values. His task utilized the semantic differential scale. These values expressed a comparative evaluation based on reasonable and commonly accepted judgments. It did not provide an exact measurement or indicate a specific quantity. One decade later, Ferrario's study was found to be more comprehensive in its use of different types of organizational categories and also incorporated numerous cross perspective valuation measures which caused him to emphasize existing attractions (Lew, 1987).

Tourism's uniqueness is that the final product is not shipped to its markets, but it attracts customers to come and consume it in its place. Without the existing attractions, other facilities, tourism services and marketing strategies to follow them are not very necessary. There are only a few tourist areas or nations that have organized a complete and systematic inventory of their resource base. Besides, information may be limited to tourism pamphlets or other advertising materials and are rare for assessing the existing value of their tourist resources to market preferences (Ferrario, 1979a) and promotions.

Most researchers agree that attraction is the basic element of tourism development (Gunn, 1979). The attraction phenomenon has three main components:1) a tourist; 2) a site to be viewed and 3) a marker or image which makes the site significant. Basically, tourist attractions comprise all elements of a non-home place, landscapes to observe, activities to participate in, and experiences to remember (MacCannell, 1976). Dang et al. (2002) introduced a model of tourist attraction evaluation studied in national parks. They suggested five major parameters, consisting of tourism resources, tourist facilities, accessibility, local communities, and peripheral attractions.

Recently, the ASEAN Tourism Investment Forum has discussed the development of ASEAN tourism as both an investment and marketing campaign. The forum supported promoting tourism investment opportunities for spreading tourism benefits across the region through the establishment of the ASEAN Tourism Investment Corridor Development in 2010. It focused on improving logistics and connectivity within the corridors of many ASEAN transport links, as well as developing infrastructure and facilities such as hotels, home stays, food and restrooms, which are necessary requirements for tourism promotion (ASEAN-Secretariat, 2010). According to this forum, the present research also responds to the policies of tourism development by finding potential ways to develop and invest in tourism facilities covering the corridor area.

By including the set of criteria adopted for finding the potential levels of tourist attractions, this study explored the current appearances of attractions, infrastructure and tourism facilities of each tour site along the corridor. The criteria used for evaluating potential tourism resources consisted of eight

factors; Seasonality, Accessibility, Admission, Importance (Value/Uniqueness), Popularity, Facilities, Activity and Endemic disease.

2.7.1 Seasonality

Seasonality refers to the length of the tourism season when it is proper to visit each tourist attraction. A long tourist season usually has considerable value (Ferrario, 1979b). Tourism related to industry or economic activity could be more afflicted by seasonal changes. The traditional seasonal patterns of demand indicate spatial tours, festivals, lower rates, more year-round activities and the growing number of travelers in the market of tourist places (Robinson, 1976). Due to seasonality, there is a limited part of the year, which is uneconomical, when some remote areas cannot be accessed by local desirable transport.

2.7.2 Accessibility

Accessibility refers to how tourists are able to reach the tour sites. In this study, it involved physical accessibility by private automobiles and public transportation (e.g. bus, ferry, and train), as well as by walking from the public transport stations or other facilities (e.g. accommodation, petrol stations) to the main tourist attractions. Wang, Zhang and Ran (2007b) measured the accessibility of the eminent tourism resources by using the accessibility index. It is used to weigh the degree of movement among the nodes in a network. The nodes refer to the site of the cities where the eminent tourism resources belong to without direction and the relative data of the traffic routes. The calculating formula is as follows:

$$A_{ij} = \frac{\sum W_{ij}}{n-1}$$

In the formula, A_{ij} means the accessibility of node i, W_{ij} is the weighted shortest distance between node i and node j, and n is the total amount of the nodes in the network. According to the weighted distance, it is calculated by

$$W_{ij} = \frac{\sum D_{ij}}{v},$$

where D_{ij} means the real shortest distance while, v is the velocity of flow of certain traffic.

2.7.3 Admission

Admission is the permission to access the attraction, including the entrance fee. Visitors have to obtain prior permission to visit and partake in activities (Ferrario, 1979b). The permission to enter the destination area could be afflicted by the political situation in the country.

The political, economic and social system in particular countries will have an important bearing upon their tourism organizations. Some areas are under direct government control and well developed. However, some places with direct government intervention seem to be not only desirable, but also indispensable (Robinson, 1976).

2.7.4 Uniqueness/Importance

This refers to the intrinsic importance of the attraction and how it ranks among other features in the same category (Ferrario, 1981). In the study, the importance parameter considers the value and uniqueness of each tour site compared within the same class of attractions, such as national tourist attractions, relaxation and entertainment, and cultural tourist attractions. Comparatively, a high rank is for the most outstanding tourist attraction that tourists should not miss. They are found in only one place in the region, country or even in the world. On the other hand, a lower rank is more normal. They look the same as other places in similar environments, meaning that tourists are able to find them in other places with similar appearances or characteristics. Wang and others (2007a) used the Delphi method to evaluate each tourism resource in South Jiangsu, China. The assessment of potential tourism resources was classified into five grades. Grades 1 and 2 indicate ordinary tourism resources. Grades 3 and 4 refer to the eminent tourism resources, whereas grade 5 stands for a special eminent tourism resource. Moreover, the lowest grade of 0 represents ungraded tourism resources. According to Wang's study, the grade assessment of potential tourist resources was applied to evaluate the value or uniqueness of tourist attractions in the present study.

2.7.5 Popularity

The degree of acceptance by the frequent visits of domestic and foreign tourists to tourist attractions has already been considered (Ferrario, 1981). Popularity was applied to measure the number of domestic and international tourists visiting attractions per day, month or year.

2.7.6 Facilities

The degree of completeness of tourism facilities and infrastructure supports the attraction places and tourists within destinations. However, basic infrastructure (e.g. electricity and water supply and telecommunications) is already covered by the study area. In this study, tourism facilities were thus categorized into four types: public transport stations, accommodation, petrol stations and hospitals or healthcare centers. According to the Yuksel and Yuksel study (2001), accommodation proved to be highly significant for tourist satisfaction, aside from hospitality and service quality obtained by the tourist staff and local residents in the destination area. In the study, the facility factor was measured by the service area analysis function calculated in the Network Analyst Extension of the ArcGIS package. The outcome displays the service networks of accessibility from facilities to the

tour places. The tour sites in the service areas tended to have high potential levels, while others outside were likely to have lower levels of potential.

2.7.7 Activities

This factor refers to tourism-related activities that are available within the tour sites. Mieczkowski (1990) suggested that activity is an outstanding factor for space requirements of recreation and tourism. This activity is one of the attractive ways to invite a number of tourists to visit and be entertained. Some places provide multi-activities, such as bird watching, swimming and camping, whereas other sites offer only one activity.

2.7.8 Endemic disease

Currently, the concern about epidemiological data associated with travelers' health has been widely discussed in numerous studies. Steffen and DuPont (1994) showed the incident rate per month of health problems during stays in developing countries. Out of 100,000 travelers, 50,000 became ill and 400 hospitalized abroad, whereas one traveler died abroad. Many lines of evidences showed that diarrhea is the most common illness, while other infectious diseases such as Malaria, Influenza as well as Hepatitis A and B have been found in particular tropical regions and developing countries (Pai and Lai, 2008, Steffen et al., 2008, World Health Organization (WHO), 2011). One of the precaution strategies to protect travelers from travel-associated infections is to give pre-travel consultation to determine specific risks of endemic diseases, including immunization regulations (Shandera, 1993). The World Health Organization (WHO) and Centers for Disease Control and Prevention (CDC) have been involved in supporting up-to-date information about travelers' health risk in endemic areas and counseling about vaccinations and prophylaxis. Therefore, the geographical distribution of endemic diseases have been considered to evaluate potential levels of tourist attractions in the present study because this factor directly influences people's health and travel decisions on their destination, length of stay and activities.

2.8 Technical methods for the research analysis

In this thesis, many spatial analysis functions of GIS and Analytic Hierarchy Process (AHP) were integrated for designing and analyzing tourism databases and facilities covering the study area. Under the GIS environment, much digital information, either spatial or attribute resources, were created into this system. The relevant spatial analysis techniques, Network Analysis as well as AHP, were melted into GIS to obtain the optimal output for tourism development.

2.8.1 Geographic Information Systems (GIS)

GIS were developed in the 1960s as a computer application for organizing, storing and analyzing large amounts of digital resources (Goodchild, 2004). It is therefore highly flexible and serves as a powerful tool with multiple purposes.

Since the late 20th century, GIScience (Geographic Information Science) has been widely mentioned and defined by many geographers, academic institutes and relevant organizations. One definition was given by Goodchild (1992) as the science behind the system. GIScience is a science to describe measure, analyze and represent the phenomena on the earth by activating GIS for implementation of human needs. Miller and Wentz (2003) presented GIScience as contributing to computational methods that have the capability to store and digitally represent geographic features, as well as spatial analysis processes.

Currently, GIS is used as an enormous potential tool for monitoring the carrying capacity and evaluating locations for tourism and recreation. It allows greater quality of configuration, analysis and answers hypothetical questions in a few minutes (Reid, 2003). GIS is a response to human needs for information management and analysis. It has been expected to create more applied GIS research than pure science. GIS is a tool for supporting a wide range of techniques of spatial analysis. It has the capacity to analyze the locations and attributes of features and to model them using multiple features and classes of objects and the relationship between them. Besides, it also includes primitive geometric operations such as calculating the centroids of polygons, creating buffer zones (Goodchild, 1992), as well as more complex operations of model building and network analysis to determine the shortest path and service area through a network model.

The functionality of GIS continues to grow in widespread use. Research involved in GIS is like geographical data, and the more closely one looks, the more interesting issues appear (Goodchild, 1992). GIS and spatial analysis techniques were developed originally by quantitative based knowledge which was integrated between geography and computer-assisted cartography. Many spatial functions are complex computations and more powerful than ever to apply in interdisciplinary settings (Miller and Wentz, 2003).

However, in tourism there have been many attempts to use GIS to visualize trip patterns that display stopover location, but not travel routes. The places where travel routes were mapped have been described by fixed air, rail, cruise and other routes. Therefore, multiple destination self-drive travelers may find an alternative option of routes by using GIS (Holyoak et al., 2009). On the other hand, many tourists cannot drive by themselves and need multiple route patterns for their itineraries. The application of the ArcGIS Network Analyst extension for tourist itineraries can produce various

tourist travel scenarios with multiple stops and directions for tourists' itinerary guides before starting their journeys.

2.8.2 Network analysis

A network is made up of a series of links (the flows of lines) which sometimes are called edges, vertices or arcs. The network is structured by connections between arcs and nodes. There are various means of networks depending on the discipline that network is applied in. In terms of mathematic and GIS-based network analysis, network analysis was described on graph theory and topology. Graph theory is able to explain a network in both simple characteristics as numbers of arcs in the network, a degree of arcs on a graph and as complex structural characteristics (Curtin, 2007). In addition, the transportation network is referred to as a system of arcs topologically structured by a number of geographic routes (arcs) and nodes (terminates and interchanges). However, these networks are also displayed as the movement of people and goods, service delivery, tourism activities and flow of resources, information and energy. A typology of networks can be used to describe the physical manifestation and spatial interactions surrounding tourism and transport.(Duval, 2007). The typology of a network has been divided into 5 patterns:

1) Branching network
2) Circuit network
3) Center-oriented/ hierarchy network
4) Paul Revere's Ride
5) Traveling salesman network

Yuan (2008) claimed that social networks associating people can be explained by three basic network topologies to show the connection between individuals and organizations. First, the chain network connects people in a sequence by an arc, and end-to-end communication has to depend on intermediate connections. Second, the star, hub or wheel network requires connections through the center. Finally, the all-channel network connects everyone to everyone else and promotes collaboration. Furthermore, he also claimed that hybrid networks include two or all three topological networks (Figure 2.4). Many networks are dynamically reconfigured to perform different functions in the development of the network and the process to complete a mission.

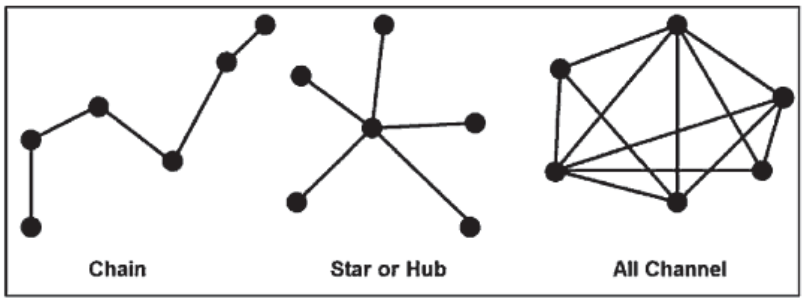


Figure 2.4 Three basic network topologies (Yuan and Hornsby, 2008)

Moreover, geographers analyze networks in a variety of ways. In this study, network analysis was used to visualize the tourist itinerary routes and accessibility, as well as to analyze service areas of facilities and location-allocation of new alternative tourism facility sites on the road network of the study area. To do these analysis processes, all digital road networks need to be generated topology which connects every arc and nodes smoothly and do not overlap among each element.

2.8.3 ArcGIS Network Analyst

ArcGIS provides an extension for network-based spatial analysis used in the study. It was built to perform an analysis on a network dataset which is created from feature sources or sources that participated in the network, and incorporates an advanced connectivity model (ESRI, 2006). It is used to find the least-cost path through geographic space. In addition, it also shows travel direction, closest facilities, service areas of tourism resources and activities, such as tourism information centers, public transportation stations, hospitals, hotels etc.

The service area function was implemented as a significant tool for defining a set of criteria for the facility factor in the present study. It demonstrates that all accessible streets can be reached within the defined time or distance. In addition, service areas of accommodation, public transportation centers and other related facilities will be examined for analyzing the potential of tourist sites in this study.

Moreover, the Network Analyst extends its capacities to analyze the location-allocation problem. The location-allocation model is an essential tool for finding optimal sites of facility locations and evaluating the efficiency distribution of facilities of past locations for decision-making and improving existing locations (Rahman and Smith, 2000). The location-allocation model is divided into 2 types: *p*-median problem and covering problem. The most popular and widely studied for public facility location method is the *p*-median problem (Murray 1997 sheet3). This method aims to find the optimal sites of *p*-service facilities on networks for a set of facilities that can minimize the

total weighted travel distance (time) for all demands to reach their closest facility. It is assumed that all costumers of the facility prefer choosing the nearest facility and they benefit from having a closer facility.

There are two major approaches to solving methods for the p-median problem: 1) optimization, and 2) heuristic. The heuristic method is a basic, quick and good solution that is easy to explain and to apply in programming. It was first developed by Teitz and Bart (1968). With its capacities, it has been widely used for getting optimal solutions for many purposes. However, heuristic is limited in its potential when the solution is applied for local optima. Later, the meta-heuristic was developed to escape local optima. It supports the global optimization problem with a high quality of location solution. In addition, the meta-heuristic technique is an efficient search approach for larger and more complicated problems, particularly for the solution of multi-criteria location problems (Zanjirani Farahani et al., 2010). The ArcGIS 10 software package uses location-allocation in network analysis based on meta-heuristic approach.

However, the optimal solution, which minimizes the weighted travel distance of the *p*-median problem, may be unreasonable in cases where there are few facilities and where customers are forced to travel far, mainly in remote areas. This is because the use of service facilities decreases rapidly when the travel time or distance exceeds a critical value (Rahman and Smith, 2000).

On the other hand, the covering problem was introduced to solve some limitations of the *p*-median problem. It aims to find the facilities for customer/demand within a specific distance/time travel. So, the customers or demand points can receive services by each facility if the distance between the customer and facility is equal or less than a predefined distance or time value, called coverage distance or coverage radius (Fallah et al., 2009)**.** This coverage distance is sometimes called impedance cutoff, particularly in the ArcGIS software package.

According to Rahman and Smith's reviews, the covering problem developed into two major forms. First, the Location Set Covering Problem (LSCP) can be defined as the solution to finding the minimum number of facilities that can service every demand, at least a facility within the given time or distance. Second, the Maximal Covering Location Problem (MCLP) maximizes coverage or total covered demands within a maximum threshold of service distances or times by locating a fixed number of facilities near locations with a high density of demands.

The location-allocation performed in ArcGIS 10 package has the capacity to solve six different objectives or problems as follows:

1) *Minimize Impedance*: This aims to find the set of locations of facilities that can minimize the sum of distances or weighted costs from all demand points to the nearest facility

locations. This model was formed similarly to the p-median problem, which optimizes the location that has a minimal total sum of weight distance from demands to the closest facility in a fixed number of facilities.

2) *Maximize Coverage model*: This model intends to find the optimal locations for a fixed number of facilities that covers demand points within the impedance cutoff or the threshold of service distance or time as much as possible. This method is similar to the MCLP which was modified by Church and ReVelle (1974). It is a potential tool to locate facilities in the public sector and emergency response organizations, such as fire stations and health centers.

3) *Minimize Facilities model*: This aims to minimize the number of facilities that are required to cover all demands possible within a specific cutoff distance or time.

4) *Maximize Attendance*: This solution provides the optimal location for facilities with a close proximity to the greatest numbers of demand points. This model acts as the Maximize Coverage; however, the optimal location is influenced by demand weights, which are the distance between demand points and facility. Maximize Attendance is based on the assumption that the demand weights diminish in relation to the increased distance between facility and demand location, whereas Maximize Coverage gives all demands the same weight, whether it covers or does not cover the service areas of facilities.

5) *Maximize Market Share*: This model aims to find the location, which will maximize the market share in the specific number of facilities. The model is based on a Huff model developed from a gravity model, which is used for solving the competitive location problem on networks to establish new potential stores or facilities.

6) *Target Market Share*: This solver chooses the minimum number of facilities necessary to capture a specific or threshold percentage of the total market share that meets users' requirements in the presence of competitors. The total market share is calculated by the sum of all demand weight for valid demand points.

Algharib (2011) did his PhD dissertation to assess and investigate the fire stations and their service coverage within a 4-minute response time in Kuwait City by using 4 types of model solvers (i.e. Maximize Coverage, Minimize Facilities, Maximize Attendance, and Minimize Impedance) running on location-allocation analysis in ArcGIS 10. According to his results, he claimed that Maximize Coverage, Minimize Facilities and Minimize Impedance were better solutions than the Maximize Attendance model within the same conditions and impedance cutoff. This systematic comparison of these four models provided the potential guideline for choosing the proper models for specific conditions of location problems and purposes.

2.8.4 Analytic Hierarchy Process (AHP)

Analytic Hierarchy Process (AHP) developed by Saaty in 1977 is a well-known method to calculate prioritizing alternatives when there are various criteria that must be considered. The AHP approach starts with an arrangement of objectives used for a decision in the form of a hierarchy. All criteria/factors which are considered relevant for decision-making are compared against each other in a pair-wise comparison matrix, which is used to determine relative weights of individual factors or alternatives. Accordingly, numerical values of comparisons are assigned according to a judgement scale of the relative importance or preference. The judgment scale of preference is normally quantified by a linear scale or a nine-point intensity scale (Saaty, 1990, Hu and Tsai, 2006).

This pair-wise comparison matrix is the primary advantage of AHP to provide the measurement scale of weights among criteria. The technique is able to apply both tangible and intangible factors. In addition, AHP offers an estimation of consistency ratios to determine the degree of consistency in the pairwise comparisons (Nydick and Liberatore, 2008). If the estimated ratio is less than 0.10, it indicates that this comparison matrix is at a reasonable level of consistency. On the other hand, if the consistency ratio is more than or equal to 0.10, it means that the value of the comparison is indicative of an inconsistent judgment (Malczewski, 1999a).

The final AHP approach is the combination of rating and weighting every criteria of each alternative. The rating of each alternative has to be multiplied by the weights of the sub-criteria in its level of hierarchy. The outcome of the operation displays the total score of each alternative, with the higher scores indicating alternative more potential or suitability than lower ones. In this step, users can classify groups of alternatives into clusters of potential levels, such as best, medium and lowest groups, depending on their output scores.

Much research has applied AHP to make a complex decision, which combines multiple criteria and is difficult to quantify. In addition, the AHP technique is a practical tool to operate in GIS. The GIS software supports the AHP process, including efficient output visualization. The present study implemented the AHP technique in the GIS framework to find the potential levels of tourist attractions within the study area.

2.9 Model of travel itineraries

The vacation plans of tourists vary according to the characteristics of both vacation and vacationer. Somehow, the specific characteristic refers to the duration and travel style. Likewise, specific characteristics of a vacationer include age and novelty-seeking motivations. Lew and Mckercher (2006) claimed that urban transportation modeling provides the geographic foundation for

understanding the movement of people for trip-generating places to destination places over a transportation network. However, there is no model responding to the actual path of every person. Nevertheless, researchers may select some models and apply them as sufficient planning tools if all tourists share the same interests and seek to optimize their visits in the same way.

Lue et al. (1993) presented the model of alternative spatial patterns of pleasure trips. This model was derived from the concept of four typologies of pleasure trips that considered the destination and benefits sought or purpose: 1) a single benefit from single destination; 2) multiple benefits from a single destination; 3) a single benefit from multiple destinations and 4) multiple benefits from multiple destinations. Patterns 3 and 4 enable pleasure trips to be classified in deeper detail of multi-destination patterns. Lue et al. extended the model of alternative spatial patterns of vacation trips as follows (Figure 2.5):

1) Single destination pattern
2) En-route pattern
3) Base camp pattern
4) Regional tours pattern
5) Trip chaining pattern

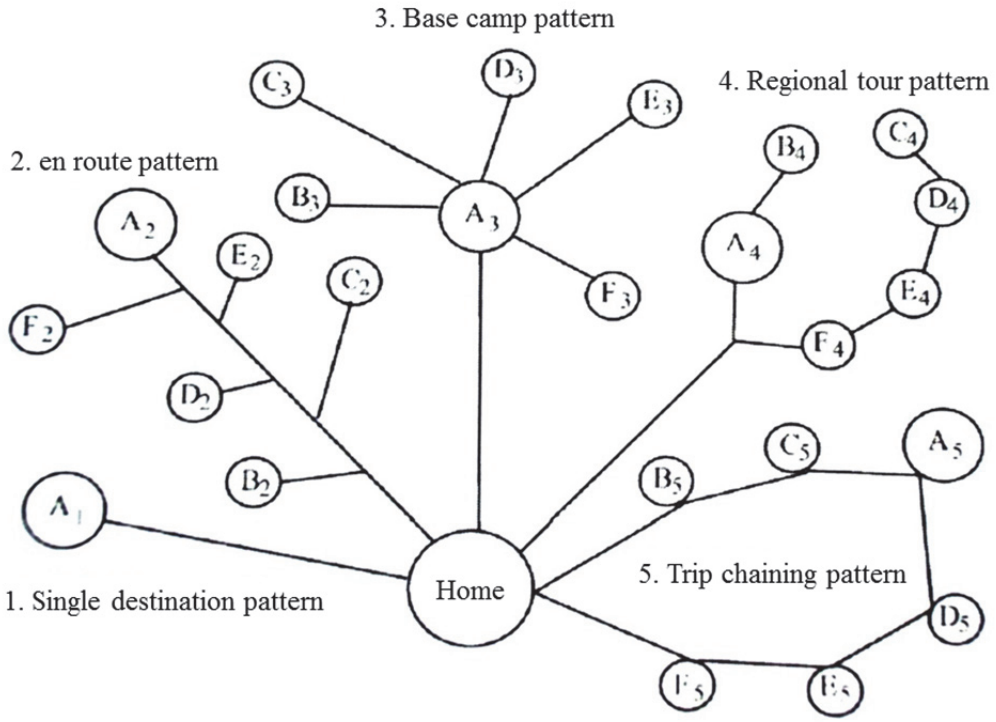


Figure 2.5 The model of alternative spatial patterns of pleasure vacation trips (Lue et al., 1993)

According to Figure 2.6, the symbols A1-A5 show five destinations for a trip from home. Symbols B, C, D, E and F define the extra opportunities of destinations in that area. The single destination pattern is a basic pattern and usually stands alone without relating to other attractions. The en-route pattern is also a single primary destination. However, tourists may stop and spend time along the way to and from the destination. Alternatively, the third option is the base camp pattern in which tourists stay throughout the vacation in a spot that acts as a main destination of that area. Next, the regional tour pattern is likely a loop. Tourists travel to a region and sequentially visit a series of destinations in the area before returning to their origin. The final route is the trip-chaining pattern, which is selected for the traveler who has many focal destinations and areas. However, most of the patterns support the attraction of places within a nation and region.

A few years later, Oppermann (1995) presented a set of travel itineraries for destinations which can serve as both single and multi-destinations. This set of itineraries was tested on primary data of tourists with either intranational or international travel patterns in Malaysia.

Oppermann's tourist traveling pattern divided destination patterns into two majors groups (Figure 2.7). First, the single destination pattern refers to two separate single destinations represented as S1, and a base camp represented as S2, that have an overnight stop and start day trip destination around it. The other pattern is a multiple destination pattern, which consists of five different types:

1) Stopover pattern (M1)
2) Full loop (M2)
3) Destination area loop (M3)
4) Open jaw loop (M4)
5) Multiple destination areas loop (M5)

Both the stopover pattern (M1) and full loop (M2) excluded in Oppermann's study are based on overland travel from home. Although S1, S2, M1, M2, and M3 patterns correspond to spatial patterns identified by Mings and McHugh (1992) and by Lue et al. (1993), two multi-destination patterns were added. First, the open jaw loop (M4) indicates a type of long-haul travel and is becoming much more popular. This group of tourists spends time in many destinations, which are too far away to return to the arrival point, so they use different gateways to arrive and depart. Another pattern is the multiple destination area loop (M5) which combines M3 and M4 patterns. The tourists visit completely different regions and travel to a number of places within each region. This special pattern acts as the round-the-world tour (Oppermann, 1995). Besides, it also includes either intranational or international travel itineraries.

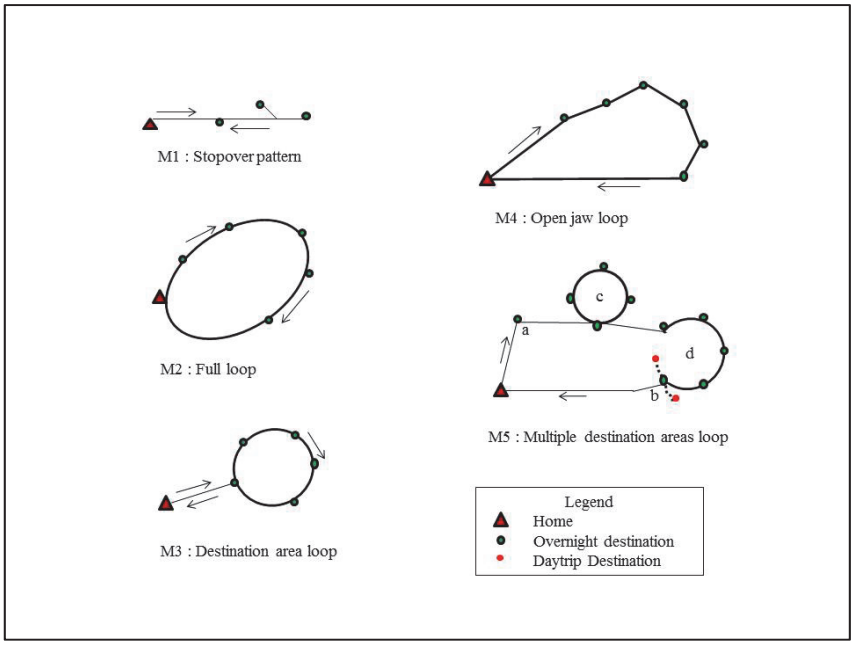


Figure 2.6 Oppermann's travel itinerary models (Oppermann, 1995)

The few earlier studies that are reviewed here used models of the entire trip pattern to form their basis for further analysis of visitors to the destinations. Thus, the present study also tries to apply Oppermann's model for base decisions of multiple itineraries of tourists and to find the potential routes along Southeast Asian of EWEC.

However, Oppermann's itinerary pattern provides valuable information on the destination's market, although that information can be confusing because it is not clear where the destination lies within the larger tour itinerary and there is no indication of what the significance is of being situated in one part of an itinerary versus another part. This argument is not included in the single destination pattern (Lew and Mckercher, 2002). For long haul journeys and large areas, some itinerary patterns need to be adapted, to clearly indicate where the predominant destinations along the route are located, particularly in multiple destinations. According to tourist decisions, multiple destination itineraries are likely to be viewed as rational behavior patterns which save time and costs associated with travel.

Lew and Mckercher (2006) contributed to the influential factors and models of intradestination movement patterns of tourists. They divided the geometry of these movements into two dimensions: territoriality and linearity. The group of territorial models shows variations in the distances that tourists venture from their place of accommodation. Another model is the Linear Path Model which identifies four broad types of destination patterns: a single destination and return trip, with and without side trips; a circle tour with multiple stops with or without side trips; a transit to a destination area followed by a multiple stop circle tour; and a complex combination of linear and circular trips from different hubs along a larger multiple destination itinerary route. However, they

did not focus on the fourth pattern because it would have been rare for the local destination movement in their research.

Example of network models for tourist routes

Referring to Romagosa and Russo, the Council of Europe identified a network of particular thematic European cultural routes in 1987 for representing a shared European cultural heritage. There were 14 main European cultural routes in 2007 (Table 2.2). This network is organized through the recognition of linear continuities in culture over national borders and, at the same time, provides an illustration of cultural diversity, human rights, cultural democracy, inter religious dialogue and mutual exchange as key features of the continent (Jansen-Verbeke and Priestley, 2008).

Table 2.2 The Major Council of Europe Cultural Routes

Major Council of Europe Cultural Routes
1. The Santiago de Compostela Pilgrim Routes (Pilgrim Routes)
2. The Mozart Route (Historical and Legendary Figures of Europe)
3. The Legacy of Al-Andalus
4. The Route of the Castilian Language and its Expansion in the Mediterranean: The Sephardic Routes
5. The Hansa
6. Parks and Gardens (Landscape)
7. The Viking Routes (Vikings and Normans)
8. The Via Francigena (Pilgrim Routes)
9. Saint Martin de Tours, a great European figure, a Symbol of sharing
10. The Jewish Heritage Routes
11. The Clunisian Sites in Europe
12. The Routes of the Olive Tree
13. The Via Regia
14. The Transromanica (Routes of Romanesque art in Europe)

These routes are good examples of a regional development of networks and routes to cooperate and exchange regional benefits of economic development. UNESCO (2008) suggested the guidelines on the inscription of Heritage Routes on the World Heritage List. The suitable determination of a heritage route should be considered as follows:

- It should be a requirement to be held as having outstanding universal value.
- A heritage route is composed of tangible worthy elements of which the cultural significance comes from exchanges and a multi-dimensional dialogue across countries or region. It should also illustrate the exchanges and interaction of movement along the route, in space and over time.
- It may be considered a specific, dynamic type of cultural landscape, just as the latest view of its Operational Guidelines.

What's more, it based on common features: strength, tangible and intangible elements, testimony and other worthy aspects related to its natural framework, purpose and symbolic dimensions. Romagosa and Russo (Jansen-Verbeke and Priestley, 2008) indicated common elements of tourism strategies for organizing routes and itineraries connecting centers and peripheries in physical and semiotic aspects :

- Building on thematic continuities between centers and peripheries. This means the development of corridors to bring visitors to travel in hinterlands and complete journeys within a potentially large territory.
- Developing networks and clusters of peripheral nodes, focusing on products, which are complementary to those located in the center and regional marketing. This strategy tries to not only expand the opportunities for diversification, but also to exploit the advantage of connectivity and proximity of a region.

However, these strategies will contribute towards regional tourism development. In this present research, we attempt to integrate these ideas mentioned above to indicate proper patterns of vacation touring routes. Specifically, the EWEC region was dominated by the integration of multi-Asian history and culture based in Indochina region. Although there are diverse kinds of tourist attractions for exploration, they share some spectacular themes to offer tourist routes. Regarding national tourism plans of the GMS tourism sector (Asian Development Bank, 2010), Ministry of tourism and Sports, Thailand (2011) and Tourism Tripartite Collaborative Meeting (25 June 2012) among Thailand, Lao PDR and Vietnam, the stimulated EWEC tourism themes can summarized as follows:

- Buddhist pilgrimage/spiritual tourism in the EWEC
- Adventure tourism and ecotourism (Tak, Sukhothai, Phitsanulok, Phetchabun, Chaiyaphum, in Thailand and Savannakhet (Lao PDR))
- Isan region and Mekong river civilization
- World heritage route (Sukhothai, Phitsanulok, and Khon Kaen,in Thailand, and Thau Thien Hue and Da Nang in Vietnam)

Besides, the wartime heritage route between Lao PDR and Vietnam can be suggested for special exploration. Furthermore, the EWEC passes through most rural areas of Thailand, Lao PDR and Vietnam, which local people primarily work in agriculture sectors. Therefore, agro-tourism in working farms can be enhanced throughout the EWEC region.

However, all themes mentioned above are offering specific interests among tourist groups. Some tourists may prefer visiting on multi-purposes and interests during their journeys in this region. Thus, tourist itineraries arranged in this study will be prioritized on the groups of high potential tourist attractions which are ready to serve tourists in mixed interests. The routes will suggest the possibilities of tourist movements in the EWEC destination region starting from the public transportation station to the EWEC attraction sties. In addition, the specific EWEC tourism themes can be included in particular visualizations of tourist movement models.

2.10 Related research review

Jansen-Verbeke and Lievois presented the project of the visiting patterns in Historic Cityscapes, which took place in Ghent, Belgium where an urban cultural heritage dominates. They explained the role of the cultural build-up area: historical buildings, monuments and churches influence the vacation and create landmarks in the tourist's mental map. It also shows patterns of visitors' space use in their trips. As essential locations of tourist places, walking routes were mapped in GIS and translated into indicators of space use (Jansen-Verbeke and Priestley, 2008).The result of this paper explored the main factors affecting the spatial pattern of visitors. Thus, they include the experience, motive, city landscape (heritage places, museums, and cultural sites). Besides the tourism facilities, events, public festivities and shopping opportunities have a high power to attract visitors to the city. These factors may be used for innovative policy tools for urban tourism development.

The GIS was developed as a tool for modelling travel pattern of self-drive Tourists. The researcher applied GIS to design a set of multiple destination self-drive models of tourists on road networks by using Visualizing Relatively Unpredictable Movement (VRUM™). The model also displays the changes in travel patterns over time and for different groups of travelers. This research was conducted in the outback of Australia and assigned algorithms to show the location of activities,

paths used among locations, the direction of travel and the length of stay in each location (Holyoak et al., 2009).

Miller (1991) created the model of accessibility by using the concept of space-time prism and GIS capability. It models individual accessibility derived from the potential path area in GIS. It is defined based on the representation of different locations, turn time and travel time by using the shortest path function. Its function shows the feasible and non-feasible arc in the network for travel for individual or population aggregates as well.

GIS acts as a potential tool for describing the spatial clustering of urban logistics activities. Button and Kulkarni (2001) examined two sample cities in the USA (Washington and Detroit), looking at the distribution of warehouses, storage, tracking and urban transport facilities. They used the near-neighbor technique to analyze cluster phenomena for both warehouse and tracking/courier. The result shows the variations in the degree of clustering between various types of two main urban logistics activities.

Wang and others (2007a) studied the analysis on the spatial structure and characteristics of the eminent tourism resources in South Jiangsu by using a GIS-based environment. They started with evaluating tourism resources by using the Delphi method in five cities: Nanjing, Suzhou, Wuxi, Changzhou and Zhenjiang in South Jiangsu. Then they used the Gini coefficient technique to examine the spatial distribution of eminent tourism resources, showing the characteristics of concentration as a radius. The results showed that the eminent tourism resources clustered near the center of the city, particularly for human resources, while the distance increased from the center, the number of tourism resources reduced. On the other hand, the more distance there was from the center, the more proportional natural tourist resources were.

The natural tourist resources reached the highest in the outer suburbs. Finally, they analyzed the spatial structure of the eminent tourism resources through association degree and accessibility. The connection and accessibility of spatial structures of eminent tourism resources could be compared to each other, as differing competing locations, which depended on the strong importance of the centralization of the hub.

Hyde (2008) described the model of pre-vacation decision-making for touring vacation as involving three main activities: information searching, vacation planning and vacation booking. Pre-vacation behavior of tourists varies with characteristics of vacations and vacationer. People who have novelty-seeking motives did not wish to research, plan and book their vacation. On the other hand, the group of visitors who desired to know the destination and activities offered made plans with predictable vacation itineraries. They usually had high searches, high plans and high bookings.

Besides, some groups researched and planned their touring vacation but did not decide where they would go and what they wanted to do, and they did not book accommodation.

The structural properties of destination network was studied and illustrated by network analysis techniques using a number of case studies within four tourism regions in Australia. Network analysis not only visualized the whole structure of the destination area, but also provided metrics for cohesion of resources in terms of density, centrality and clustering measurement. Besides, it also allows the comparative study of the development of destinations. This technique is able to show some areas of weaknesses in destination structures that can be addressed by conducting strategies of planning and management (Scott et al., 2008).

The AHP has been reviewed and applied widely in medical and health care research. Nydick and Liberatore (2008) collected 50 articles that applied the AHP technique to health care management and administration, including patient care issues. They found that AHP is a potential decision support tool for major decision making in this field, such as shared decision making between patients and doctors, the evaluation and selection of therapies and treatments in different cases of patients and the evaluation of health care technology and policies.

Sener and others (2010) applied AHP and GIS to select a suitable landfill for the disposal of municipal solid waste in Turkey. The site selection had to consider several groups of major criteria, including socio-economic, environmental and technical issues such as distance, slope and height. With the capacity of GIS, AHP processes on calculating all criteria were rapidly performed and mapped the best solution for waste management problems. The AHP was a potential tool to support decision making when the problem combined the various complex parameters at hand.

2.11 Summary

In conclusion, this current study reviewed relevant tourism information and analysismethods to support tourism development along the EWEC. In addition, this chapter described the spatial interaction models between tourists and attractions, including the theoretical models used for study analysis process. Regarding the literature review, GIS was widely used as a practical tool to create an extended database of tourism structures and analyze potential tourism places by integrating several concepts and methods mentioned above. Moreover, the use of the Network Analysis extensions were reviewed to determine optimal tourist traveling routes, investigating the disparity of tourism facility service areas and locating possible alternative locations for expanding new tourism services and investments. The total outcome will contribute to the equal development of the whole EWEC region and, consequently, it can become a leading destination area for exploring Asian nature and culture.

Chapter 3

Study area

This chapter provides information on the study area located in the Indochina region of Southeast Asia. Geographic characteristics and the socio-economic background of the whole region, as well as tourist attractions on the Southeast Asia East West Economic Corridor (EWEC), are mentioned in detail. This chapter is organized to give basic information about the EWEC member nations and explain the tourism situation. In addition, attributes and spatial data of national boundaries, road networks, infrastructure, and tourist attractions will be explored.

3.1 The EWEC background

The Southeast Asia East West Economic Corridor (EWEC) is the major route across the countries of the Indochina peninsula within the Greater Mekong Subregion (GMS). The GMS is a large national economic area bound together by the Mekong river basin, situated in Southeast Asia. It is comprised of six nations: Myanmar, Thailand, Lao People's Democratic Republic (Lao PDR), Vietnam, Cambodia and the People's Republic of China (Figure 3.1).

The subregion covers an area of 2.6 million square kilometers and is inhabited by approximately 326 million people (GMS Secretariat, 2010). The Mekong River Basin is defined as the land area surrounding all the streams and rivers that flow into the Mekong River, nearly the size of France and Germany (Mekong River Commission, 2005-2009). With a length of 4,880 kilometers, the river ranks as the ninth largest and the twelfth longest river in the world (Douglas, 2005, Gupta and Liew, 2007). From the Tibetan Plateau, it runs through spectacular gorges and enters the Chinese province of Yunnan with mountain ranges and valleys. The river then runs through the "Golden Triangle," linked by the borders of Myanmar, Lao PDR, and Thailand, and flows along the length of Lao PDR. It also forms the border between the northeast of Thailand and Lao PDR before passing over the Khone Falls, and then into the broad Cambodian floodplain. After continuing into Vietnam, where a fertile delta was generated, the Mekong finally flows out to the South China Sea (Figure 3.1). The Mekong serves multiple functions; it is used as a major transportation route and for consumption purposes by residents in the surrounding nations. Moreover, because of its diversetopographic characteristics, combined with the spectacular cultural fabric and varied demography in the region, the river inspires tourists to visit.

Figure 3.1 A map of the Greater Mekong Subregion (GMS) and the Mekong River (Adapted from: http://www.gmsbizforum.com) (GMS Business Forum, 2001-2005)

The EWEC is a GMS flagship initiative that was launched more than a decade ago at the Eighth GMS Ministerial Meeting held in Manila in 1998, (Asian Development Bank, 2010) as a collaboration of six nations in co-operation with the Asian Development Bank (ADB). It is a transport corridor created as a GMS regional cooperation strategy and program (RCSP), supported by the ADB, to increase sub-regional economic cooperation and investment and to facilitate the movement of goods and services, including tourism across the borders (Operation Evaluation Department, 2008).

In addition, the major objectives of the EWEC project are: 1) to enhance and develop economic cooperation and investment between the EWEC member countries, 2) to reduce transport costs and facilitate the movement of goods and passengers, and 3) to alleviate poverty and increase income by providing employment opportunities and promoting tourism (Asian Development Bank, 2005).

The EWEC is a main road network constructed across four countries from Myanmar to Vietnam, connecting Myanmar, Thailand, Lao PDR and Vietnam. Moreover, it is the only accomplished corridor that serves as a direct and continuous land route between the Indian Ocean (Andaman Sea) and the South China Sea in the Pacific (Figure 3.2).

In the present study, the scope of the study area is a 60 km swathe of the EWEC line, which extends 30 km above and below the line from the main road (Figure 3.2). Within this boundary, tourist attractions located in every province of the EWEC member countries will be covered.

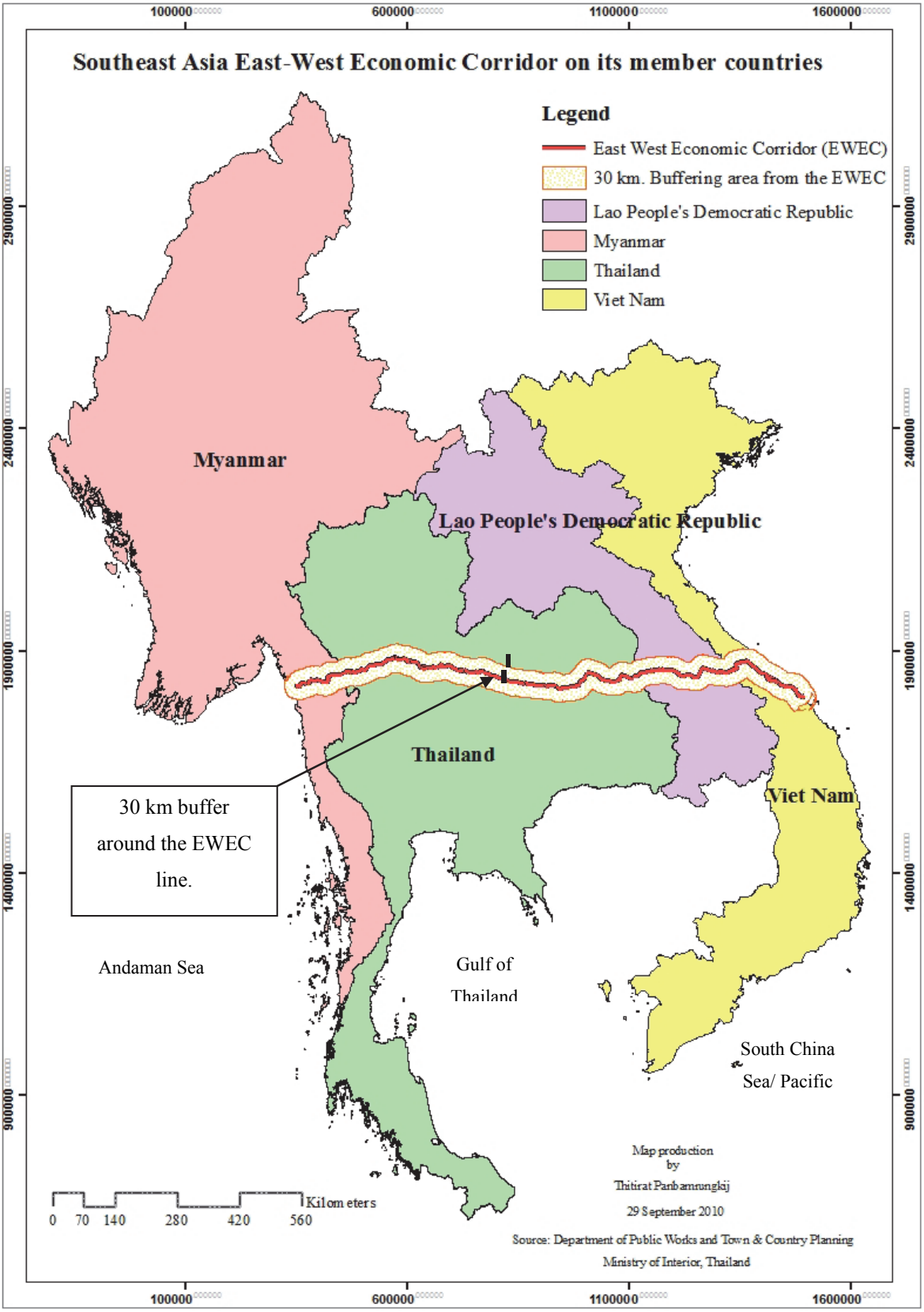


Figure 3.2 Southeast Asia East-West Economic Corridor

Transport of the EWEC

The east-west transport corridor is a continuous land route approximately 1,320 kilometers long that was constructed to link many cities from Myanmar to Vietnam (Figure 3.3). The details of each nation are as follows:

1) Myanmar: The EWEC covers a total of 200 kilometers, starting from Myawaddy, located on the western side of the Thailand border (Mea Sot), to Mawlamyine in Myanmar. The road also connects certain cities, in particular, Thingannyinaug (Thin Gan Nyi Naug) and Kawrakeik, before entering Mawlamyine where the EWEC route terminates.

2) Thailand: The length of the route from the Mea Sot border to many cities in Thailand's territory is about 619 kilometers. The highway extends from Mae Sot city in the Tak province to the Mukdahan province close to Lao PDR. Along the way, it enters the provincial boundaries of Sukhothai, Phitsanulok, Phetchabun, Chaiyaphum, Khon Kaen, and Kalasin. It finally ends in the Mukdahan province.

3) Lao PDR: The road connects the Thai-Lao PDR border (the Second Friendship Bridge) to the Dan Savan-Lao Bao Border checkpoint, which separates Lao PDR and Vietnam. The route is approximately 229 kilometers long and passes through the center of the Savannakhet province.

4) Vietnam: The length of the route from the Lao Bao checkpoint to Da Nang, where the route ends, is 271 kilometers and links the provinces of Quang Tri, Thua Thien Hue and Da Nang City.

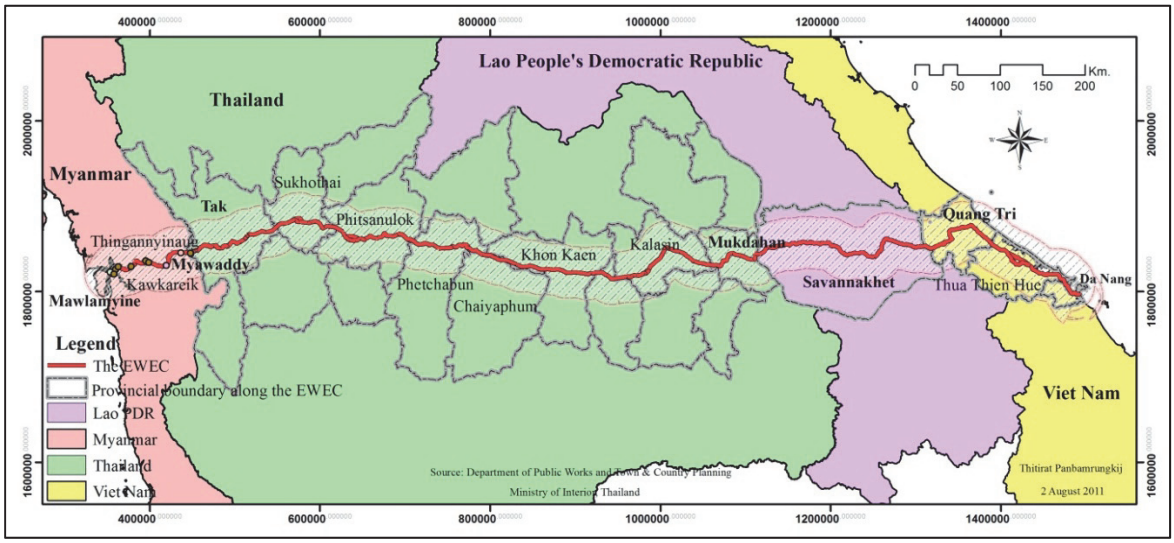


Figure 3.3 Transport of the EWEC

The route has notable geographic characteristics because it serves the following four main functions (Asian Development Bank, 2010):

- Commercial nodes linking important centers among neighboring countries; Mawlamyine-Myawaddy in Myanmar, Mae Sot-Phitsanulok-KhonKaen- Kalasin-Mukdahan in Thailand, Savannakhet-Dansavanh in Lao PDR, and Lao Bao-Hue-Dong Ha-Da Nang in Vietnam.
- Border nodes containing immigration checkpoints.
- Gateway nodes at the important ports in Vietnam and Myanmar.
- Interchange nodes for several north-south arterial routes.

In addition, this route is a wonderful land route for the tourism and business sectors. Traveling in the different seasons along the entire route has been possible since 2006 (Krongkaew, 2004). It allows travelers to cross the borders on overland routes and benefits the EWEC member countries through trade, transportation and tourism. As early as the mid-twentieth century, many countries prioritized the development of international boundaries among nations, particularly those along the EWEC route. The EWEC is thus not only a political line, but it also links activities, attractions, work, trade, investments, employment and national tourism collaboration spreading throughout the region (Timothy, 2002).

3.2 Topographic description of the region

The EWEC spans the territories in most of the Indochina region, which has diverse geographic characteristics. The Indochina region extends the southeastern area of the vast Eurasian continent. The rough physical appearance is composed of mountainous and plateau areas in the northern part, and plain areas in the central and lower part where the coast and Mekong River are. The region is situated at a latitudinal extent approximately 5 degrees from the equator to the upper Tropic of Cancer (23.5 degrees north of the equator). The location is influenced by different climates within the Indochina region. All of the lowland areas of Indochina are in a tropical monsoon zone where most of the rain falls in the summer months. Some of coastal and eastern parts are struck by typhoons in late summer and autumn. The winters are a bit dry except in the mountain area (McCune, 1947). Moreover, topographic characteristics vary among particular parts of this region.

According to the physiographic landforms of Southeast Asia presented by Gupta (2005), the Indochina region holds six major patterns. First, there is the north and northwestern mountain range covering the northern and western part of Myanmar, including northern Thailand. This area is the highest point in Indochina and even Southeast Asia. Therefore, it holds Asia's greatest rivers, such as the Mekong, Salween and Irrawaddy, which drain down to create a series of basins and plains (Hill, 2002). Second, there is the central plain of Thailand - a large plain and floodplain extending from the north to the south lowland and formed by the Chao Phraya River. Thirdly, the Khorat Plateau (Khorat Upland) is formed on the east side of the central plain as a border, which also separates the next

landform on its east side with the Mekong River. Fourth, the Mekong Lowland extends north south from the northern mountainous area to the South China Sea. The lowland is narrow along the Mekong River from the north (Lao PDR) and becomes a wider plain in the south, developing a large fertile delta in Cambodia. Fifth, the Annamite Chain, a continuous range of mountains and plateaus, runs from the northern mountain range to the southern part of Vietnam through Lao PDR as a margin that separates the Mekong lowland in the west and the North Vietnam Plain. This area contains the great biodiversity and tributaries, which contribute to the fertility in the lower Mekong basin. This resulted from the erosion of diverse folded and fractured sedimentary rocks with granitic intrusions and volcanic rocks (Douglas, 2005).

The final landform is the North Vietnam Plain, a coastal plain covering a large extended delta of the Sông Hóng (Red river) in the north. It narrows and extends parallel to the coast in the south. Along this plain, there are a number of short streams running down from the Annamite Chain to reach the coast. Most of the EWEC lies on the second and third landforms in Thailand; the rest passes the Mekong lowland, the Annamite Chain and the North Vietnam Plain.

These different types of landforms affect the varieties of natural resources, prevailing wind patterns, temperature, and land cover. Also, land utilization is influenced by these topographic characteristics. In the mountainous area of Myanmar, Thailand and Lao PDR, some forests have been altered by shifting cultivation. However the Annamite ranges of plateau and lowland along the Lao PDR – Vietnam border still provide one of Southeast Asia's largest remaining areas of undisturbed river and forest (Douglas, 2005). On the lower slope, there are terrace rice fields on the valley floors and flatter parts of the lower basin.

In the central plain, paddy rice is dominant in particular floodplains, while natural levees are used for housing and planting vegetables and cash crops. Other crops are planted in colluvial and alluvial deposits. Land-use changes around the Khorat Plateau area in Thailand because of low soil moisture storage capacities. The plateau was a sea during the Tertiary era a few million years ago (Hill, 2002), causing salinity problems with the low fertility, sandy soil in the plateau and adjacent areas. However, corn cultivation is possible, and many kinds of agriculture have emerged in the Mekong lowland in Lao PDR. The lowland at the mouth of the Mekong is a delta and is influenced by river and tidal currents from the South China Sea in Vietnam. This is a pivotal area for rice cultivation in Vietnam, even though it is affected by deep flooding during the rainy season. During the dry season, the Mekong River has less energy to flow, so seawater is able to intrude into the delta plain. Saline water is not suitable for rice growth in this season (Douglas, 2005).

The Mekong region is one of the most important subregions in Southeast Asia, possessing a variety of land-uses and resources. However, forests in the hills and some lowlands were deforested

and changed for agricultural land use. In addition, some land was altered for various reasons, such as for accommodation, military bases, transportation, leisure and recreation, to support an increasing population. Additionally, legacies of war have been uncovered in some areas in Vietnam and Lao PDR, such as memorials, bomb craters, tunnels, military bases, air shelters and battlefields. After the war, many countries in this region rigorously developed their national economies and began promoting scenic resources and landscapes for tourism. They continue to facilitate infrastructure developments and tourism investments to widely welcome tourists from all over the world. Member countries also support economic growth and tourism development within the region through the EWEC route. In the late 1990s, the trend to visit Vietnam coincided with twenty-first century mass tourism. Tourist destinations such as Lao PDR and Cambodia are being increasingly promoted (Douglas, 2005). The EWEC has gained more importance for readily exposing the different facets of the region to other continents around the world.

3.3 National context of the EWEC

The EWEC stretches from Mawlamyine in Myanmar to Danang in Vietnam, through many cities of the four GMS member countries: Lao PDR, Thailand, Vietnam, and Myanmar. This subregion covers mostly developing countries whose majority population still lives in rural areas. However, the potential of the tourism sector is a crucial step for driving the socio-economic growth and for bringing tools for development into the whole GMS region and Southeast Asia. In addition, tourism has been identified as one of the twelve priority sectors that will help hasten the integration of the Association of Southeast Asian Nations (ASEAN) countries by 2015 (ASEAN Secretariat, 2011).

According to the ASEAN Tourism Strategic Plan (2011), tourism products identified by the ASEAN National Tourism Organizations (ASEAN NTOs) attract and encourage travel within the region. In particular, the EWEC member countries offer tourists the chance to experience culture, nature, cruises, marine activities (except Lao PDR), local hospitality, food, medical tourism (only in Thailand), festivals, events, shopping and handicrafts. However, based on an investigation among tourism stakeholders, it was clear that culture, nature and cruise activities are seen as having the highest potential for product development. The challenge is to develop a set of unique tourism products, which are available in local areas and express the traditional lifestyle to visitors.

The unique geographic appearance and socio-economic characteristics of the EWEC member countries are outlined in more detail below.

3.3.1 Myanmar

Myanmar is a resource-rich nation where many ethnic and indigenous people still depend on agriculture and natural resources. The country remains undeveloped and has an assorted biodiversity. Myanmar possesses natural resource management systems and places intensive concern on biodiversity conservation. However, it is one of the least developed nations on Earth, with approximately USD 800 US dollars per capita GDP in 2011. It has a complex history and a diverse native ethnic population. The estimated total population of Myanmar was 62.417 million in 2011 (International Monetary Fund, 2011b). The largest ethnic group is Burmans, who account for approximately 60% of the total population. Other ethnic and indigenous people represent about 40 %, and include the Shan and Karen (10 %), and the Wa, Chin, Akha, Kachin, Karenni, Lahu, Kokang, Tavoyan, Pa-Oh, Naga, Mon, Kayan, Arakan, Rohingya, Palaung, Indian, Danu and Chinese (30 %) (The Burma Environmental Working Group (BEWG), 2011).

Myanmar is the single largest nation in Southeast Asia, with a land area of about 676,577 square kilometers. It is situated between 09° 32' N and 28° 31' N latitudes and between 92° 10' E and 101° 11' E longitudes (Ministry of Foreign Affairs Myanmar, 2011, ASEAN Secretariat, 2009), which is a prominent monsoon region that receives almost 5000 mm of rainfall a year (The ASEAN Tourism Association, 2010). The country is located close to China in the northeast, Lao PDR and Thailand in the southeast, Bangladesh and India in the west and the Andaman Sea in the south. In this study we focused on the EWEC route's starting trail on the west side located in Myanmar (see Figure 3.3). This route passes the Mon and Kayin states from Mawlamyine city through Babugon, Kawbein, Kyondo, Kawkareik, Thin Gan Nyi Naung and Myawaddy. Mawlamyine, a capital city of Mon state, is a place of historical and religious attractions and hosts an attractive seaport. The suggested tourist attractions are the Kyaikthanlan Paya (Pagoda), Shampoo Island, the Mon cultural museum and fishing villages. Over half of Kayin state is covered with mountainous areas of evergreen forests that provide valuable natural resources such as wood, wildlife and waterfalls. One of the main cities along the EWEC belonging to Kayin state is Myawaddy. It is a gateway to the Mae Sot province in Thailand and is about 156 kilometers from Pha An, the capital of Kayin state. It serves as a trade center, an economic hub and a Buddhism pagoda.

3.3.2 Thailand

Thailand is located between latitudes 5° 36' 35" N and 20° 27' 41" N and longitudes 97° 20' 32" E to 105° 37' 36" E. It is situated in the southeastern part of the Asian mainland, close to Myanmar in the west and north, Lao PDR in the northeast, Cambodia in the east, and Malaysia in the south, with a total land area of 513,115 square kilometers. Thailand is divided into six regions according to topographic characteristics and cultures (The Royal Institute (ราชบัณฑิตยสถาน), 2007) (Figure 3.4): the North, Northeast, Central, East, West, and South.

In this study, Thailand's regions were grouped to explain four distinct geographic characteristics. First, the mountain and intermontane plains in the north and the west generate principal rivers (Ping, Wang, Yom, and Nan) that flow southward and join in the upper central region, which later was named Chaophraya River. Second, the Central Alluvial Floodplain of the Chaophraya River and tributaries is the largest fertile alluvial basin in the country. Third, the Khorat Plateau in the northeastern region distinctly divides the north, central, as well as the east, in the southwestern part of the region. Finally, regions in the southern peninsula and eastern coastal plain have mountain ranges in the central area. The southern peninsula stretching downward to the Malaysian border consists of narrow strips of the eastern and western coastal plains, separated by central rocky ranges. The eastern coastline is close to the Gulf of Thailand and the western coastline is close to the Andaman Sea.

Thailand is one of the world's major producers of rice because of its physical landscape. Approximately 40 % of land is used for agriculture, with one-half being paddy fields. Other agricultural land is used for field crops, and more than 14% is planted with fruit trees (Office of Environmental Policy and Planning, 2000). Thailand has a rich cultural heritage and a stunning landscape of natural beauty, proving to be a multi-faceted destination (Tourism Authority of Thailand, 2007). The appeal of such idyllic landscapes and warm culture has made the country one of the world's most popular tourist destinations over the last two decades (Peleggi, 2007).

Thailand's population reached approximately 64 million in 2011, with a GDP per capita income of 5173.71 US dollars, the highest estimated per capita income among the EWEC countries (International Monetary Fund, 2011b). Since the 1980s, Thailand has been systematically developing its' tourism sector to boost foreign exchange earnings and investment under the global capitalist system. It dominated development among the Mekong regional countries with the number of tourist arrivals, increasing from 1 million to almost ten million annually over the last 20 years (Pleumarom, 2002).

Thailand is located in the central part of the EWEC area and covers the largest part of the route. This route passes a number of provinces in the west, in the upper central parts and in the northeast (Figure 3.4). It starts from Tak province in the west, close to the Myawaddy province at the Myanmar border. Tak has great mountains along both sides of the border, providing breathtaking scenery, waterfalls, perfect rivers for rafting, and the opportunity to see local traditions and customs. At present, it has become more accessible and is attracting visitors for many tourist purposes.

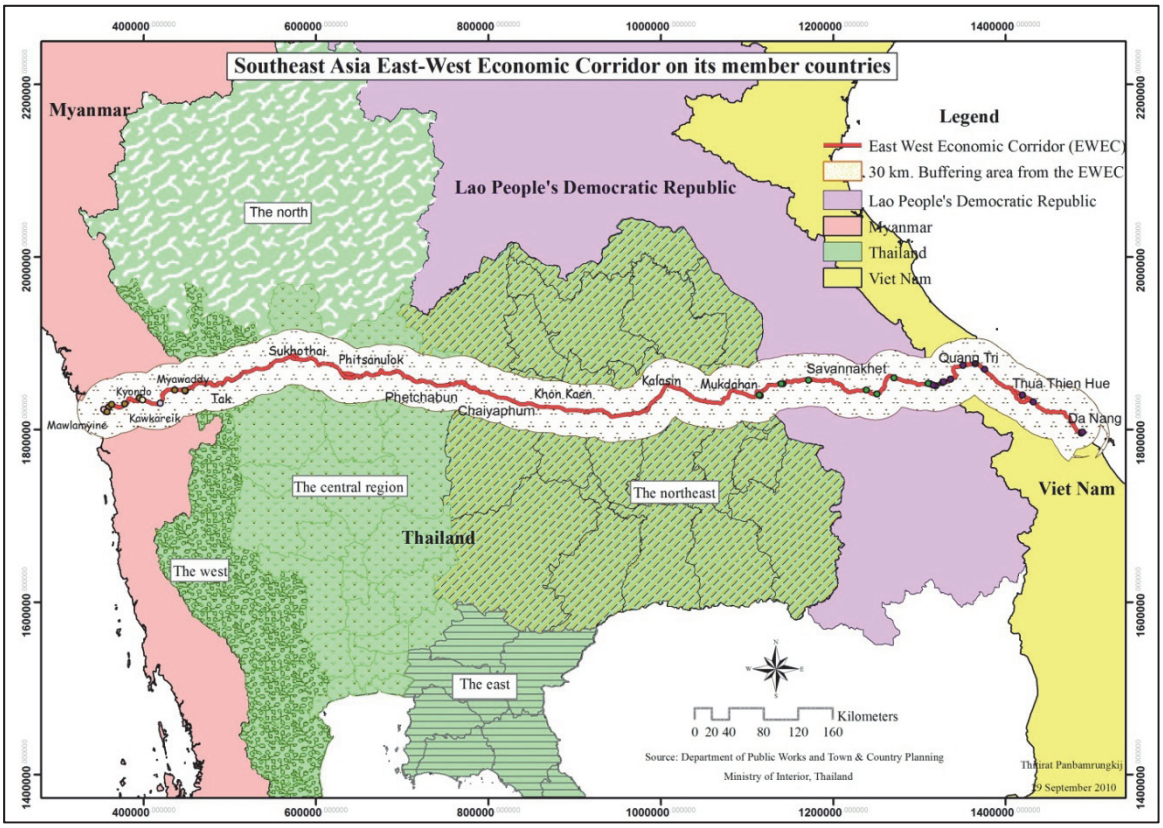


Figure 3.4 Regions and Major cities in Thailand along the EWEC

Then, the route runs through the upper central plain before entering the Khorat Plateau in the east. In the center, the EWEC passes through the marvelous provinces of Sukhothai, Phitsanulok, and Phetchabun. Sukhothai was the capital of the first powerful and extensive Thai kingdom in the peninsula. It is thus one of the top must-see tourist sites, representing an historical art and flourishing Buddhist center in Thailand. The former greatness of Sukhothai city has been preserved in Sukhothai Historical Park by the Fine Arts Department in Thailand, in cooperation with the United Nations Education, Scientific and Cultural Organization (UNESCO) World Heritage Centre. The site has preserved and restored the abandoned and over-grown superb Buddhist temples, walls, gates, moats, dams and monuments (Tourism Authority of Thailand, 2003-2010).

Passing through the next province, Phitsanulok is a breathtaking zone with notable Thai history, religious sites and great natural parks with varied native biodiversity. There are many famous Buddhist temples here, such as Wat Phra Si Mahathat Woramahawihan, home to the most beautiful Buddha image in Thailand, called Phra Buddha Chinnarat, Wat Chula Mani (the oldest temple in the town) and Wat Na Prathat. In addition, Phitsanulok contains evidence of an ancient community and is the birthplace of King Naresuan (Chan Palace) who declared Ayutthaya's independence from Burma in 1584. Besides the interesting attractions mentioned above, travelers can discover magnificent natural landscapes and parks in the province, such as Phu Hin Rong Kla National Park, Namtok Poi (Poi waterfall) and Khao Krayang Forest Plantation and Lam Nam Khek rafting. Therefore, the province is a natural hub and an ideal base for travelers wishing to explore the lower North and western Northeast.

Next to the Phitsanulok province, the EWEC links with Phetchabun, which has a pleasurable climate nearly year-round and fertile land for agriculture. Phetchabun contains mountain ranges running both west and east, and has the Pasak River basin in the central area. The province provides a number of tourism activities primarily related to the outdoors and heritage sites, such as trekking, swimming in waterfalls, shopping for fruit crops, camping, wildlife sighting and learning history.

The route continues in the eastern direction to the northeastern region of Thailand called "Isan region". It passes through Chaiyaphum, Khon Kaen, Maha Sarakham, Kalasin, and Mukdahan, and is situated on the Khorat Plateau, which is a margin separating the central region. The Mekong River separates Thailand from Laos in the east, while the Dong Rek Mountains form the boundary with Cambodia in the south.

It is one of the most traditional areas of the country and a particularly intriguing destination with many Stone Age and Bronze Age dwellings and artifacts. In addition, this region remains the legacy of the great Khmer Empire, and has traces of dinosaur footprints in Khonkaen, Karasin and Mukdahan. Therefore, by driving through the center of the region along the EWEC route, tourists can explore splendid remote towns and cities where culture, nature and old Thai customs have remained relatively unchanged. The population is renowned for being friendly and polite, even though it is one of the poorest regions in the country (Tourism Authority of Thailand, 2003). There are many attractive tourism sites, such as the Khit Cloth Weaving Center in Chaiyaphum, the Ban Chiang Archaeological Site (a UNESCO World Heritage Site), King Cobra Village, Phu Wieng National Park in Khon Kaen, Pottery Village, Hin Rong Park in Maha Sarakham (commonly called Lan Hin Rong or "pot hole on sandstone"), Sirindhorn Museum and Phu Kum Khao Dinosaurs Excavation site, and Pu Thai Cultural Village in Kalasin. The final province between Thailand and the Lao PDR border is Mukdahan, which hosts a number of great attractions such as Mukdahan National Park and the Indochina Market.

3.3.3 Lao PDR

Lao PDR is a landlocked and mountainous country bordered by Thailand to the west, Vietnam to the east, Cambodia to the south and China and Myanmar to the north. The country is situated between 13° 54' N to 22° 3' N latitude and 100° 05' E to 107° 35' E longitude, comprising a total land area of 236,800 square kilometers. The northern area is dominated by high mountains and plateaus. Flat areas are found along the river and the central part of the country (Philakone, 2010). It contains colorful landscapes and its people have a unique culture, inviting travelers to explore Lao PDR on a journey of a lifetime.

However, Lao PDR, commonly called Laos, faced a long period of war and civil unrest. In 1893, it was a French colony and was shortly occupied by Japan during the Second World War. Although it later became fully independent in 1953, it was politically unstable and experienced internal conflict, entering into a civil war that was influenced by big outside powers involved in this region during 1963 to 1975 (Harrison and Schipani, 2007). Simultaneously, its neighbor Vietnam faced intensive war (the Vietnam/American war), which Laos indirectly drowned in, suffering terribly from massive bombing and disruptions (Fujita, 2006). During the Vietnam War, northeast Lao PDR was politically under the Laotian Communist, known as 'Pathet Lao', and was closely supported by the Viet Minh who fought against the colonial ambitions of France in Vietnam. The southern group represented the anti-communist government forces, the Rightists, and was supported primarily by the USA, whereas the Neutralists believed in a nonaligned strategy and preferred complete power. After the communist victory in Vietnam in 1975, the Pathet Lao, similar to communist North Vietnam's struggle for national liberation, took governmental power, and proclaimed the Lao People's Democratic Republic (Lao PDR) as a communist state that year (Anderson, 2005, Harrison and Schipani, 2007).

The results of civil unrest not only affected the quality of life, but also changes in land use. Natural resources were destroyed and some remote villagers had to migrate across the country to refugee camps or relocate to other safe places. They particularly settled in the lower catchment areas like the Nam Ngum catchment (Douglas, 2005). This brought about deforestation because new villages were settled and shifts in cultivation expanded (Fujita, 2006). In the meantime, Lao PDR had to recover from the ravages of war, despite the fact that it was one of the world's poorest nations with an estimated per capita income of US$ 268.63 in 1999 (International Monetary Fund, 2011b). Most people still work in the agricultural sector, although there is less than 10 % arable land. Almost 70 % of the land mass is covered with mountains and high plateaus (Aas et al., 2005, International Monetary Fund, 2011b). The Annamite Mountains run the eastern length of the country, while the Mekong River winds through the territory from the north to the south, creating fertile plains in the central and the southern region. Thanks to the natural resources, Lao PDR has abundant mineral

deposits such as tin, gold, iron, silver, sulfur and sapphires; rare wildlife as well as plentiful water resources. The Mekong River is not only the main transport artery and means of irrigation for citizens, but also serves as a large potential hydropower energy resource.

The country is rapidly expanding, recovering economic growth and increasing incomes, especially through hydropower, garment exports, foreign direct investment and tourism. Recently, Lao PDR has experienced 7.9 % (US$ 984.153 GDP per capita) economic growth in 2010. GDP growth in 2011 has been favorable, up to 1057.94 per capita of U.S. dollars, with a total population of 6.565 million (International Monetary Fund, 2011a).

Even though Laos was not directly involved in the Vietnam War, its location is close to the Vietnam border. Specifically, the EWEC route in Lao PDR is called Route No. 9, running from the Savannakhet province of Lao PDR to the Quang Tri province in Vietnam. It connected entryways of vital supply lines for the Vietnamese forces, called the Ho Chi Minh Trail, from the north to the south during the Vietnam War. Route number 9 (No. 9 highway) of the EWEC runs through five districts of Savannakhet: 1) Savannakhet city, 2) Seno, 3) Phalanxay, 4) Phine and 5) Sepon, before connecting the Lao Bao district of Quang Tri province in Vietnam (Figure 3.5).

Along the route, there are plenty of attractions ready for visitors to discover: traditional customs, historical architecture, museums, Buddhist temples, dinosaur footprints, and waterfalls. Although this area had suffered from the history of violence and struggle for independence, the calm lifestyle of rural villagers is present alongside the remaining evidence of the war left behind (Figure 3.6). This evidence has high potential to become wartime heritage sites in the region. For example, battlefields, bomb craters, war museums and soldier monuments are easily accessed along the way.

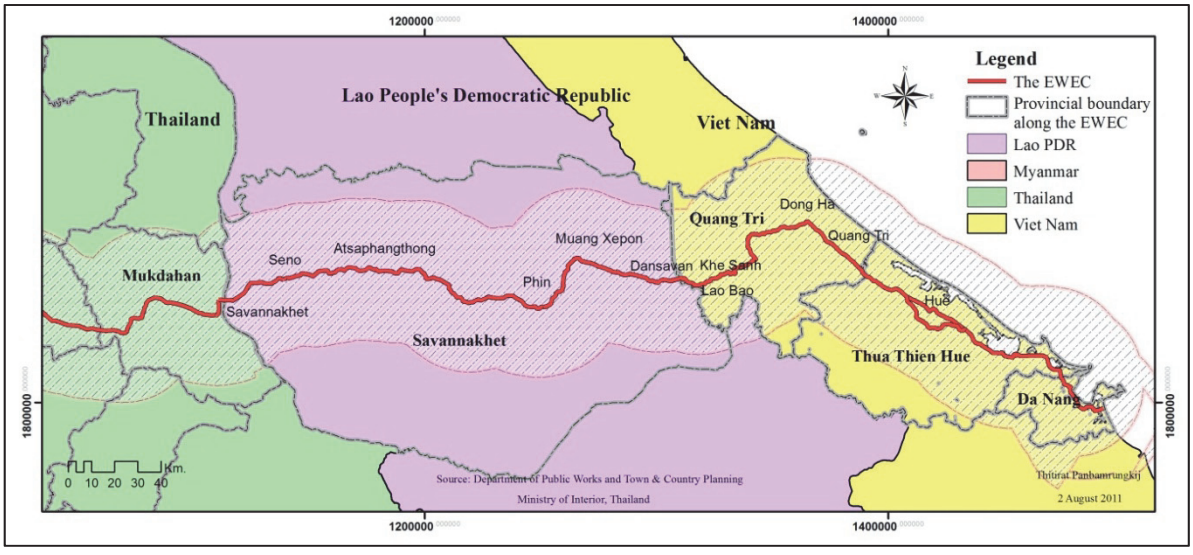


Figure 3.5 Cities in Lao PDR and Vietnam along the EWEC

Figure 3.6 Lively images representing Laos' lifestyle: (a) adapted farmers' truck, (b) boats made from bomb materials, (c) thatched cottage, (d) countryside barber shop and (e) traditional weaver

However, Lao PDR's government has tried to recover the country through economic development. Tourism broadly serves as a tool for development and poverty alleviation. The government has welcomed international tourism since 1989 and published the country's first national tourism plan in 1990 (Hall, 2000, Lao People's Democratic Republic (Lao PDR), 1990). Later, many implementation plans and strategies were initiated to support investment, employment and tourist arrivals from all over the world. Recently, the Lao National Institute of Tourism and Hospitality (LANITH) proposed Project LAO/020 - a bilateral development project supported by official development assistance (ODA) from the Government of the Grand Duchy of Luxembourg. It supports human resources in the hospitality and tourism industry in Lao PDR by raising the quality of service throughout the country. The project thus responds to significant human resources needed to impress tourists in the tourism sector (Lao National Institute of Tourism and Hospitality, 2011).

3.3.4 Vietnam

Vietnam is located on the east Indochinese peninsula. It borders China in the north, Lao PDR and Cambodia in the west, and the South China Sea in the east, covering an area of approximately

327,500 square kilometers. It lays on a long and narrow S-shape strip of land which stretches across 1,700 kilometers from 23°23' N to 8°27' N, with only 50 kilometers in width in the center (Verbeke, 1995).

Regarding the topographic appearance, Vietnam has a variety of physical characteristics such as hills, mountains, floodplains, continental shelf, deltas and beaches, reflecting the long history of geology and topography formation in a humid monsoon climate with strong weather exposure. The topography is lower from the northwest to the southeast, which can be clearly observed in the flows of major rivers. Three quarters of Vietnam's territory is made up of low mountains and hilly regions, and only one-fourth is covered by deltas (Dungpt, 2010). The long coastline provides wonderful beaches and archipelagos, particularly in Danang and Hoi An, where the east-end destination of the EWEC terminates.

With a 4,000-year history, Vietnam is a country which consists of approximately 54 ethnic groups, forming a complex ethnographic structure with diverse cultural traditions (Doan, 2002). In the 19th century, Vietnam and neighboring countries suffered greatly from Western colonialism and the Indochina war. These affected Vietnam, causing remarkable changes in the social structure and lifestyle of its citizens. Recently, Vietnam's population totaled about 89 million, with a GDP per capita of 1,327 U.S. dollars in April 2011(International Monetary Fund, 2011b).

Due to its various landscapes and long history, Vietnam has plenty of cultural and natural resources for economic and tourism development. The country offers visitors many unique touristic possibilities, such as national parks, adventure tourism, beaches, scenic locations, historical architecture, monuments, French colonial buildings (primarily in the cities), Indochinese cultural heritage and wartime heritage sites.

The EWEC route covers three main provinces in Vietnam: Quang Tri, Thua Thien Hue and Danang City, located in central Vietnam (Figure 3.5). All three areas expose the important historical, traditional, cultural and natural sites of Vietnam. Quang Tri is the first province along the EWEC in Vietnam, close to the Savannakhet province on the Lao PDR border. It is an important province that endured the fiercest fighting during the Vietnam War, and thus provides historical war relics that have been transformed into tourist attractions, such as the Vinh Moc tunnel and Quang Tri Citadel. Vinh Moc is a spectacular tunnel consisting of three floors and more than 60 strong solid soil chambers, covering a length of nearly 2 kilometers beneath the ground surface. It is linked with 13 doors, seven of which open to the sea and six to the hills. During the war, this structure was used for many purposes, such as taking shelter from bombardments, hosting social functions (cooking and meetings), receiving medical treatment and transporting foodstuffs and weapons. So, it bears

testimony to the endurance, wisdom and bravery of local people in their fight for independence (Tourism Information Technology Center, 2011).

From Quang Tri, the EWEC continues to Thua Thien Hue and Danang City. The Thua Thien Hue has plenty of religious sites, warm traditional cultures and national tourist attractions. For example, the national heritage site, the Dai Noi Imperial Citadel (Hue Imperial City), was officially classified as a World Heritage Site by UNESCO. It is situated along the Song Huong (Perfume River) in Thua Thien Hue. In the same province there are also tourist sites representing the prosperous Buddhist monastery, such as the Tien Moo Pagoda Temple and the Dynastic Temple (in the southwest of the Hue Imperial Citadel). In addition, there are sophisticated handicrafts, like incense and Vietnamese hat making. Besides, Lang Co beach offers a spectacular view of Hue. It has officially been the 30th member of the "World's Most Beautiful Bays" club (World-bays Club) since June 2009 (Tourism Information Technology Center, 2011).

The final EWEC destination province is Danang, which conjures up images and memories of the American troops landing in 1965. It was used as both a base for marine helicopter units and as a center of paramilitary activities. Danang has a variety of interesting attractions because of its topography and long history, such as long stretches of beach, Ngu Hanh Son (Marble Mountains) and the Han River. Vietnam expanded from the north to the south 1,000 years ago when it dominated the Cham Kingdom in the center of the country and the Khmer in the Mekong delta area. Visitors can find cultural heritage elements in the Museum of Cham Sculpture in Danang city. In addition, the ancient town of Hoi An (UNESCO World Heritage Site) in Danang attracts tourists to discover a traditional Asian trading port and is an outstanding material manifestation of the fusion of cultures over time.

To sum up, the EWEC member nations vary greatly in geographical appearance and natural resources, providing a wealth of fascinating things to see and do for collecting memories. By integrating unique cultures, long histories and different traditions from each nation, the EWEC fuses splendid attractions and the warm welcome of its citizens, thus serving as a highly viable option to meet tourism demands. The multitude of attraction themes offered by the Southeast Asian EWEC route play an attractive role for long haul journeys through time.

However, because of the political difficulty between Thailand and Myanmar, this study focuses on all nations of the EWEC member countries except Myanmar. The Burmese government does not allow independent tourists or goods to be transported across the border at the Myawaddy-Mae Sot checkpoint. According to the Thai Asean News Network (2011), the Mae Sot-Myawaddy border has been closed off since 18 July 2010 and has shown no indication of reopening. Therefore, information on Myanmar tourism along the corridor could not be recorded for analysis in this study.

3.4 Socio-Economic context of the EWEC member nations

The socio-economic structure and core infrastructure are basic indicators for evaluating the capability of the EWEC member countries to support tourism. Population distribution, national monetary status and tourism facilities also influence the direction of tourism development.

3.4.1 Socio-Economic situation

The basic information of EWEC nations is shown in Table 3.1. Since the EWEC was launched a decade ago, the aim was to distribute transport systems, telecommunications, energy infrastructure, business investments and tourism among the member countries. These improvements will create a higher socio-economic structure of the nations' populations.

However, the economic status among the EWEC nations is still low regarding GDP and Current Account Balance (Table 3.1). Most countries have a negative account balance except Thailand, which had just US$ 21.866 billion in 2009, compared to other developed nations such as Germany with about 167 billion. In addition, EWEC member countries' GDP per capita is rather low compared to other nations in Southeast Asia. For example, Singapore estimated US$ GDP per capita up to 36,112 in 2011.

Table 3.1 Basic socio-economic and infrastructure information of EWEC nations

	Lao PDR		Vietnam		Thailand		Myanmar	
	2009	2011*	2009	2011*	2009	2011*	2009	2011*
Total Population (Million)	6.32	6.57	87.21	89.32	63.53	64.26	59.98	62.42
GDP at current price (Billion) US$	6	7	93	119	264	332	35	51
GDP per capita (US$)	886	1,058	1,068	1,327	4,151	5,174	587	821
Current Account Balance (Billions)	-0.98	-0.94	-6.12	-4.75	21.87	9.14	-0.45	-1.82
Total land area (km^2)	236,800		331,051		513,120		676.577	
Airports (total)	42		44		103		74	
Airports (international)	1		3		6		3	
Sea ports (international)	-		7		3		2	

Source: International Monetary Fund (* estimated data after 2009), Association of Southeast Asia Nations (2010), and the CIA World Factbook (2012)

The population distribution was classified proportionally to each of the EWEC member country's total population. The EWEC provincial population of Thailand accounts for 12 % of the country's population, while in Lao PDR it represents up to 15 %. The proportions are significantly low in Myanmar (8 %), and the lowest is 3 % in Vietnam. Although Lao's population accounts for the greatest proportion, Thailand's EWEC provinces account for the largest percentage of the provincial total among all EWEC member countries, up to 60 % (Asian Development Bank, 2010).

However, the corridor boundary contains many people living below the poverty line, according to a World Bank document (1995) - approximately 46 % of Laos' population lives in poverty, compared to 51% in Vietnam and 22 % in Thailand. The provincial GDP of the eastern EWEC nations (Thailand, Lao PDR and Vietnam) is distributed differently within their provinces. Many places still have a low GDP, particularly provinces on the border such as Mukdahan and Quang Tri (Figure 3.7). In general, Thai provinces along the corridor have an obvious higher GDP, indicating a higher standard of living than in provinces in Lao PDR and Vietnam.

In addition, during 1992-1993, before the EWEC existed, 53 % of the population in Lao's Savannakhet province was living in poverty. It fell, however, to an estimated 43% during 2002-2003 (Lao Statistics Bureau, 2011). In Thailand, there was an average of 39.9% poverty in 1992 in the northeastern provinces, which are mostly covered by the EWEC, but that number fell dramatically to 17.7 % in 2002 (National Economic and Social Development Board, 2004)*.

In Vietnam, the three poorest regions are in the northern uplands, the central highlands and the north central areas. Most EWEC Vietnamese provinces are bound between the lower part of the central-north and central coast. Over half of the population in Quang Tri and over one-third of the population in Thua Thien Hue are classified as poor, whereas provincial poverty headcount is lower in Da Nang at an estimated 16 % (Minot and Baulch, 2004).

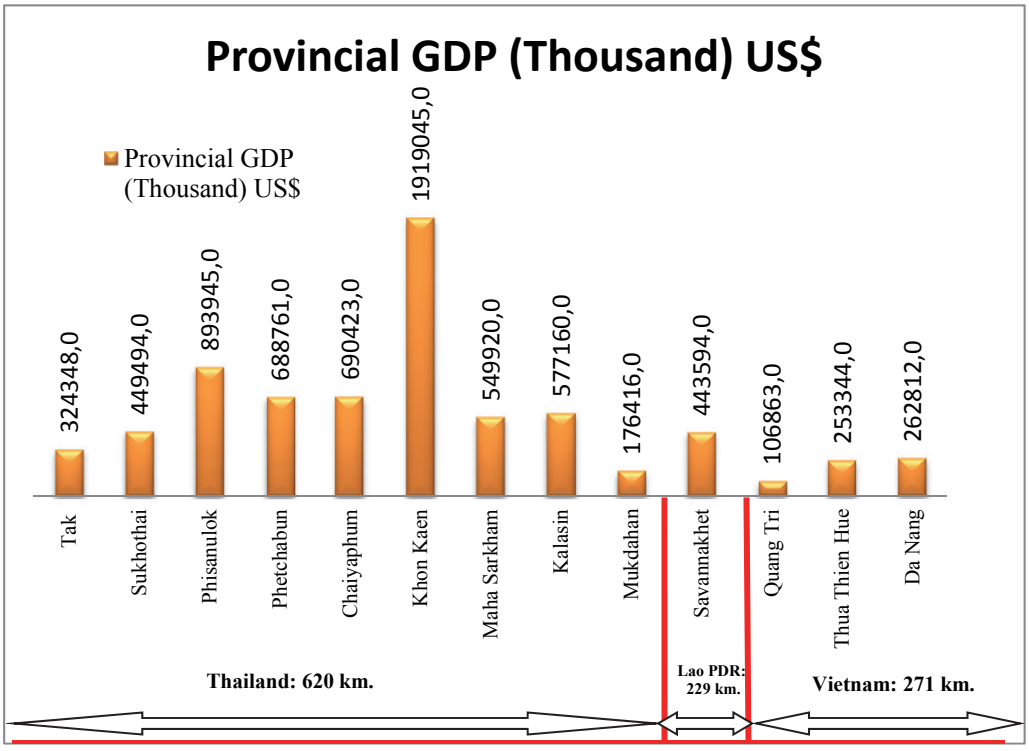


Figure 3.7 The eastern part of the EWEC provincial GDP (Asian Development Bank, 2010)

*This data is based on the head-count ratio using the official poverty line. However, using revised spatial price indices and other revisions, the calculated poverty incidence in 2002 for the northeast provinces is 21.9 % (see Jitsuchon, S., "A framework for Revised Official Lines in Thailand". Presented to UNDP and NESDB on Review of Official Poverty Line Project, 2004)

However, the Thai government has suggested a new policy to develop economic ties between Thailand and neighboring countries by clustering provincial groups along the EWEC in different levels of economic development. These levels are based on geographic conditions, administrative characteristics and capabilities of local organizations (Yongvanit, 2011). The policy was implemented directly corresponding to the development of major commercial interchange nodes. Regarding Thailand's situation, it is in the heart of the GMS at main corridors and junctions, so there are priority nodes serving as commercial centers and a tourism hub for economic expansion in the region. In particular, Phitsanulok is situated at the intersection of the North–South Economic Corridor (a linkage between Kunming (China) and Bangkok (Thailand) via Myanmar and Lao PDR) and thus, the EWEC is known as the Indochina Crossroad. It has the advantage of distributing trade and tourism movement throughout the region. Moreover, Khon Kaen serves as a central point along the EWEC and intersects the Vientiane (Lao PDR)-Bangkok route. It could be responsible for the central development of education and finance in Thailand's northeast.

3.4.2 Infrastructure Progress along the EWEC

1. Transportation roads

Transportation roads along the EWEC are distributed among the member countries as follows: 11% Myanmar, 54% Thailand, 16% Lao PDR, and 19% Vietnam. According to the action plan for 2008-2012, based on the 2001 Pre-Investment Strategy and Action Plan (Asian Development Bank, 2010), most road networks along the corridor are good quality highways. There are still some sections that will be improved and expanded into four-lane highways, for example, a 70km section of road from Kalasin to Ban Na Krai (Kuchinarai District) in Thailand. Also, in Lao PDR, from Sepon to Atsaphangthong, some sections of route No.9 in Savannakhet are in need of major repairs.

In addition, the EWEC is situated at the center of several Indochina crossroads of GMS corridors (Figure 3.8). For instance, the EWEC is intersected by the North-South Economic Corridor, which stimulates the economy and tourism between China and EWEC member countries. Recently, the route has been intersected by the Hanoi-Phanom Penh route at the Samakhet-Mukdahan border node. Beyond the above mentioned, there is a future plan to construct the Danang-Bangkok route called, Second East West Economic Corridor (EWEC-2), to facilitate the transportation of goods and services, including tourism distribution in the whole region (Asian Development Bank, 2010). Therefore, the EWEC acts as a pivotal corridor linking the major cities of Southeast Asia. It also serves as a transit route to connect main Southeast Asian hubs such as Bangkok and Singapore.

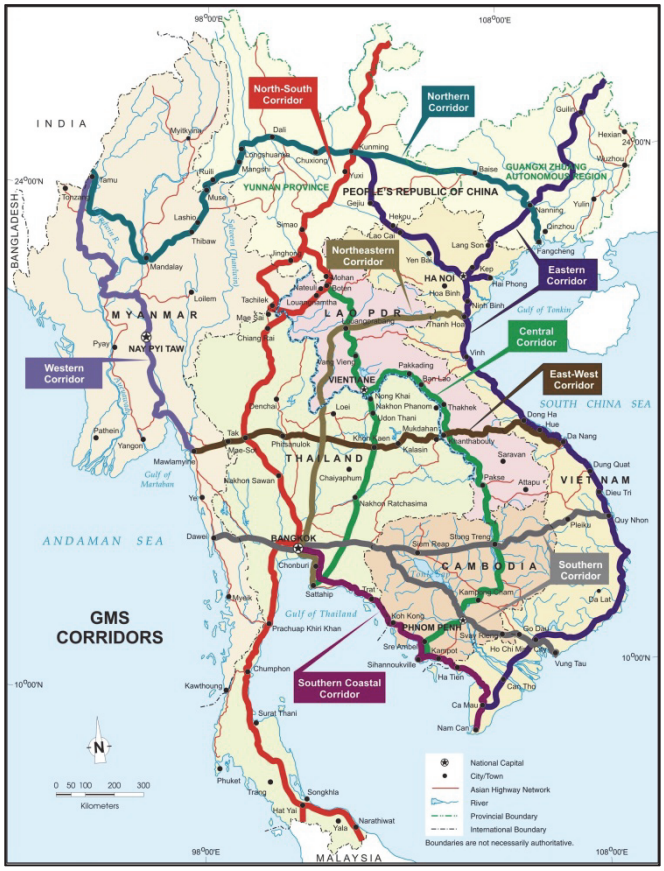


Figure 3.8 GMS nine road corridors (*Source*: ADB referred in http://www.boi.go.th)

To realize the EWEC transport corridor, the route was subsidized by the budgets from major organizations. For the eastern part of corridor running from Thailand to Vietnam, financial sources were provided by the Asian Development Bank (ADB), the Japan International Cooperation Agency (JICA) and the Japan Bank for International Cooperation (JBIC). In the western part of the corridor passing through Myanmar, the Thai government provided financial assistance for road design and construction.

2. Bridges and Tunnels supporting the EWEC

- The Second Friendship Bridge: connects Mukdahan (Thailand) and Savannakhet (Lao PDR) across the Mekong River and was opened to traffic in 2007. In the meantime, the EWEC became a large and growing transportation network for delivery between big commercial hubs such as Bangkok, Hanoi and Hong Kong.

- Hai Van Tunnel: it is the longest tunnel in Southeast Asia with a length of 6.3 kilometers. It was opened for official use in 2005 and supports the linkage between Da Nang and Hue on Highway No. 1 to facilitate the movement of goods and services. It later became an attraction point in Vietnam.

3. Da Nang Port

The Da Nang port provides sufficient modern facilities to satisfy customer demands. It has a multi-functional port, which handles, delivers, receives and stores cargo. It also serves piloting vessels in and out of the port, trading in land and marine transportation. The port facilitates 7 tugboats from 305 HP to 1,750 HP; 16 mobile cranes from 5 to 8 tons; 19 forklifts from 1.5 tons to 42 tons, including 2 reach stackers of 42 tons; 6 tractors; 11 excavators and 25 trucks of many kinds. Da Nang port stimulates regional trade and supports the circulation of goods around Lao PDR and northeast Thailand via Road No. 14B and Road No. 9, linked with the EWEC routes (Asian Development Bank, 2010). In addition, there is a plan to construct a deep-water port in Myanmar, but it has not yet been implemented.

4. Railway Network

The GMS members and ADB planned to establish a rail link in Lao PDR along the EWEC. This rail route will run through Atsaphangthong, Phalarn, Phin, and Sepon to Lao Bao on the Vietnam border. Then, the link will continue onward to Da Nang port.

5. Public bus service

The first direct air-conditioned bus service started in early 2008. The daily service covers three significant routes: 1) Khon Kaen to Vientiane (duration 5 hours), 2) Mukdahan to Hue in Vietnam (duration 5 hours) and 3) Mae Sot to Mukdahan (duration 13 hours). The bus services boost regional movement and tourism in this region (Yongvanit, 2011).

6. Other facilitating projects

Other facilitating projects operating through national governments and relevant organizations for supporting travel on the EWEC are mentioned here.

Cross-Border Transport agreement (CBTA)

The Cross-Border Transport agreement (CBTA) between Thailand, Lao PDR and Vietnam, the Tripartite Agreement, has been successfully operating since 2007. Under this agreement, vehicles registered in one member country are allowed to enter the other national territories (ADB 2010 EWEC).The CBTA intends to include six member countries in GMS to support cross-border movement of goods, people and vehicles. Unfortunately, full implementation of the agreement and its annexes and protocols were expected to conclude in 2009, but have not yet made it. In addition, the agreement would not be available for Myanmar.

Visa agreement

The ASEAN Tourism Agreement initiated in 2002 allows ASEAN national travel into and within the region without a visa. The agreement helps distribute tourism development throughout the region, but unfortunately it does not cover international travelers (Wong et al., 2011). However, a single visa for tourists travelling within ASEAN has been heavily advocated to be ready by 2015, (ASEAN Secretariat, 2011).

Moreover, the Asian Development Bank (ADB) has financed many tourism facilities and infrastructural projects, facilitating tourism movement in the Lower Mekong Basin, including the EWEC area. Besides this, the GMS Tourism Working Group (TWG) and the Mekong Tourism Coordinating Office (MTCO) also facilitate and support many sustainable tourism projects for developing tourism resources of member countries.

To sum up, the actual EWEC route and basic infrastructure are currently completed, but supportive and administrative procedures are still lacking, including sufficient border facilities (Banomyong, 2010). Moreover, the development of service facilities along Route 9 is still lacking, particularly in Savannakhet.

However, there has been a recent agreement among Laos, Thailand, and Vietnam to cooperate on further tourism developments at their national borders in three targeted adjoining provinces: Savannakhet (Laos), Mukdahan (Thailand), and Quang Tri (Vietnam) along the EWEC (Vinnaly, 2011). This will boost tourism and the economy throughout the region.

3.5 The tourist trend in EWEC members

As the EWEC is in Southeast Asia, it is situated in a tropical zone blessed with abundant sunshine and plentiful rain. It offers a number of touristic attractions and activities, such as idyllic tropical beaches, nature and wildlife, water sports, tropical food and cultures, shopping as well as health and spa. Due to this rich diversity, a number of tourists are enthusiastic to explore the region. Tourist arrivals to ASEAN countries have been considerably and consistently increasing (Table 3.2). The top ten tourist arrivals from 2007 to 2009 were from the following countries/regions: ASEAN, the European Union, Japan, the Republic of Korea, China, the USA, Australia, Taiwan, India, and Hong Kong SRC respectively (ASEAN Secretariat, 2009).

Regarding the UNWTO (World Tourism Organization) report in 2010, international tourist (worldwide) arrivals reached 940 million. This growth was particularly fast from -3.8% (decline) in 2009 (09/08) to 6.6 % in 2010 (10/09). Even though the world faced the global financial crisis in late 2008 and 2009, the tourism sector recovered more strongly than expected, particularly in the

emerging economies. In addition, the Asian Pacific region was the first region to recover with a relatively high growth rate of 13% in international tourist arrivals in 2010. Southeast Asia ranks second in this region, having increased its growth to 12.1% from 0.5% in the previous year, but Northeast Asia surpassed this with 13.8% growth in 2010. However, the average annual growth in Southeast Asia (6.8%) ranks the highest in the entire Asian Pacific region and second of all regions in the world.

Tourism contribution is a major socio-economic vehicle for increasing economic development. Over the past six decades, the tourism sector has continued expanding, providing new emerging destinations and diverse activities. It's becoming the largest and fastest growing economic sector in the world (World Tourism Organization, 2011).

Table 3.2 The number of tourist arrivals in ASEAN countries during 2005 – 2009

Country	Number of tourist arrivals (in thousand arrivals)				
	2005	2006	2007	2008	2009
Brunei Darussalam	127.1	158.1	178.5	225.8	157.5
Cambodia	1,421.60	1,700.00	2,015.10	2,125.50	2,161.60
Indonesia	5,002.10	4,871.40	5,505.80	6,429.00	6,452.00
Lao PDR	1,095.30	1,215.10	1,623.90	2,004.80	2,008.40
Malaysia	16,431.10	18,471.70	20,236.00	22,052.50	23,646.20
Myanmar	660.2	652.9	732.1	660.8	762.5
The Philippines	2,623.10	2,688.00	3,092.00	3,139.40	2,705.00
Singapore	8,942.40	9,751.70	10,287.60	10,116.50	9,681.30
Thailand	11,516.90	13,822.10	14,464.20	14,597.50	14,091.00
Viet Nam	3,467.80	3,583.50	4,149.50	4,253.70	3,772.30
ASEAN	**51,287.60**	**56,914.50**	**62,284.80**	**65,605.50**	**65,437.60**

Source: ASEAN Tourism Statistics Database (ASEAN Secretariat, 2009)

In the EWEC nations, numbers of tourist arrivals have tended to be similar. This upward trend of each nation has steadily increased even though it dropped in some years due to external problems such as natural hazards and the economic recession. Figure 3.9 presents tourist arrivals to the EWEC nations from when the EWEC project first started (1998) until 2009. Thailand had the largest share of visitor arrivals of the EWEC groups, and Myanmar had the smallest. In 1998, the number of tourists grew in Lao PDR (8%), Myanmar (4.8%) and Thailand (7.5%), but decreased in Vietnam (-12.4%). In 2008, a few years after the EWEC road was completed, the growth rate of

tourist arrivals was significantly higher in Lao PDR (11.3%) and Vietnam (8.9%), while Thailand slightly dropped down to 5.8% (ASEAN Secretariat, 2003, ASEAN Secretariat, 2008).

Lao PDR has tried to intensively develop its tourism sector and welcomes international tourists. It published its first national tourism plan in 1990 and a second National Tourism Development Plan in 1998. In the second plan, four types of tourism are emphasized: conventional sightseers, special interest tourists, domestic tourists and cross border tourists (Hall, 2000, Lao People's Democratic Republic (Lao PDR), 1990). Therefore, the tourism sector has become an important pillar for economic development of the nation since that time.

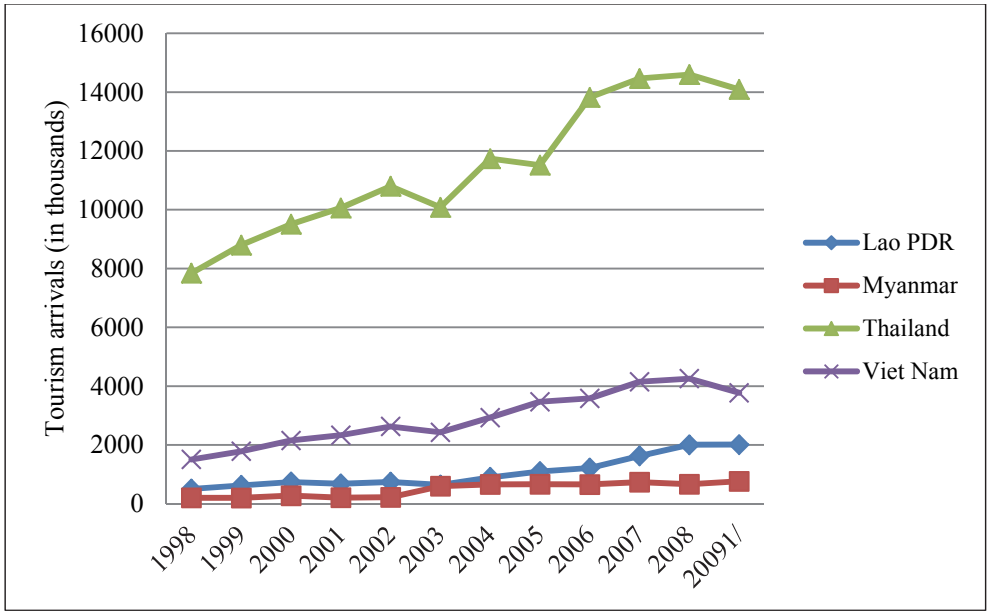


Figure 3.9 Number of tourist arrivals of The EWEC members

Whilst dividing the number of tourist arrivals to the EWEC region by provinces of each country from 2005 (before the completion of the EWEC road construction) to 2010 (Table 3.3), we found that the trend of tourist arrival was not dependent on the country profile but the specific region. At 2010, three provinces obtained the highest number of tourist arrivals were Khon Kaen (Thailand), Pitsanulok (Thailand) and Danang (Vietnam), respectively. On the other hand, the three provinces that had lowest number of tourist arrival were also found in Vietnam (Quang Tri) and Thailand (Kalasin and Maha Sarkham). After the completion of the EWEC road construction in 2006, the number of tourist arrivals was growing continuously over the period in most EWEC provinces except Mukdahan, Chaiyaphum, Maha Sarakham. The highest average growth rates of tourist arrivals comparing between 2005 and 2010 is Savannakhet (Lao PDR), accounted for 75.4% (Table 3.3). It was suggested that this surge of visitors may be the results of the grand opening of the 2nd Friendship

Bridge (between Thailand and Lao PDR), and Sawan Vegus Hotel and Casino in 2006 and 2009, respectively.

Table 3.3 Total number of tourists arrivals classified by provinces in the EWEC region

Country	Province	Total number of tourist arrivals						Growth Rate*
		2005	2006	2007	2008	2009	2010	
Thailand	Tak	752,667	820,849	903,711	1,095,478	1,055,776	1,334,082	15.4
	Sukhothai	612,409	632,964	706,514	856,436	656,015	810,620	6.5
	Phisanulok	1,800,058	1,900,108	2,071,448	2,511,009	1,667,680	2,156,814	4.0
	Phetchabun	485,244	495,859	632,692	766,949	823,140	1,226,193	30.5
	Chaiyaphum	945,164	1,089,708	1,216,586	1,152,509	571,425	731,361	-4.5
	Khon Kaen	2,369,894	2,458,854	2,570,011	2,393,512	2,443,631	2,749,436	3.2
	Maha Sarakham	409,578	445,259	479,060	350,040	417,285	316,788	-4.5
	Kalasin	378,645	398,251	422,479	325,105	394,820	424,109	2.4
	Mukdahan	927,209	947,678	1,078,099	894,333	868,088	891,499	-0.8
Lao PDR	Savannakhet	192,560	192,385	430,604	474,826	791,924	918,683	75.4
Vietnam	Quang Tri	204,742	258,000	n/a	n/a	n/a	470,400	26.0
	Thua Thien Hue	1,050,000	1,165,316	n/a	n/a	n/a	1,144,407	1.8
	Da Nang	659,456	774,000	1,022,900	1,269,000	1,350,000	1,780,000	34.0

* The average annual growth rates (%) were calculated from the growth rates of tourist arrivals at 2010 compared to 2005, and then divided by 5 (5 years).

n/a: Data is not unavailable

Source: 1) Department of Tourism (2011) and Tourism Authority of Thailand (2008), Ministry of Tourism and Sport, Thailand, 2) Savannakhet Provincial Tourism Department (2011), and 3) Institute for Tourism Development Research (2010), Vietnam

3.6 The EWEC Tourist Attractions

The EWEC supports not only movement of goods and services within subregions, including Southeast Asia, but it also transports tourists to attractions in many cities and remote areas. Thus, attractions in member countries are unveiled to national and international visitors. The study explored tourist attractions in three EWEC member nations: Thailand, Lao PDR and Vietnam, within 30 km above and 30 km below the EWEC line.

208 tourist sites were collected within the study area. These tourist attractions were described and classified according to their countries and provinces (see Appendix I). Thailand has the largest numbers of tourist sites along the EWEC, comprised of 150 sites, while 37 and 21 of them belong to Vietnam and Lao PDR respectively. In addition, each site was generally defined by type of attraction, making 7 tourism categories based on their major tourism purposes:

1) Natural tourist attraction (NT)
2) Cultural/Religious and Historical place (HC)
3) Viewpoint/Landmark/Monument (VP)
4) Tourism Shopping site/Market (SP)
5) Recreation/Entertainment (dam, man-made beach, and amusement park) (REC)
6) Arts and Sciences Educational tourist attraction/museum (research center, experimental station, exhibition, convention center) (AS); and
7) Agro/Eco tourism (AGCO)
8) Nature-based treatment/Spa (NBT)

Among the 208 tour sites, there are 61 attractions for NT, 88 for HC, 12 for VP, 5 for SP, 15 for REC, 24 for AS, 2 for AGCO and 1 for NBT.

3.7 Summary

This chapter has given basic information about Southeast Asia and used various dimensions to describe the capability of EWEC member nations to support the development of tourism across the region. The brief explanation of the EWEC's geographic features, national contexts, transportation, socio-economic situation, and tourism trends were explored. Finally, tourist attractions located within the study area were documented. These attractions will be entered into the GIS framework for further processing in the following chapters.

Chapter 4

Methodology

This chapter describes the research methods and tools that were implemented to respond to the main problem statement and objectives in Chapter 1 concerning tourism development along the EWEC route. The first process of the research methodology aims at generating a tourism database and to represent the potential tourist attractions. Second, tourist journeys were optimized according to the road networks of the study area. The final process presents alternative options for facilitating services and investments for tourism stakeholders. The chapter starts with the research methodology and design, and then moves onto the research procedures that were utilized, mainly the GIS. In the final analysis, specific applicable tools are explained, particularly the AHP and Network Analysis.

4.1 Research Methodology and Design

In order to summarize the research approach and strategy used in this dissertation, the research methodology is presented in a chart (Figure 4.1). It displays the research process step-by-step with specific tools, materials and data analysis. The two main purposes of this study were to evaluate the range of potential tourist attractions within the study area and to implement optimal itinerary models for visitors. The final step was to investigate the relevant tourism developments, which were involved in tourism facilities, services and investment plans. GIS acted as the main machine, integrating many geographical techniques and mathematical models (e.g. AHP, Spatial Analysis, Network Analysis, Descriptive statistics and Weight Linear Combination (WLC)) for retrieving the pertinent data needed for the research objectives, and for analyzing spatial and attribute data from the whole database.

The research methodology is divided into six processes. It starts with the data collection approach, followed by the organization of factors and criteria, and then the generation of a tourism database using ArcGIS software. From this process (database design and management) to the application process, all utilized data and techniques were manipulated in the GIS framework. The next process is data analysis which mainly involved spatial data analysis. Both attribute and spatial data were handled and manipulated by various GIS spatial techniques. The final process is an application which is classified into three sections: the assessment of tourist attractions' potential, optimization of tourist itineraries and finally, exploration of possible locations for new facility sites for investments and services. The research procedures are addressed in more detail below.

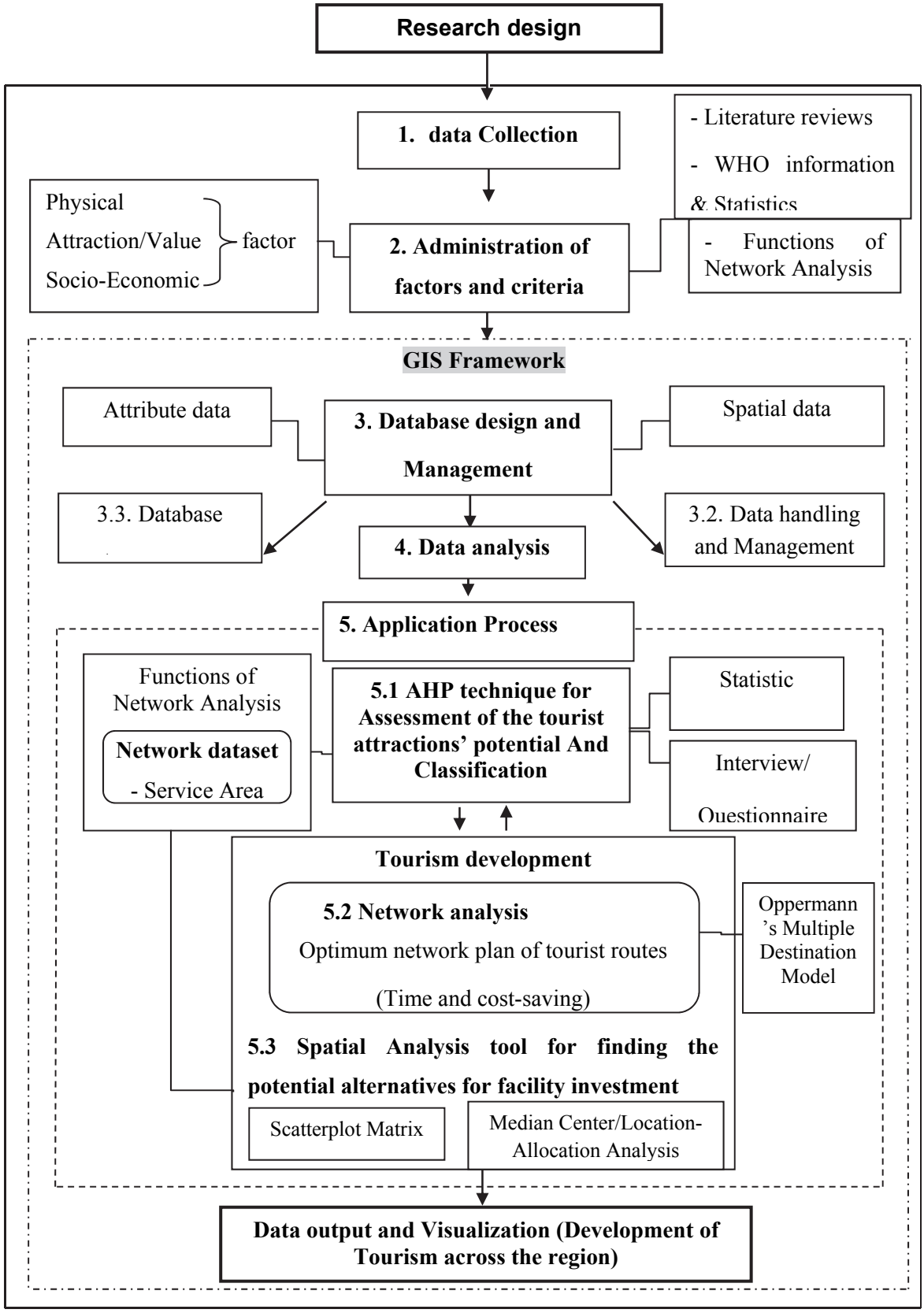


Figure 4.1 Research design

4.2 Data Collection Approach

Tourist attractions along the EWEC were collected from multiple sources, including fieldwork conducted in tourist sites during July - October 2009 and in November 2010. Secondary data sources came from relevant research literature, statistics, charts, tourism information found on national tourism websites and other tourism publications of each EWEC country. In addition, the information on endemic diseases in the EWEC areas was gathered from reports and publications of national organizations, whereas information on tourism facility services was available in digital data format from national organizations and surveys.

Using GIS, data collection included data input and storage. Data input refers to identifying and gathering required data for analysis and application. GIS data input are closely related to other disciplines such as surveying, photogrammetry, remote sensing and digitization processes (Kainz, 2009). The data input process transferred all data into compatible patterns used in GIS. It covered acquisition, reformatting, geo-referencing, compiling, and documenting data in an attribute table. GIS systems typically provide alternative methods of data input such as digitizing, keyboard and scanning. In this study, both spatial and attribute data structures were generated via the ArcGIS Desktop 10.0 software.

4.2.1 Data input

Data input in GIS is divided into six methods: 1) Data digitizing, 2) Scanning, 3) Global Positioning System (GPS), 4) Input of existing digital data, 5) Keyboard entry, and 6) Mouse entry.

1) Data digitizing: digitizing is a process that encodes analogue data (hard-copy maps or graphics) into digital data. There are different types of digitizing techniques, i.e., manual digitizing, semi-automatic digitizing and automatic digitizing. In manual digitizing, humans operate and control map features with a mouse device (cursor). This technique can be formed on a digitizing tablet or on-screen (head-up digitizing) to trace and record spatial data in digital vector structures of points, lines and polygons. In on-tablet digitizing, base maps fit on a special tablet and a cursor moves over the map to extract spatial features, whereas on-screen digitizing requires a scanned image loaded on the computer screen and then the cursor captures the outline of selected features. In both cases, data captured are sent to a computer and read by the software to display digital spatial features. In addition, users need to register control points to define referenced coordination of digitized data from given source materials. Therefore, whenever the cursor moves over the features of digitized sources, the locational data is associated with a known coordinate system.

On the other hand, semi-automatic or automatic digitizing also works on scanned images of the original maps, but uses the software capacities to automatically find features in the images. Some

unwanted features, however, might be digitized and shown in the results. The choice of digitizing techniques depends on the quality, complexity and content of input maps or images. Complex images with many details and colors, such as topographic maps and aerial photographs, are better suited for manual digitizing. On the other hand, it is better to use semi-automatic digitizing for images with only a few types of spatial features and which require users' interpretations. Fully automatic digitizing is suitable for drawing only one type of feature, such as contour lines and cadastral boundaries (Georgiadou et al., 2000).

Digital spatial data used in the study, particularly street networks, were created by manual head-up digitizing because most original map sources had complete information and various features and symbols. Therefore, most scanned images of base maps were loaded into the GIS and then digitized manually by the author. Other sources of digitized data were obtained from Google Earth, which allows users to trace the outline of objects on the screen.

Recently, Google Earth has become a crucial educational tool, as it gives users a comprehensive view of the Earth's surfaces. It offers enormous potential to explore the earth in a dynamic and interactive manner (Patterson, 2007). In addition, its functions allow users to create and digitize spatial features by following the features of the Google Earth satellite image on-screen. With an overlaying ability, it can display spatial features engaged in GIS with other layers. Data extracted from Google Earth in this study was saved in KML format and then transformed into compatible formats, such as a shapefile for ArcGIS Desktop software.

2) Scanning: Scanning is a method of data input used in GIS which converts analogue documents into a digital raster structure via a flat-bed scanner and a drum scanner. Scanning is usually done when users need to capture large amounts of data. Unlike the digitizing process, it is an efficient method for capturing just a few maps with minimal spatial features (Malczewski, 1999a). In general, photographs of maps and aerial photographs are scanned in GIS. For this study, various maps of Lao PDR and Vietnam were scanned to create complicated road networks in the city center and facility and tour site locations. These were comprised as follows:

- Vietnam Tourist Map from the Vietnam National Administration of Tourism, produced by the Tourism Information Technology Center with a scale of 1:2,200,000.
- Savannakhet Map (scale of 1: 6,500) produced by the Lao National Tourism Administration.
- Ho Chi Minh Trail, a tour circuit along EWEC in Savannakhet (scale of 1:500,000), produced by the Provincial Tourism Department, Lao National Tourism Administration.
- Savannakhet Tourist Map (scale of 1:1,250,000) produced by the Provincial Tourism Department, Lao National Tourism Administration.

3) Global Positioning System (GPS) from ground survey

GPS is a data input system that operates through a constellation of satellites orbiting above the earth, which are used to determine precise coordinate locations of objects. GPS is composed of sensors and normally needs at least four satellite signals to determine accurate locations. Geographic coordinates of particular points can be determined wherever sensors are located. GPS technology is widely developed and used in many fields of studies, such as geodesy, photogrammetry, surveying and logistics. Recently, vehicle tracking and navigation technologies have been developed for convenient and simple use, enabling real-time determination of vehicle location. In this study, some tourism facility and attraction site locations were indicated by using GPS during fieldwork. A total of 208 tourist attraction sites, 395 accommodation sites, 621 petrol stations, 834 hospital/healthcare centers and 61 public transportation stations were explored. In addition, some road networks were tracked on-site and digitized while driving through the study area. Then, digital spatial features with their geographic coordinates were transferred as point and line features in GIS framework.

4) Input of existing digital data: Some digital spatial data formats were contributed by the Department of Public Works and Town & Country Planning, Thailand. These were then imported and transferred to compatible formats for ArcGIS 10 software. This data was mostly composed of:

- Road networks in Thailand (1: 50000),
- Administrative boundaries in Thailand and National boundaries in Southeast Asia (1: 50000),
- Public transportation station in Thailand (airport and pier),
- River networks (1:50000) and,
- Some tourist attraction locations in Thailand.

In addition, most tourism facilities around Thailand were obtained from the Ministry of Transport, particularly accommodation, petrol stations, and hospital/healthcare centers.

5) Keyboard entry: This was used for attribute (non-spatial data) input, which included text and numbers describing characteristics of spatial data and other detail. Moreover, it was also utilized to control the operating system of the computer used during GIS operation.

6) Mouse entry: This is a pointing device used to identify objects on the monitor screen. It was applied to either select objects or enter graphic primitives (line, shape and symbol). In addition, it was used to generate and edit digital spatial data with GIS software.

4.2.2 Data storage

After the process of data input, GIS was applied to categorize and store all data into its database. The database was defined as a collection of non-redundant data gathered in the computer. Data storage enables data to be stored, retrieved, manipulated, classified, updated, and shared. The GIS database was able to generate either a geographical entity or non-spatial data (attribute) (Malczewski, 1999a). A geographical entity refers to objects represented as a geo-referencing coordinated real-world model, such as highways, buildings and national boundaries, while attribute data describes characteristics of objects.

Typically, Database Management Systems (DBMS) are chosen to employ GIS. There are different types of database structures classified by the model of data sets and their relationships. Healey (1991) broadly categorized DBMS structures into four types: inverted list structure, hierarchical model, network model and relational model. However, the relational model is used most widely for GIS databases. It is a flexible structure based on relational algebra, making it easy to modify and extend new relationships, data and records. In particular, it supports Structured Query Language (SQL).

At present, the Environmental Systems Research Institute, Inc. (ESRI) provides a geodatabase model in the ArcGIS package to collect and manage geographic datasets. It was developed in advanced functions, which are based on relational database concepts and leverage the strengths of the underlying database management system (DBMS). The geodatabase system has the ability to work with both geographic and attribute data in a variety of files and formats. For instance, it supports various spatial data sources (e.g. shapefiles, computer-aided design (CAD), and Geography Markup Language (GML)), as well as several types of information held in a common database file system, a Microsoft Access database, and a multiuser relational DBMS (such as Oracle, Microsoft SQL Server, PostgreSQL, Informix, and even IBM DB2 (ESRI, 2011c).

The geodatabase combines two types of geographic datasets (classified as feature class and raster dataset) and a simple tabular of spatial and attribute data. Other elements are attached to the table, such as a table system used to describe each geographic dataset, rules, and relationships (Figure 4.2). Personal geodatabases supported in ArcGIS Desktop package have high capacities to gather over 300 million features of individual datasets and provide scalability beyond 500 GB per file with very fast performance.

In the present study, all crucial files for the project were eventually bundled into the geodatabase system. The single-user personal geodatabase was created via the ArcCatalog module in ArcGIS Desktop 10 (Figure 4.2). Then, all elements used in the study were created under this

personal geodatabase. The detail of the database design and creation is described in the next process of GIS capacities under "database arrangement".

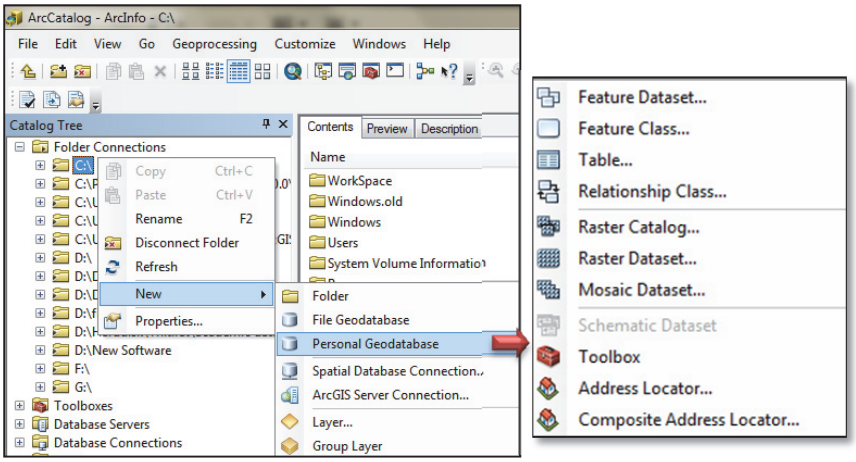


Figure 4.2 The creation of Personal geodatabase and datasets under ArcCatalog module in ArcGIS Desktop10

4.3 Administration of Factors and Criteria

The second process of the research design was to define factors and criteria for measuring the potential of tourist attractions. To develop the tourism sector, the most valuable tourism resources will attract a number of tourists and travelers. Basically, opening new routes like the EWEC and evaluating the potential of tourist sites is an initial step to investigate the current situation and characteristics of tourist attractions. The outcome not only benefits tourists who have never been to the study area, but also the tourist stakeholders who are responsible for developing tourist attractions as leading destinations in Southeast Asia. Besides, the study intends to find applicable ways of improving tourism resources and services to increase tourists' interests. At present, no research has evaluated tourist attractions along the Southeast Asian East-West Economic Corridor (EWEC). The factors that can support tourism at each tourist site should be considered. In this study, multiple factors were combined to evaluate the levels of potential that tourist attractions have. Multi Criteria Evaluation (MCE) was applied to model the set of criteria for relevant factors used in creating a spatial data in the GIS for the evaluation of tourist attractions' potential.

Multi Criteria Evaluation (MCE) is a potential tool to support decision-making, and is composed of various criteria concerning problems and objectives. It is used for evaluating alternative choices in a variety of different situations. In particular, the MCE technique can operate in the GIS framework. Carver (1991) successfully implemented MCE integrated with GIS to evaluate various alternatives on suitable sites for the disposal of radioactive waste in the UK. MCE, sometimes

referred to as multi-criteria decision analysis or Multi Criteria Analysis (MCA), was developed in the early 1970s (Carver, 1991).

In addition, the MCE can be used with many techniques to obtain criterion weight and overall evaluation outcomes. Combining weighting methods in MCE is necessary because various relevant evaluation criteria normally hold different important values. One of the most widely used methods for calculating relative criteria weights was the Pairwise Comparison technique developed by Saaty. This technique was commonly tied in the AHP (Analytical Hierarchy Process) context, which is a method supporting multi-criteria decision rules. Therefore, the present study integrated AHP into an evaluation model of potential tourist attractions along the EWEC. To calculate potential degrees of all alternatives (the EWEC tourist attractions) in this model, a Weighted Linear Combination (WLC) was then applied to multiply between various criterion rating scores and weights.

In the present study, multiple sets of criteria were organized into the three key categories and eight sub-categories as factors to assess levels of tourist attractions' potential:

1) Physical factors: composed of three sub-factors: accessibility, facility and seasonality.
2) Attraction factors: composed of three sub-factors: value/uniqueness of attraction, popularity and activity.
3) Socio-Economic factors: divided into two sub-factors: admission and risk of endemic disease.

All factors are considerably important when tourists decide on their destinations. These factors and their definitions are shown in detail in Table 4.1.

Table 4.1 Key factors and definitions

Factor	Definition
1. Physical Factors	
Accessibility	How easily tourists can access tour sites and time consuming it is. How many modes of transportation are provided to get there. Some attraction sites can be reached by various means e.g. public transportation (train, bus, and van), whereas others are difficult to access e.g. only with a private automobile or long walk.
Facility	Tourism facilities and infrastructure supporting the attraction, i.e. accommodation (hotel, resort and homestay), petrol stations, public transportation stations and hospital/health care centers. However, this factor relies on the availability of transportation to take travelers from touring sites to the facility they wish to use, and vice versa, within a specific time or distance.
Seasonality	Duration of available visitation time. Some tour sites can be open year-round, while others are limited to certain seasons because of weather or other local specificities.
2. Attraction Factors	
Value/Uniqueness	The value/importance of each site. This factor is considered separately, according to the type of attraction, such as a national tourist attraction, a historical and cultural place or an art and entertainment touristic site. The standard assessment of touristic value was modified to assign a numeric value to each site by using various indicators, such as: Scales of uniqueness (local/region/province/country), architectural integrity, the amount of biodiversity, benefits of the tourist site for the local community.
Popularity	Degree of acceptance, which is already known by local, domestic and international tourists.
Activity	Tourism-related activities are available at tourist sites to service and entertain tourists. Some places offer many activities such as camping, swimming, rafting, and shopping, whereas others have only few activities.
3. *Socio-Economic Factors*	
Admission	How much entry costs and how difficult access to tourist sites is. Some sites are open to the public, but some require a permit from local authorities or a high entrance fee.
Endemic disease	The risk a tourist has of being infected with a disease commonly found in a particular area of the tourist sites.

According to the definitions, each factor was developed as a set of qualifying criteria for measuring the potential of attractions, which is mentioned in detail in the following chapter. However, the information to support these key factors was derived through various sources and means, including fieldwork, interviews and relevant organizations. For example, accessibility and seasonality data were recorded through fieldwork, observation and asking local tourist authorities about the sites. Some factors were obtained by searching official websites via the internet, particularly endemic disease, admission and activity. For endemic disease, most data was gathered from reports of health organizations, such as the Center for Disease Control and Prevention, which have health information for travelers, disease outbreak reports of the World Health Organization (WHO), and Avian Influenza reports from the World Organisation for Animal Health (OIE).

In addition, value/uniqueness factors were derived from modified standard assessments of tourist attractions contributed from online publications of Thailand's Department of Tourism and Ministry of Tourism and Sports. Some tour sites in Thailand directly received a value/uniqueness score by this organization, while other tour sites were informed by online information and tourist authorities of provincial tourism centers. To harmonize this data from different sources, it was adapted to correspond to the standard assessments used above for interpretation.

For the facility factor, all tourism facilities were calculated in order to find the boundaries of their service areas based on transportation networks of the Service Area analysis in the Network Analyst module.

4.4 Operation of Database design and Management

Under the framework of GIS, tourism information has been transformed to compatible formats of the GIS models and collected in databases. All received data was operated through ArcGIS Desktop package version 10. Most tourism information was organized into layers of data models.

A data model is defined as "the logical frameworks used for various geographical representation in digital database" (Goodchild, 1992). It is represented as a structured collection of geometric primitives, which are point, line and polygon for 2 dimensional structures, and volume for 3 dimensional structures (Table 4.2). The spatial reference system of each location used in this dissertation is the Universal Transverse Mercator with the WGS 84 datum.

In the study, GIS capacities were applied to many processes of data management, analysis and even visualization. The first process of data collection was already mentioned in section 4.2. The next process explains the database arrangement, data handling and manipulation. Finally, major functions adopted for operating data analysis are displayed in the data analysis process.

4.4.1 Database arrangement

All data in the GIS database is organized separately by theme or data set, which is shown as layers. Layers are often thought of as similar to individual overhead transparencies that can be stacked to show spatial relationships between them (Figure 4.3). Each layer contains information of a different nature and is considered as a variable capturing a phenomenon on the Earth's surface. Attribute data of each spatial layer is attached automatically as a georeferenced attribute table or internal attribute. Some attribute tables are created separately as external attributes, but they can be merged with other tables by using the same geocoding of common fields. Most created layers and their attributes for the study are stored in a Personal Geodatabase. A process of database creation in ArcGIS is explained step-by-step as follows:

1) Identify the key data themes based on information requirements under Personal Geodatabase containers created for the study. Some examples of key themes are: road network dataset, the EWEC national boundary dataset and tourist attraction dataset.

2) Design feature elements used in the dataset themes (Figure 4.4). The feature elements (e.g. feature classes, network dataset, terrain, and topology) are created depending on the type of data and purpose of users. For example, road network dataset required network dataset and topology as feature elements.

3) Identify the types of feature classes stored in the datasets, i.e. point, line, and polygon.

4) Define tabular database structures and behavior for descriptive attributes (e.g. identify field, column, data value, and relationship)

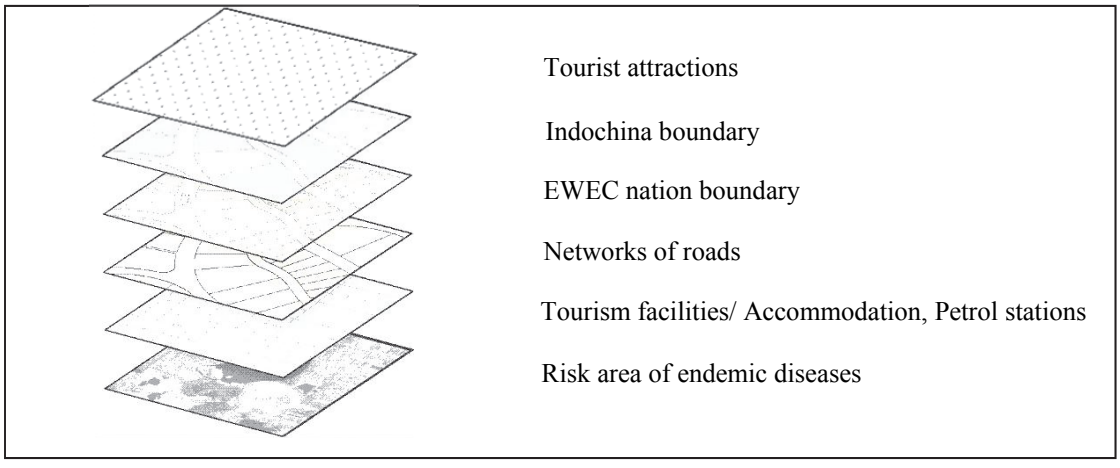


Figure 4.3 Examples of spatial data layers

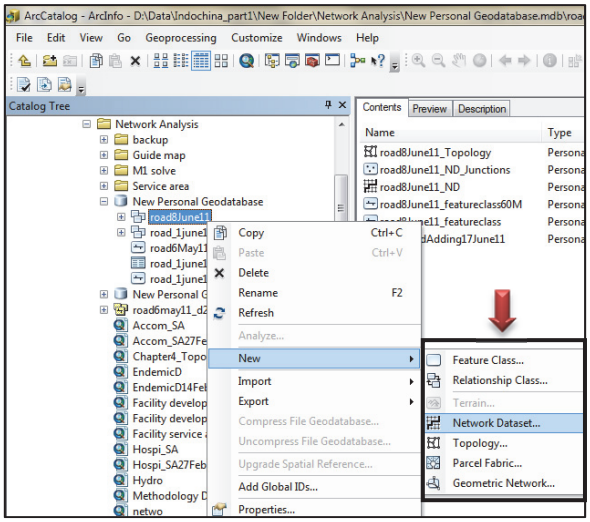


Figure 4.4 Creation of feature elements in datasets

After the database is created, database management is simultaneously done. The database management is classified into a spatial database arrangement and attribute data arrangement. Even though database arrangement is described separately by specific types of data as spatial and attribute data, GIS serves as a special system, which is able to link spatial and non-spatial attribute data. GIS users can update, query, and examine information about where things are and what they are like at the same time, and can also be bi-directional, from spatial data to attribute data, and vice versa (Kainz et al., 2000).

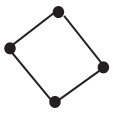
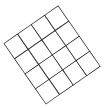
4.4.1.1 Spatial database arrangement

Spatial data in the database is arranged into two different types of data structures: 1) Vector data structures and 2) Raster data structures. Vector data structures are spatial entities represented by strings of coordinates. GIS database will represent the real-world features of vector structures as point, line and polygon models. Points are represented by a pair of coordinate values, whereas lines are represented by at least two pairs of coordinates at the start and end node. However, polygons are composed of many pairs of coordinates with the start and end node at the same coordinate, like boundary or area models (Table 4.2). Each object's spatial entity has identified a key to link the attribute to the entity. The attribute describes detailed features in tables, which relates to their spatial model. In vector structures, spatial relationships between objects are identified by topology. Topology allows GIS to perform manipulating and analyzing functions on spatial database models. This will be mentioned in detail again during the process of data handling and management.

Raster data structures, known as field-based models, are arranged in two-dimensional matrices of uniform grid cells (pixels) on regular grids. Raster structures represent spatial phenomena as being continuous, where a grid or field value can be determined at every point in space. The spatial resolution of data is affected by the size of the grid. The finer the cell size, the better the image

resolution representing spatial objects. Although, the greater resolution provides detail that can be distinguished in images, it requires a lot of computer memory and time for processing. Users need to consider the available hardware and their purposes for determining the size of grid cells.

Table 4.2 Examples of Vector and Raster representations of points, lines, and polygons

Data model	Spatial data structure		Examples of data used in research design	Description of attribute
	Vector	Raster		
Point			Locations of tourist attractions	Name of attraction, address, and value scores
Line			Streets	Length of road, name of road, road number
Polygon			Boundary of national country	Name of country, area

Both vector and raster models have advantages and disadvantages, and the model used depends on the users' purpose and data structure required for research outputs. The raster data structure can represent continuously varying data such as rainfall, temperature or elevation. It is also convenient to match with a format of satellite imagery. A vector data structure enables GIS users to closely represent real world elements as accurately as possible. In addition, every spatial data model of vector data structures is able to generate specific topology. Unlike the raster, the only topology of cell adjacency is implicit in representation (Malczewski, 1999a). However, in the present study, the vector data structure was suitable to manipulate and analyze native spatial data via GIS, particularly point overlay and network analysis. Therefore, this study implements vector data structures to complete research purposes.

4.4.1.2 Managing Attribute Data

Attribute data arranged in a database can be classified into two types of data: first, georeferenced attribute or locational data, which relates to locations of their spatial features in geographical space; second, attribute data, which describes properties and features other than their locations. These different types can be stored separately or tied together. GIS users can arrange the relationships between attribute tables according to their research design or purpose. The attribute data in the GIS database applies the relational model concept. In vector data structures, all spatial models are automatically given a unique identifier by the system, called the object ID. This object ID can be used to link the spatial features with their internal attribute table. The attribute data can be arranged to link other external attribute tables by using a primary key. A primary key can be represented by the object ID or by creating a unique value in a single column (common field) which allows each row to be uniquely identified in the table. Typically, when an adjoining table is required, primary key fields from one table look for matching keys to combine attributes in other tables where it is a foreign key.

The attribute data can be linked by common GIS commands such as joining and relating tables. The *join* and *relate* functions allow users to link two tables together when the information needed is not in the current table. In a GIS database, *join* operator is used whenever tables have common fields (primary key/foreign key) of the same data types (e.g. number to number/ string to string). It enables attribute tables to be joined, in either one-to-one or many-to-one relationships. *Relating tables* is used to operate a relationship between two tables, but the associated data is not appended to the layer's attribute table like it is with a *join* operator. Instead, you can access the related data when you work with the layer's attributes. The *relate* operator allows two tables to be linked in a one-to-many or many-to-many relationship.

In the study, *join* operation was used many times to manage multiple tables and hold information in one attribute table to prepare for analysis and visualization. For example, Figure 4.5 displays combined data from the Tourist Attractions table with the EWEC Country-Boundary table. The **Country_C** field was used as a common field to join via the Join Data command on the Table Option icon (see dialog box of Figure 4.5). Therefore, the output table inserted the attributes in the EWEC-Country-Boundary table (country_name field, provincial name field, and others) in the Tourist Attraction table. In addition, the Tourist Attraction table was designed to collect varieties of attribute data, not only descriptive information about attractions, but also valuable details of each factor used in calculating potential levels of tourist attractions.

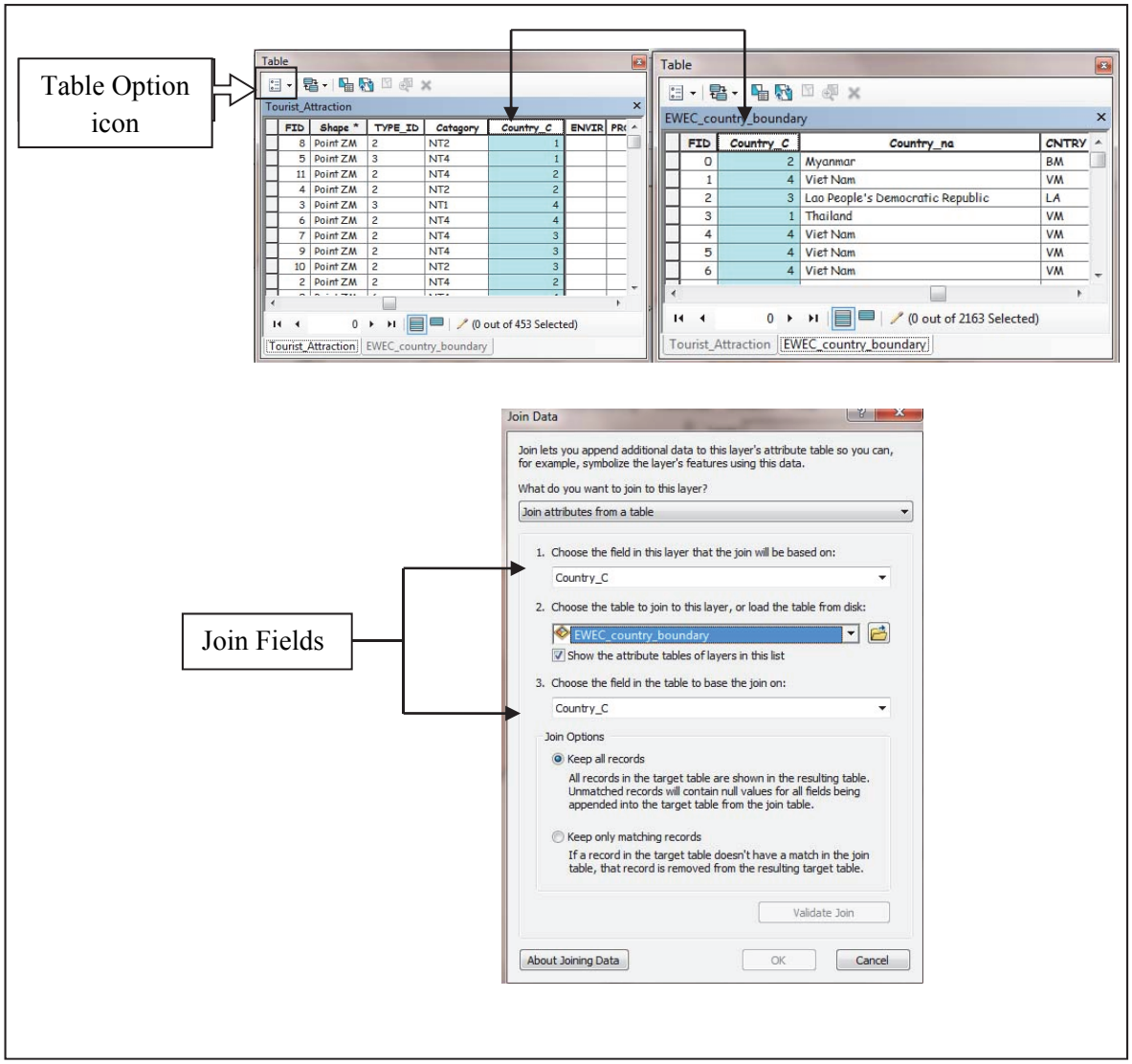


Figure 4.5 Demonstration of Join command in ArcMap module (ArcGIS Desktop 10)

4.4.2 Data Handling and Manipulation

Data handling and manipulation are fundamental processes used to prepare data for analysis and application in GIS. These operations consisted of the most basic GIS functions: Measurement, Boolean Operators, Transformation, Querying, Topology, Classification, Query and Selection.

1) Measurement: Measurement functions can measure on most spatial models of point, line, polygon and volume. The functions can calculate the total number of points and lines, as well as the number of points and lines within a polygon and are called *point-in-polygon* and *line-in-polygon*. Besides, measurement functions also enable distances between two points to be calculated, or route lengths, such as tourism and bus routes. The area measurement can be operated by measuring the distance around a polygon, the extent of an object, and the perimeter of a polygon area (Malczewski,

1999a). In ArcGIS package, this feature enables measurement of real-world distances and areas with an interactive on-screen map display tool, which requires using a mouse to draw a line between two destination nodes (points) or to draw a polygon.

2) Transformation: This process applies to data structures, data models, and coordination and projection systems. As the author mentioned, the study focuses only on vector data structures, so transformation from vector to raster and vice versa will not be used here. There are two types of transformations used in the study: reference coordinate system and data model transformations.

- Transformation between coordinate systems. The spatial reference of features is defined by their coordinate system. The geographic coordinate system is used to indicate locations of features on the surface of the earth. For the manipulation of all data in GIS, users initially have to define the coordinate system for their projects, and it is necessary that all features in one project be in the same coordinate system for implementation. In general, users obtain spatial data in different coordinate systems, and transformation changes all data into a common ccoordinate system. Geometric Transformations and sets of parameters are applied to transform data from one system to another. In the ArcGIS package, the projections and transformations toolset can be used to rectify required coordinate systems. The present study identified all spatial data layers as a system of Universal Transverse Mercator (UTM), with the WGS 84 datum. The study area covered two local zones of UTM: Zone 47 North and Zone 48 North. In the study, many derived spatial data were geographic coordinates systems (latitude–longitude) which needed to be converted into UTM coordinates.

- Data model transformation refers to the changing forms of spatial data models among point, line and polygon. The transformation can apply all spatial feature models onto patterns of point, line or polygon by using the Features toolset commands under the Data Management Toolbox in the ArcGIS package. For example, the point feature class for tracking routes obtained with GPS during fieldwork was converted to line feature class (Figure 4.6) for road networks. This transformation was operated by means of the *Point To Line* command under Feature tools in the ArcToolbox module.

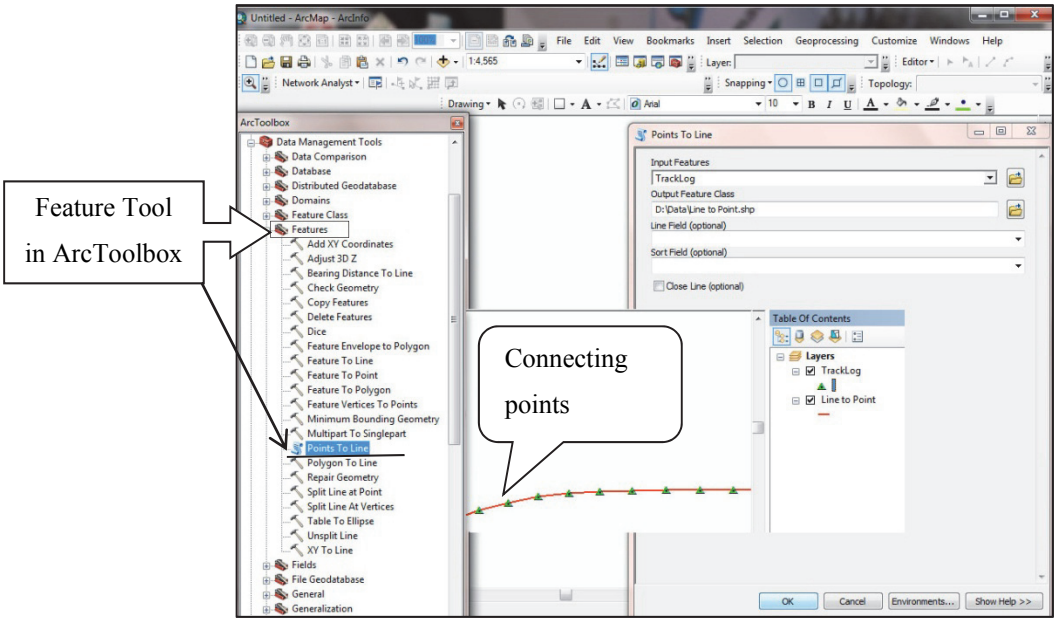


Figure 4.6 An example of transformation among data models by using the Point to Line command in the Feature toolset

There are also file format conversion tools. If geographical data is produced by different programs, it might have different original file formats, such as Shapefile (ArcView/ArcGIS), KML, KMZ (Google Earth), Tab (MapInfo), CAD (Computer-aided design software packages) and so on. However, GIS users are able to convert these into common formats that are applicable in the different projects. In this study, all data were transformed into compatible ArcGIS formats, such as Shapefile, Feature Class of Geodatabase and Coverage.

3) Topology: A spatial relationship among features is explained by a form of connection called topology. Topology is the part of mathematics dealing with the persistence of relationships, which do not change under transformations. In vector data structures, the spatial relationship will be generated on points, lines and polygons. There are three main important types of relationships: connectivity (lines are connected at nodes), adjacency (polygons are touched or adjacent if they share a common boundary line), and containment (one polygon can contain another feature, like an "island"). The topology rule is a very useful tool to check the consistency of GIS databases and perform query and spatial analysis functions.

In this study, topology was used for making relationships among road networks that were represented by a set of arcs or links and a set of nodes. In transportation analysis, the network topology link possesses various characteristics, particularly link length (meters or kilometers), link cost (travel time) and link capacity (maximum flow). The node represents an origin or destination of place to movement, and is able to serve as a junction which connects two or more links (Bell and Iida, 1997). The topological networks of roads are an essential feature when operating in Network

Analysis, and contribute to the manipulation of tourism facilities' service areas. These areas are one of the key factors indicating the potential of tourist attractions in the study. In addition, road topology was used in this research, serving as a network dataset in the Network Analysis function for designing optimum tourist routes. Topology generation in ArcGIS consists of the following main steps:

- Create a new feature dataset named "*Streets*" for generating the topology under Personal Geodatabase in the ArcCatalog module.
- Import spatial features used for generating topology into the created feature dataset (Streets). In the study, a line feature class named "*Street network*" of the study area was imported into the spatial feature dataset.
- Generate the topology dataset by clicking right on the created feature dataset (Streets), and then select *New* → *Topology* (Figure 4.7).

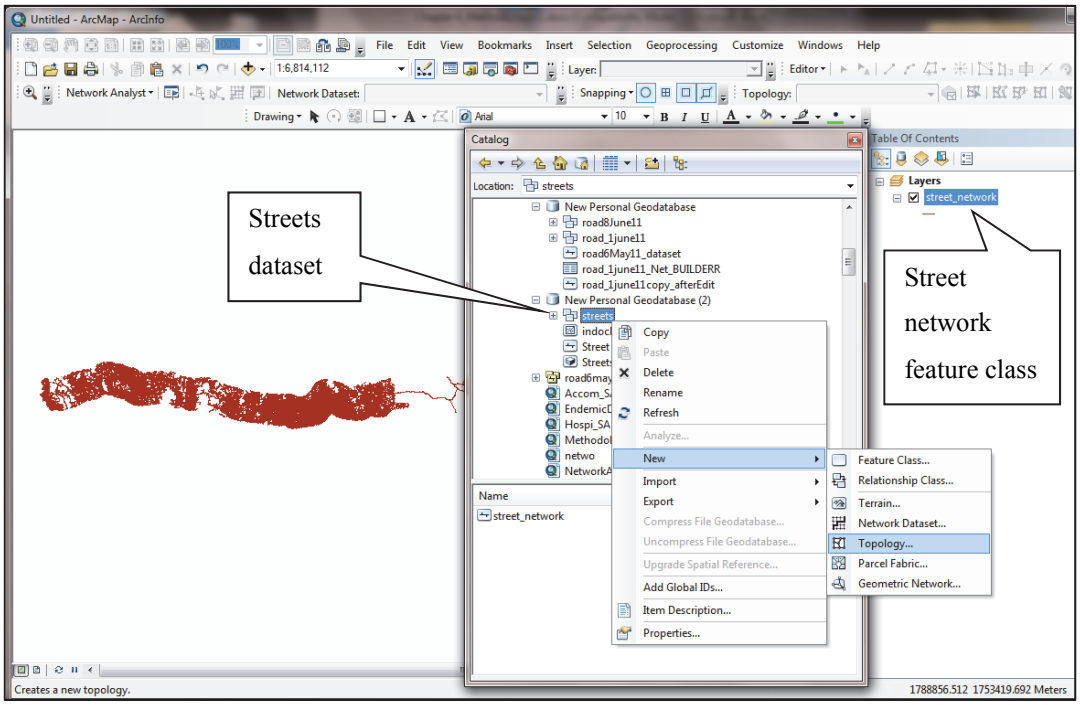


Figure 4.7 Creating new topology in the ArcCatalog module

- Under the new topology dialog box (Figure 4.8), users are required to create a new name for a topological feature class and to define a cluster tolerant referring to an area that encompasses all vertices and boundaries of the spatial features that will be snapped within the indicated distance range. In this case, *Street_Topology* was named for the new topology feature class of the *Street network* and a cluster tolerance was 0.001 meters.

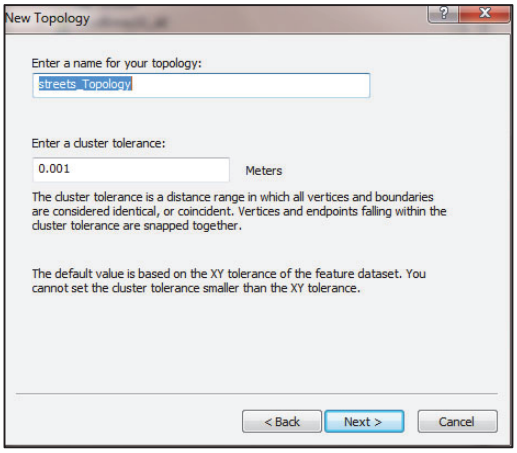


Figure 4.8 New topology dataset

- Then, spatial behaviors, spatial relationships and integrity rules for a new topological feature class (*Street_Topology*) were designed (Figure 4.9a). For example, rules were designed so that all streets split where they intersect other streets and so no street lines overlap and that street segments connect at the endpoints. These rules are used to specify the spatial relationships between and within feature classes (ESRI, 2003). The rules in the Figure 4.9b demonstrate the major rules of line feature classes in the study.

- Validating and editing topology. These steps are very important parts of the processes for GIS users because the correction of topological spatial data can indicate the quality of the GIS database. Therefore, spatial features needed to be checked for data integrity before they were brought to advanced spatial analysis. In this step, it took a very long time to correct and validate spatial data, mainly *Street_Topology,* which had to be manipulated in Network Analysis for the subsequent process. Validating the topology assists users to check data integrity by checking the topology features against the rules. In the ArcGIS software, the *Validate Topology* command can be done immediately after finishing a topological operation by clicking the *Validate Topology* button in the Topology toolbar in the ArcMap module (Figure 4.10).

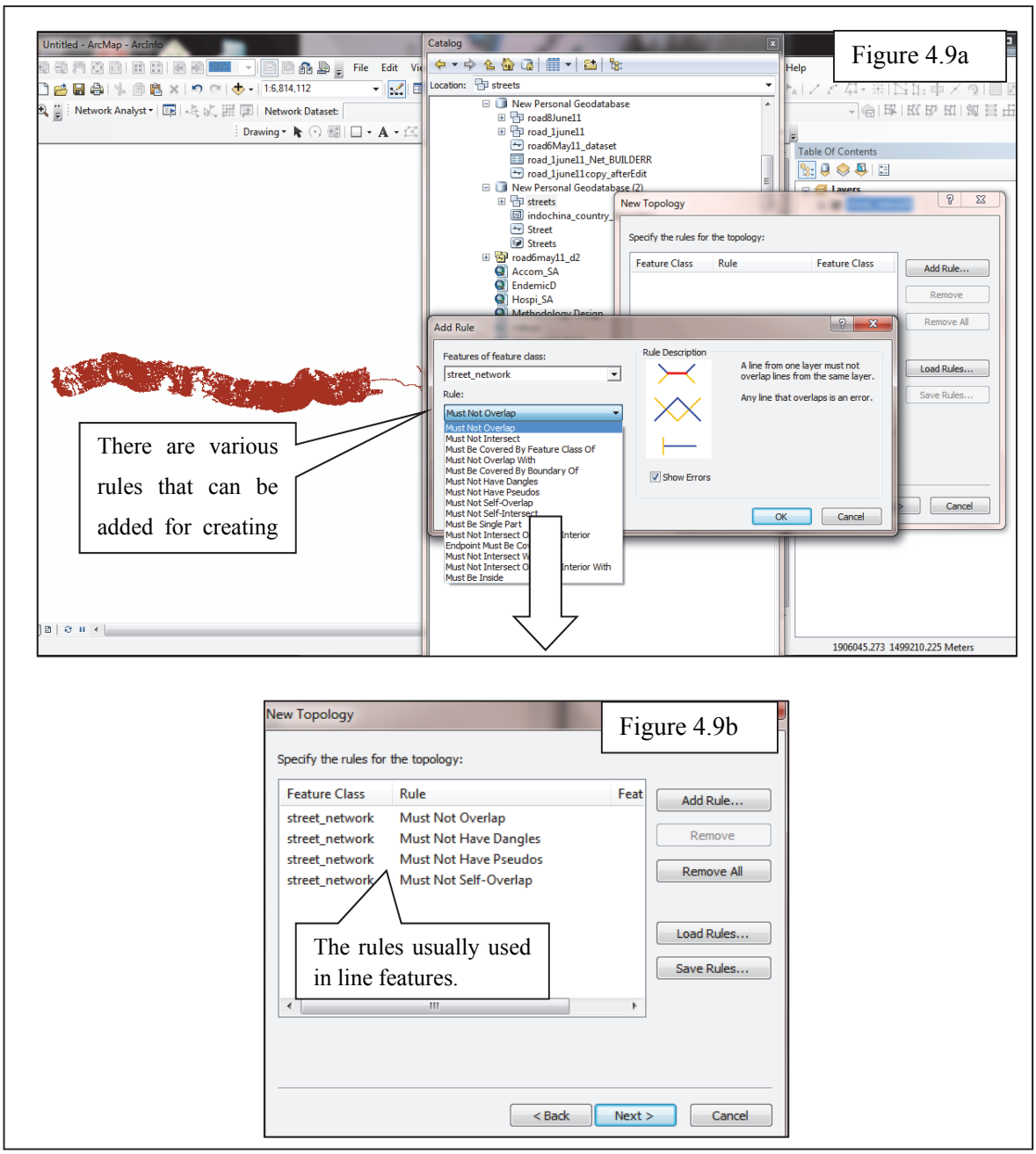


Figure 4.9 Adding spatial relationships and rules into topological features

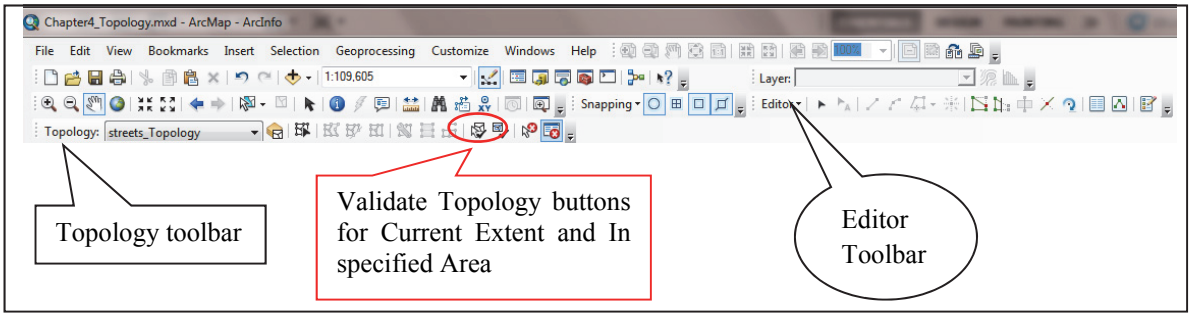


Figure 4.10 The Topology and Editor Toolbar in the ArcMap module

Whenever Validate Topology is performed, all vertices are first checked for snapping within the cluster tolerance, and then they are verified for sharing and adjacency regarding the defined rules. The identified rule violations are invalid for topological acceptance and are marked as errors. These are displayed in the ArcMap module as the ■ symbols and listed in the Error Inspector tool (Figure 4.11). Basically, users are allowed to edit and correct errors by using the Editor Toolbar (Figure 4.10), which provides various tool functions to fix the errors and update feature spatial elements. Moreover, users are aided for editing errors by using the Topology Edit Tool set in relevant commands, such as Show Shared feature, Fix Topology Error tool, Validate Topology in Specified Area and Error Inspector (Figure 4.11). This is a practical alternative way to work with topology editing. In addition, the Error Inspector window is a very useful tool to show not only the types of errors against the rules, but also the methods for resolving each error (Figure 4.11). In this study, there were 13,517 errors from 99,630 features in the *Street_Network* dataset that needed to be fixed. A number of error cleaning methods is illustrated in Table 4.3. However, some symbolizing errors were marked as *Exception* if users decided that they were not real problems in particular nodes at a cul-de-sac.

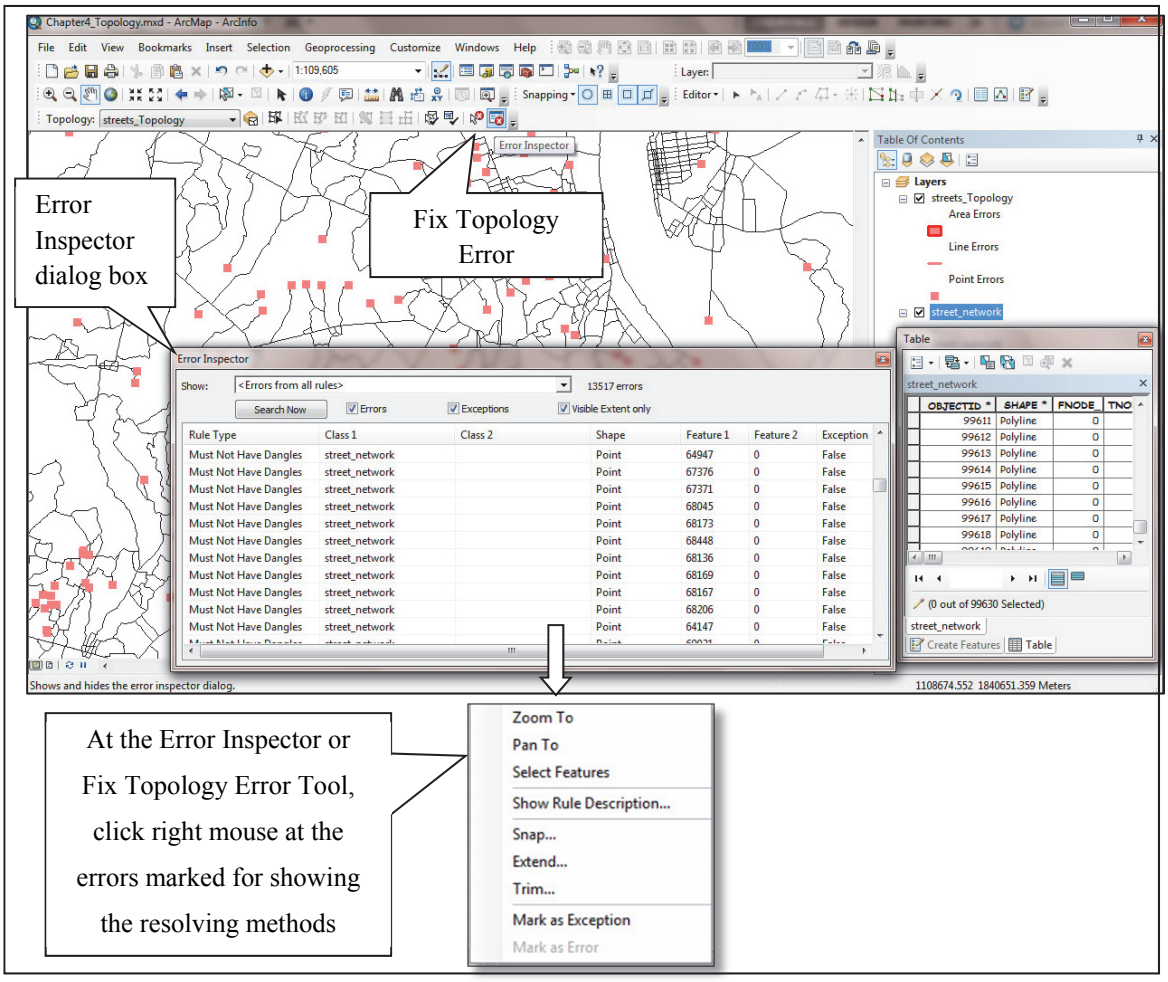
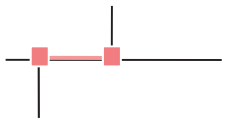
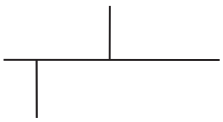
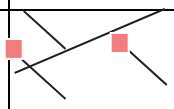
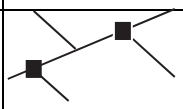
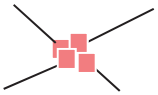
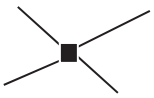


Figure 4.11 The Validating Errors and Error Inspector tool

Although there are diverse and flexible editing tools provided by ArcGIS interface, users still have to control, determine and correct shared geometric and topology features. Therefore, this process was highly time-consuming to get a high quality of topology database.

Table 4.3 The numbers of error-resolving methods found in ArcGIS geodatabase topology

Type of Errors	Before resolving	After resolving	Resolving Methods
Must Not Overlap			Subtract: remove the overlapping line
Must not have Dangles			Extend undershoot dangles and trim overshoot dangles
Must Not Have Pseudos			Merge one line with another line to change the endpoints to vertices
Must Not Self Overlap			Simplify: remove self-overlapping line segments from features
Unsnapping nodes			Snap clustered nodes

4) Classification and Reclassification: Classification is one technique often used in GIS database to set groups of input data and assign values to each group's element. Aggregating features into classes enables different patterns of classes to be displayed with a symbolizing system. There are two types of classifications: manual classification (user-controlled classification) and automatic classification (standard classification scheme).

Manual classification is a classifying technique, which users create manually. They are able to indicate classes of features after they have already designed the specific classification parameters and criteria. Classification may be defined by a particular range of attribute values or by indicating the above or below threshold values for each class, for instance, the range of national GDP of the EWEC nations. This data could be classified into two groups of lower GDP and higher GDP when comparing the average GDP per capita of the Southeast Asia countries. In some cases, classifications

are defined by the fields of attribute data regarding the Unique Values classification scheme. For example, the groups of tourist attractions were categorized by type of attraction, such as natural, cultural, entertainment, or shopping sites. In the ArcGIS interface, classification functions are provided on the Layer Properties window. Users are allowed to select the type of classification from the Categories command, depending on fields of attribute data, and they can then choose Value Field to classify (Figure 4.12).

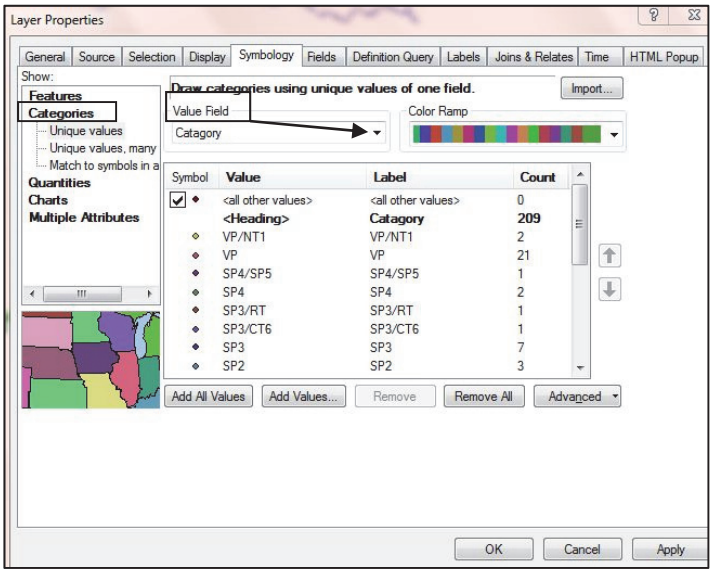


Figure 4.12 Layer Properties window for classifying by field

On the other hand, automatic classification allows GIS software to classify automatically according to numeric values. There are two main parameters in a classification scheme that users have to define before running automatically. The first is the number of classes in the output data set, and the second is the methods of determining break points to assign classes. In ArcGIS desktop 10 (used in this study), five methods are provided for this classification: (1) equal interval, (2) defined interval (3) quantile method (4) natural breaks (Jenks) (5) standard deviation and (6) geometric intervals (ESRI, 2011a). These methods are always applied to classify the quantitative data of vector and raster data structures in numerical fields.

Equal Intervals: This method classifies the range of possible values into equal-sized intervals of each category. The interval size is calculated as $(max - min)/ n$, where n is the number of classes chosen by the user and max *and* min are the maximum and minimum values of the entire data. This option is useful to display the distribution patterns of data and highlight the extreme groups.

Defined Interval: Users specify the equal interval size used to define a series of classes and then the computer selects the attribute, which has values within class boundaries to put in each class.

Quantile method: The range of possible values is divided into unequal-sized intervals so that each class contains an equal number of observations. This option is useful to highlight phenomena in the middle values of the distribution. However, the result can be misleading because widely different observation values may be assigned in the same class (Longley et al., 2005).

Natural Breaks (Jenks): This method is widely used in the GIS package and is given by the Jenks algorithm. It classifies attribute values from apparent natural groups of data values (Longley et al., 2005). The breaks are computed by the variance-minimization model. Attribute values are assigned to separate groups if a large different value is found. Typically, this method has unequal class intervals because the class break depends on the maximum value change between classes.

Standard deviation: The method calculates the mean and standard deviation of total attribute values. The attribute value is classified according to the distance of observations from the mean. Class breaks are created with equal value ranges that are proportionate to the standard deviation. This method, integrated with natural breaks (Jenks), was applied to calculate class for the output of the evaluation of tourist attractions' potential.

Geometric interval or smart quantiles: This technique defines class breaks based on class intervals that have a geometrical series. The geometric coefficient in this classifier can change once to optimize the class ranges. It creates a balance between highlighting phenomena in the middle and extreme values.

Overall methods of standard classification schemes mentioned above can be generated via the Symbology tab under Layer Properties in the ArcMap module of the ArcGIS package. Under the Symbology tab, users have to click on the Quantities command, and then on the Classification button to select the type of classifying methods and to indicate the class number (Figure 4.13).

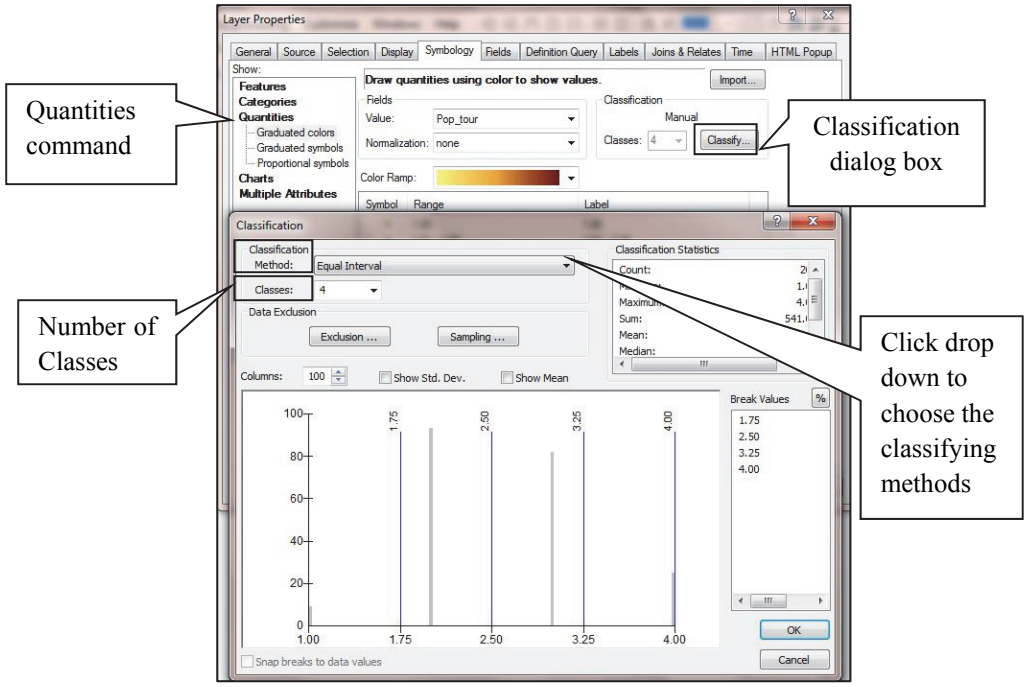


Figure 4.13 Standard classification methods in the Layer Properties window

5) Querying and Selection: Query processes are usually used to retrieve and extract information from the whole GIS database. It works as a filter that initially accesses and selects data according to the criteria used in the study. To develop multiple variable measurements for finding the potential levels of tourist attractions, query and selection were always used to prepare data for subsequent manipulation, or even analysis. Basically, the query process is based on Boolean algebra created by George Bool (1815-1864). The Boolean system is a mathematical logic which has been widely applied in GIS data manipulation in particular (Albrecht, 2007). A basic set of Boolean operators comprises Union (logical operator "OR"), Intersection (logical operator "AND") and Complement (the logical operator "NOT").

A set of Boolean operators is always used in the database to query many different results, depending on the combination of two or more operators. Usually, the GIS database is composed of large and complex tables, and then the ArcGIS package offers various options of query expressions for multiple purposes. An alternative way to query the database is by using the structured query language SQL attached in the ArcGIS package. Users can select some features and their attributes through syntax in the Definition Query space (Figure 4.14). In this figure, the accommodation layer was selected from the syntax command *'"COUNTRY" = 'Vietnam' AND "CITY" = 'Danang'"* with the Query Builder button. The result of the query is displayed in the table, showing 60 accommodations available in Da Nang City, Vietnam. However, the Definition Query can operate in one attribute table of a feature layer. The Selection function in ArcGIS provides complicated functions which allow users to operate queries on multiple attribute tables and layers.

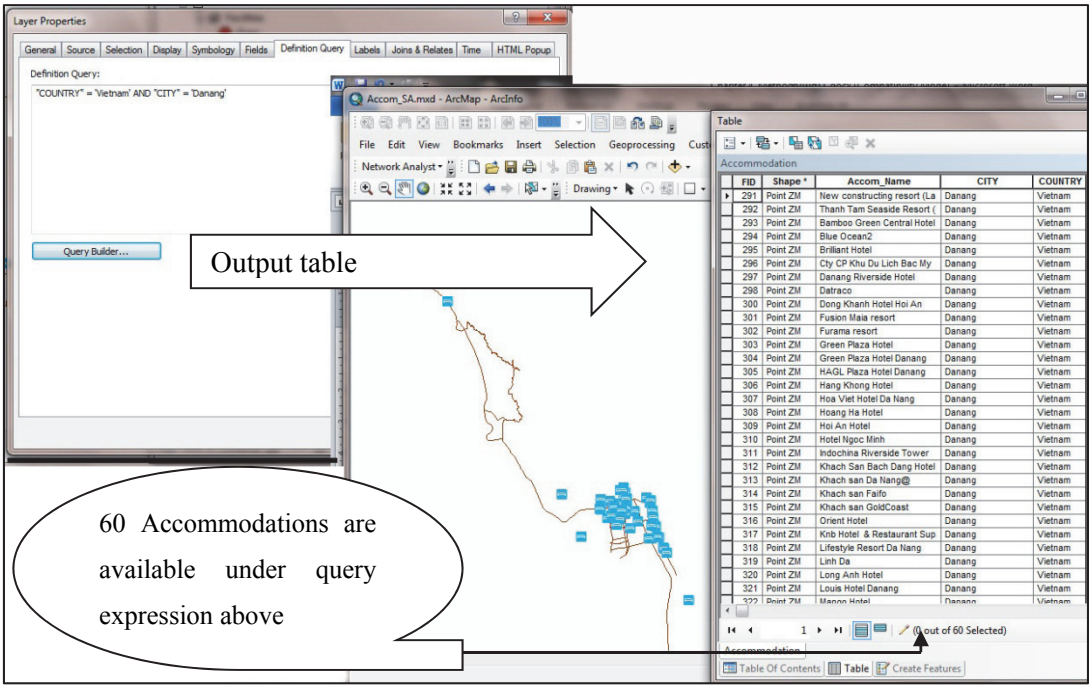
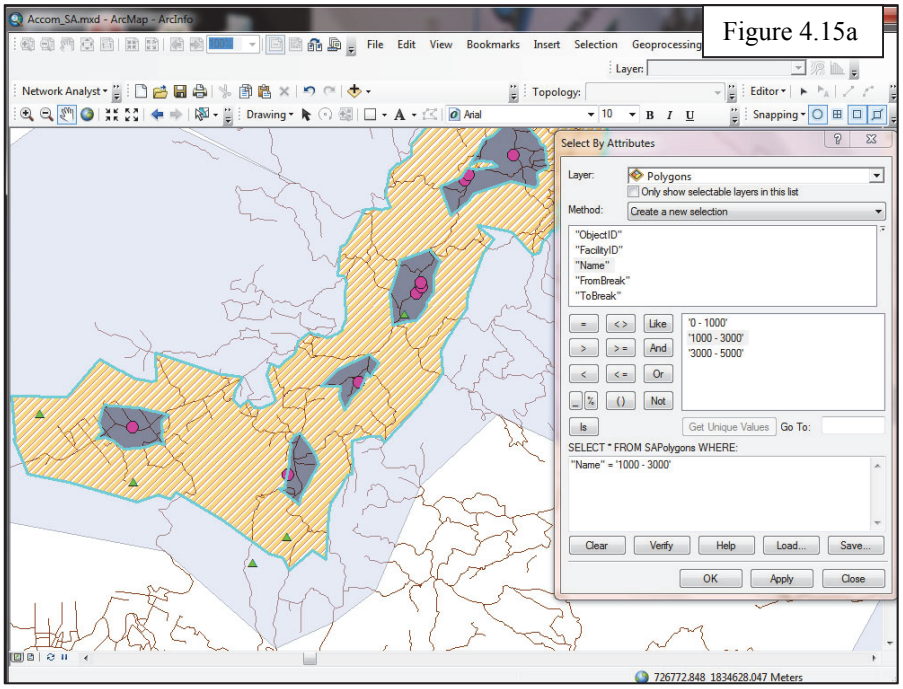
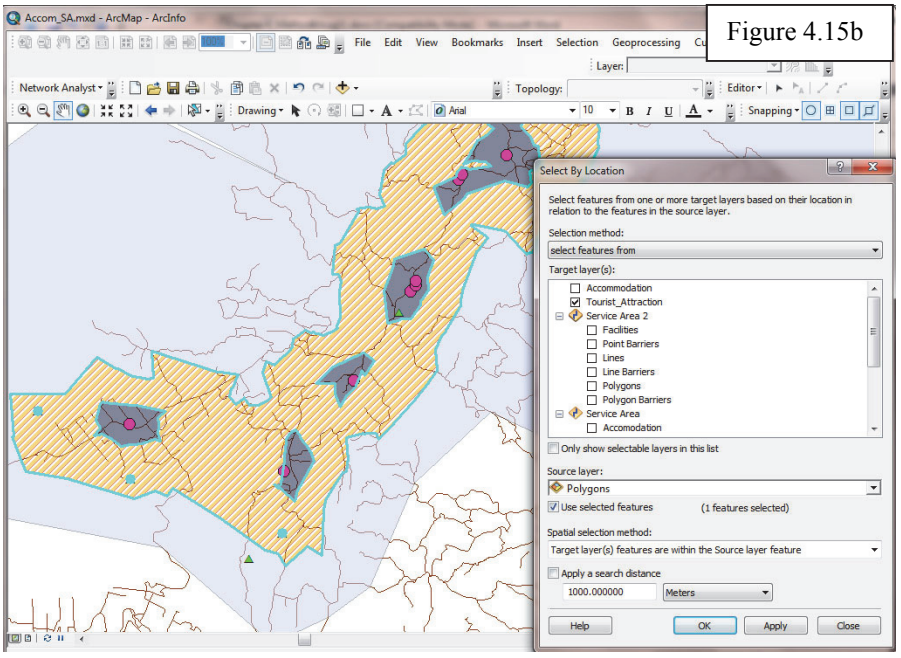


Figure 4.14 The Definition Query tab in the Layer Property window

Under the Selection command tab in the ArcMap module, multiple spatial and attribute tables can be sorted and retrieved from options on the *Select By Attribute* and *Select By Location* tool dialog boxes. The Select Layer By Attribute tool chooses features based on attribute values, while the Select Layer By Location tool collects features based on their spatial relationship to other features within the same or different layers. The spatial relationships are evaluated via mathematic models of topological invariants of intersection boundaries and interiors. The major types of relations derived from topological invariants of spatial features in a data set are classified into eight models: Disjoint, Meet, Equal, Inside, Covered by, Contains, Covers, and Overlap (de By and Kainz, 2000). In the ArcGIS package, the spatial method of the selection is operated on parameters under the following commands:[*Input_layer, /Overlap_type/, /Select_features/, /Search_distance/, /Selection_type/*] (ESRI, 2011c). These parameters comprise input layer (target layer to operate a selection), selected features (or source layer's feature which influence the target layer) and overlap type (refers to spatial selection methods). This method is important for maneuvering spatial models according to the selection criteria. The main selection methods contributed by ArcGIS are Intersect, Intersect 3D (for three-dimensional space), Within/Within-A-Distance (specifies a distance in the Search Distance parameter), Within/Within-A-Distance-3D (for three-dimensional space), Contain, Within Clementini (the result will be identical to Within except for the features entirely on the boundary in the source layer), Are-Identical-To (the features of input layer will be selected if they are identical, geometrically, to source layer's feature), Boundary-Touch, Share-A-Line-Segment-With, Crossed-By-The-Outline-Of, and Have-Their-Center-In (the features of input layer will be selected if their center falls within a source layer's feature).

Some valuable measurements of the study variables were assigned by the Selection function, depending on their criteria. In particular, the variables involved in tourism facilities, such as accommodation, petrol stations and hospitals, were produced via a selection of features at different distances of service areas. Therefore, at least two layers were considered to assign variable values between the tourist attraction layer and facilities layer. For example, if the author wanted to assign the value of the Accommodation variable, the *Select By Attribute* and *Select By Location* command would be applied to extract tourist attractions located within the distance criteria of the accommodation service area, between 1000 and 3000 meters (Figure 4.15). Figure 4.15a displays the Select By Attribute dialog box, where the Attribute field *"Name"* has been selected at a service area polygon between 1000 and 3000 meters from accommodation. Then, the selected area in Figure 4.15a was combined to operate in the Select By Location tool in Figure 4.15b. Regarding the criteria, the author wanted to manipulate the tourist attraction layer and examine whether there were features in the accommodation area within 1000-3000 meters (Figure 4.15b). The results showed that there are 33 points from 209 tourist attractions, which respond to the criteria located within 1000-3000 meters of the Accommodation Service Area (Figure 4.15c).





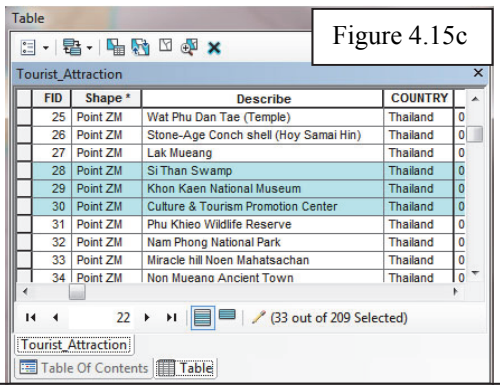


Figure 4.15 Select By Attribute and Select By Location command

4.5 Data Analysis

The process of data analysis involved many Spatial Analysis functions applied in the research. Most analysis processing covers the manipulation of vector data structures, including the fundamental spatial analysis and advanced spatial analysis. In the study, GIS fundamental spatial analysis refers to basic functions operated for obtaining useful information for further application. For advanced spatial analysis, it covers GIS functions that are capable of analyzing statistical and mathematical data based on theoretical models, mainly for applying multi-criteria decision analysis (Malczewski, 1999a). The advanced functions used in the study were Network Analysis for optimization and GIS capacities for supporting decision analysis.

4.5.1 Fundamental spatial analysis

There are many basic functions operated on GIS framework for spatial analysis. These functions used in this study included buffer analysis, scalar operation and overlay analysis.

4.5.1.1 Buffer Analysis.

The buffer operation uses the geometric distance to define the neighborhood around objects of interest by using two parameters: 1) a buffer distance and 2) the object that the buffer function operates on (Albrecht, 2007). Buffer generation is applied on objects and determines the area around them within a certain distance. In the study, buffer was used to create a specific zone of the study area neighborhood zone within 30 kilometers above and below the main EWEC road. To do this, the buffer function was operated under the Analysis Tools in the ArcToolbox module (Figure 4.16).

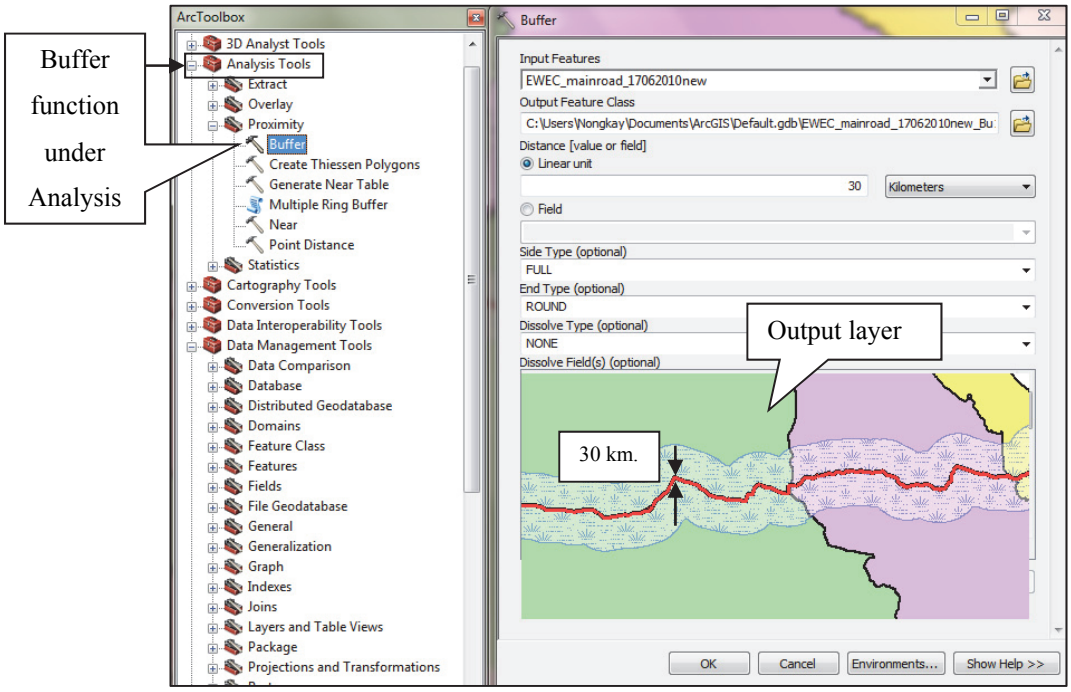


Figure 4.16 The Buffer operator dialog box in the ArcToolbox module

4.5.1.2 Scalar operation

This method is used to assign the desired value to each location on the data layer by using a single or uniform value called Scalar data layer. The point of scalar operation is to transform all objects from an existing input layer in order to change all values by a given figure. The output layer contains new attribute values that are operated via a mathematic operation and constant value (scalar). The fundamental mathematic functions are Addition, Subtraction, Multiplication, Division, and Exponentiation (Malczewski, 1999a).

- Addition (+): layer input is added as a specified constant to each attribute value.
- Subtraction (-): input layer is subtracted from a specified constant of each attribute value.
- Multiplication (×x): each attribute value on the input layer is multiplied by a specific constant.
- Division (/): each attribute value on the input layer is divided by a specified constant.
- Exponentiation (^): raises each value on the input layer to a specified exponent.

Scalar operation was also applied to calculate standardized values of attribute for each factor including multiplied weighting values to every factor layer in the study.

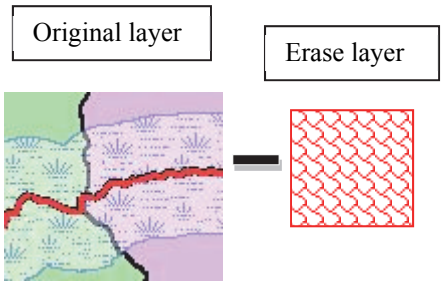
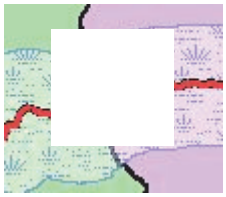
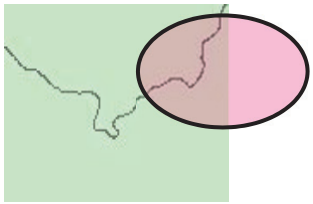
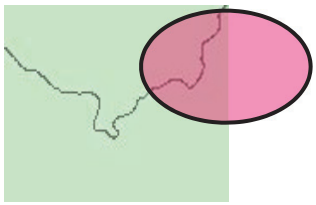
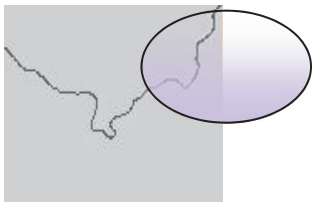
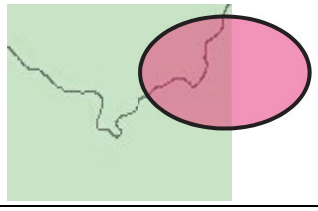
4.5.1.3 Overlay Analysis

This function requires two or more input data layers in the same coordinate system to overlay. The principle of the overlay function is to integrate the characteristics of co-location features among input layers and produce a new characteristic for each co-location in the output layer. The integration of multi- co-locational layers can be done by arithmetic functions (addition (+), subtraction (-), multiplication (×), and division (/)) or map algebra (Brimicombe, 2010). For example, one layer can be multiplied by weights and then combine the total numerical values in corresponding locations in the second layer of a new output layer. Overlay analysis often requires the examination of many different factors which may not be equally important (ESRI, 2011d). Hence, each layer can be assigned criterion weight in its attribute table before operating in the final model of data analysis.

In addition, the Boolean operator is one of the beneficial functions in Overlay analysis based on logical operations. Overlay commands in ArcGIS are based on map algebra and Boolean concepts and composed of five main functions that provide different outcomes: Erase, Intersect, Identity, Union, and Update. In Table 4.4, the results of output layers operated by different overlay methods are displayed. For example, the Tourist Attractions layer was intersected by the EWEC 30 km-buffered area layer for extracting attraction sites within 30 km. However, to operate a study project, calculated values of co-locational attribute could be obtained by integrating multi-overlay operators.

In the study, the overall values of potential tourist attractions were produced through both arithmetic and Boolean operators.

Table 4.4 The GIS operators of the overlay command with different outcomes

Overlay command	Operated input layers	Output layer
Erase		
Intersect		
Identity		
Union		
Update		

4.5.2 Advanced spatial analysis

The major implementations of advanced spatial analysis in this study involved GIS Network Analysis module including Best Route Analysis, Service Area measurement and Location-Allocation problem. However, the Location-Allocation model will be mentioned in the next section (Application process).

4.5.2.1 Generating procedures of network datasets

The network is an interconnected set of elements composed of lines (edges), connecting junctions (points) and end nodes (end points), representing geographic phenomena, mainly transportation types. A network dataset can be generated in both a single transportation mode and multiple network modes such as roads, railroads, and waterways. Creating a network dataset prepares network data resources to be analyzed for network analysis in this study. In ArcGIS Desktop, the main procedure to create network datasets is as follows:

1) Build network dataset >> New ⇨ Network dataset under Personal Geodatabase in ArcCatalog Module (Figure 4.17).

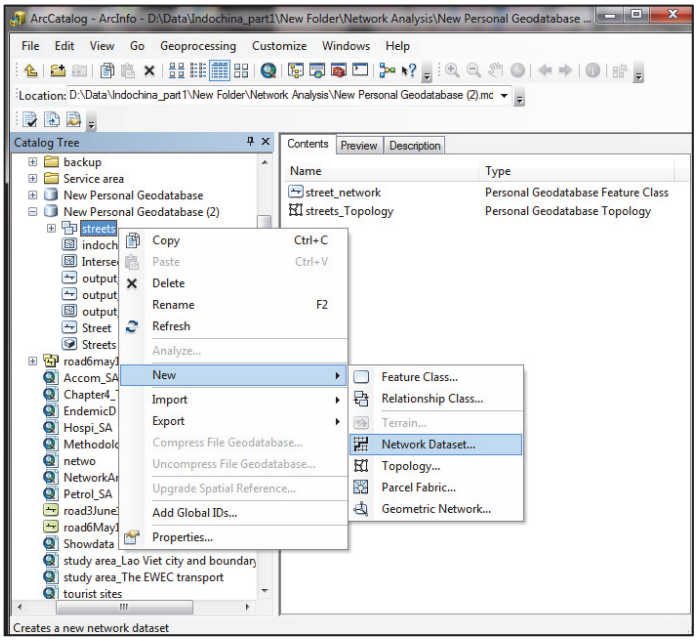


Figure 4.17 Creating a new network dataset under the ArcCatalog Module

2) Create specific fields, such as Distance, Oneway and Driving Time attributes, and then assign a constant value for their attribute values (Figure 4.18). This can be done with the Evaluator function in Network Dataset, which calculates attribute values by Boolean operators, logical functions, and parameter values in network attributes.

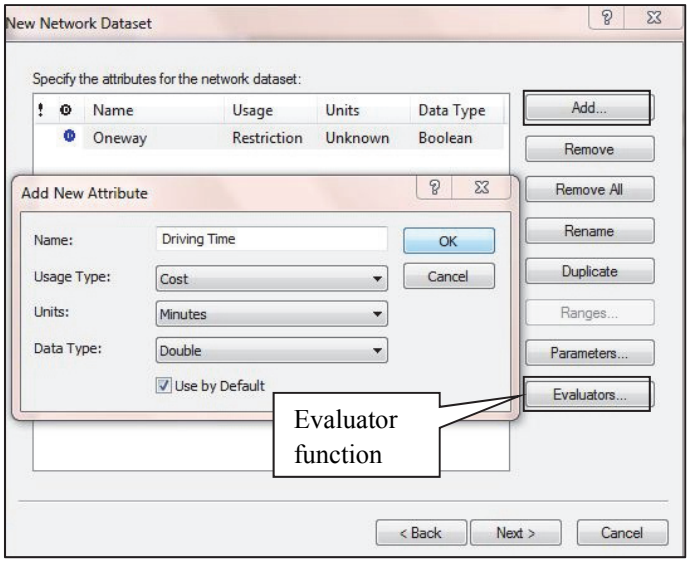


Figure 4.18 Creating specific fields in Network Dataset by using the Add New Attribute button

In this study, the Distance value can be assigned from the specific field in the attribute table of the street data layer named Shape_Length, which accurately measures the length of street line features from the process of topology manipulation. The unit of distance defined based on the street source layer as meter and kilometer.

Next, the Driving Time field of the street data layer in both From-To direction and To-From direction was assigned a value by calculating the Field Expression via Evaluator Properties (Figure 4.19). For the current study, driving time for both directions was calculated based on a driving speed of 60 kilometers per hour. However, assigning the Driving Time value could also be done by selecting a specific field, which had already recorded driving time values of street data sources by tracking or GPS.

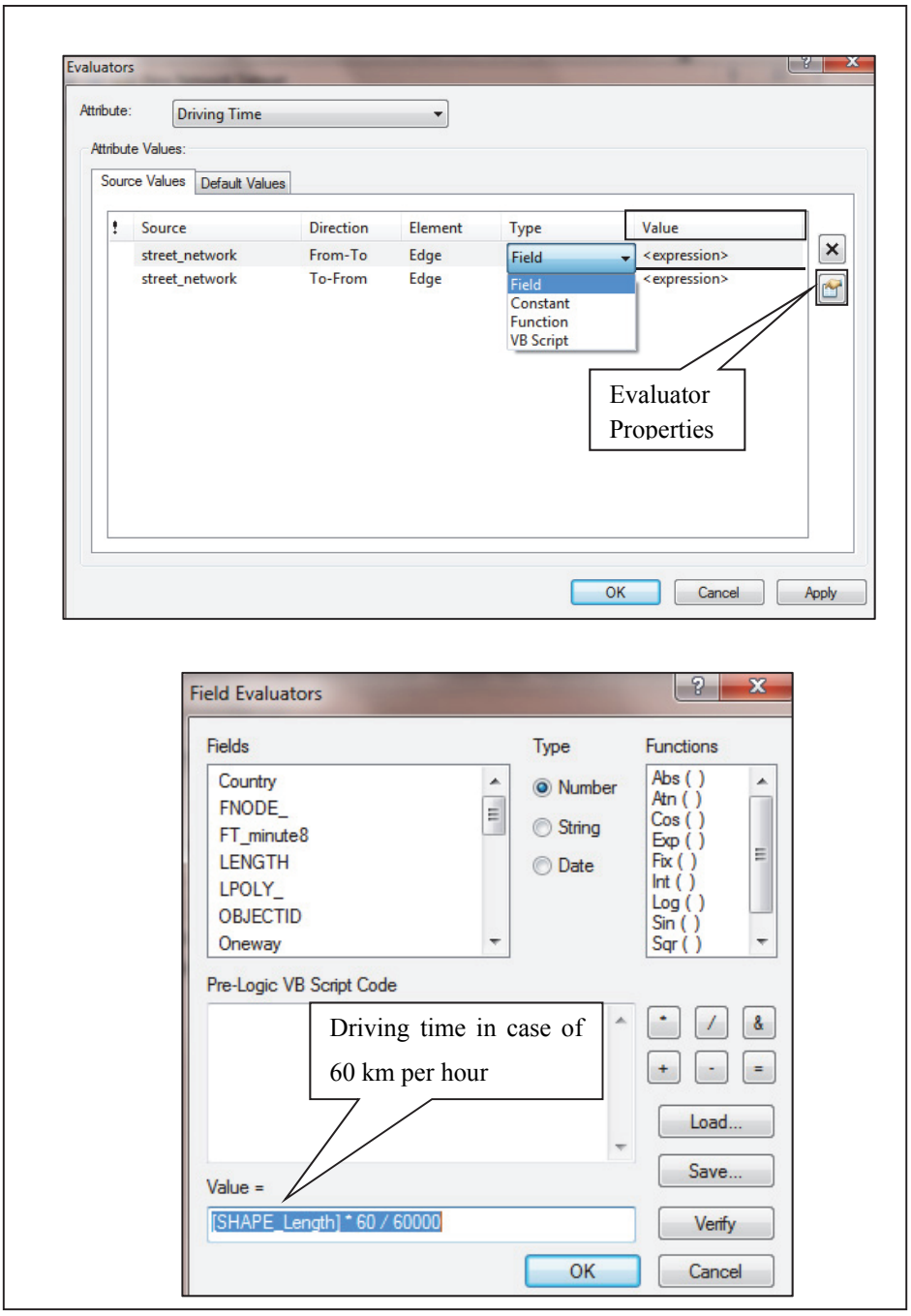


Figure 4.19 Field Evaluators for creating Driving Time attributes

Moreover, the Driving Time field could be generated by the cost of turn delay in different kinds of turning angles as well as by road classes, such as local, secondary and primary roads. GIS users can specify the time from turning, for example, an 8-second delay in all left turns from the secondary road. However, the Driving Time attribute was able to add the default cost value for transitioning between two-edge elements by using the Global Turn Delay Evaluator. The Global Turn Delay was calculated as the cost of turn delay based on the degree of two-edge and road class (Figure 4.20b). However, the Global Turn Function was not offered in the ArcGIS package released prior to

9.3, so users need to create the turn delay on their own. For the study, ArcGIS package 10 was used to operate the network dataset, so there was no problem adding the Global Turn Delay attribute in the Driving Time field. In the Evaluator window, the Default Values tab was selected, and then the Global Turn Delay type was defined at Turn element (Figure 4.20a).

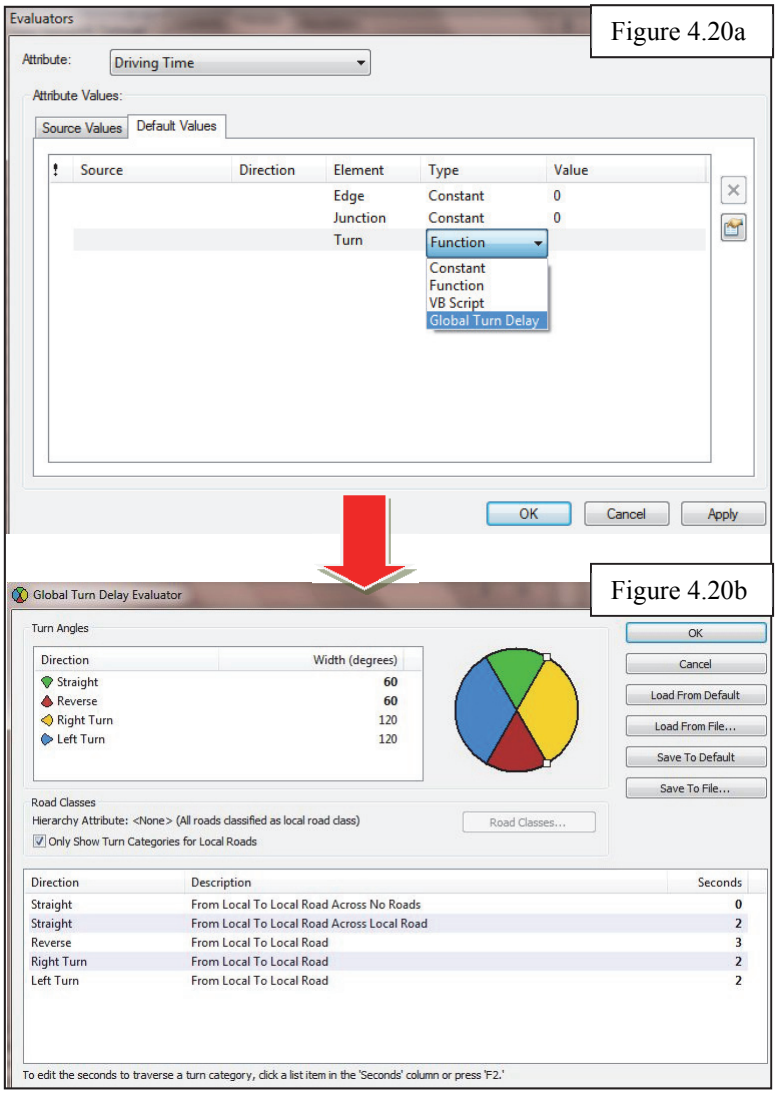


Figure 4.20 The Global Turn Delay in Driving Time field

The Oneway field was used to create specific restrictions on some streets where traffic laws allow only one-way driving. Oneway is a common field that network datasets search for to control direction, and it is assigned a text value based on the real transportation data sources:

- FT or "F" means driving is only permitted in the digitized From-To direction of line features
- TF or "T" means driving is only permitted against the digitized direction of line feature (To-From direction).

These text values were manipulated by the field expression evaluator for travel permission in the network dataset. In Figure 4.21, the Oneway restriction of the To-From direction was generated by the Boolean operator written in VB Script Code in the Field Evaluator. If the expression is true, the street line is restricted; if not, it is traversable.

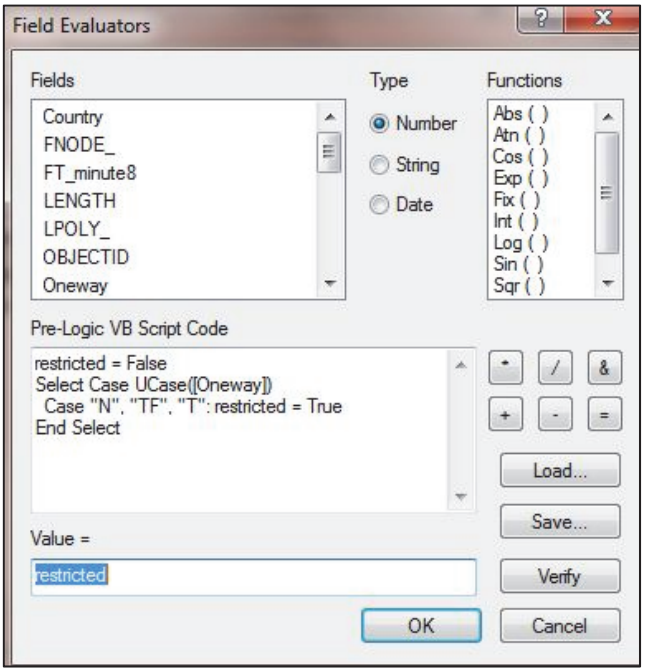


Figure 4.21 The VB Script Code for generating attribute values of Oneway restrictions

3) Create driving directions so that users can define the Direction setting and Street Name field and display results after operating the network analyst functions. After every element is defined, the Network Direction Properties window (Figure 4.22) assists users to conclude the field functions and street name before building a network dataset.

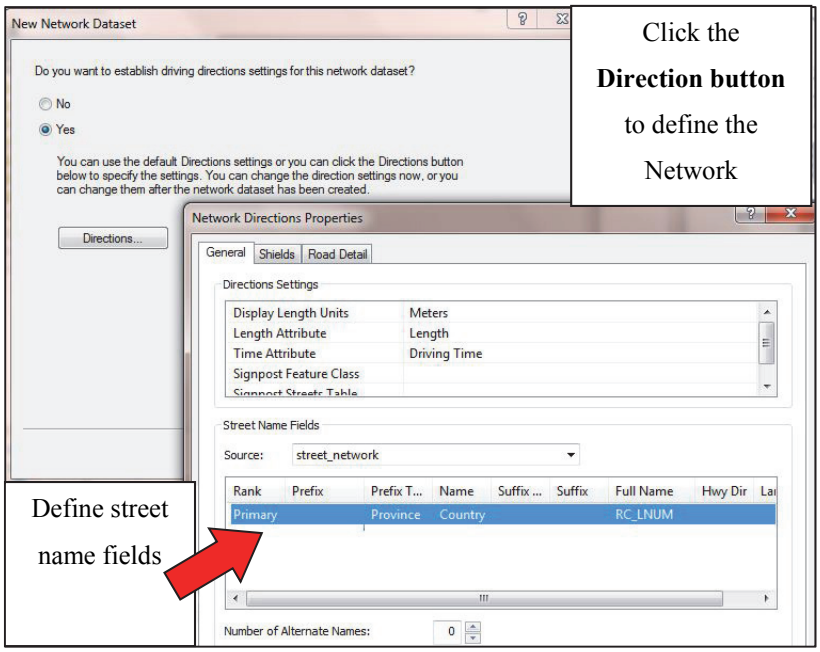


Figure 4.22 Network Direction Properties

4.5.2.2 The Best Route Analysis

The Best Route Analysis model is part of the Network Analysis for optimization. In the ArcGIS Network Analyst, it provides potential functions to solve common network problems, such as finding the best route across a city, finding the closest emergency vehicle or facility, identifying a service area in a location, servicing a set of orders with a fleet of vehicles or choosing the best facilities to construct. In the study, the Best Route and Service Area functions were applied to respond to the objectives.

The Best Route Analysis is referred to as the Shortest Path Analysis. It determines the best route from an origin to a destination in minimum time or distance. The best route operated via ArcGIS is based on the Dijkstra Algorithm. The algorithm is explained on a weighted connected simple graph to find the shortest path from one node to all other nodes. The method assumes that the graph is made of nodes and edges, which link nodes together, containing a value of distance or weight (cost). This distance, or the edge weights, are referred to as positive (Worboys and Duckham, 2004). The algorithm is expressed by a set of commands applied by Renaud Waldura (2007) to explain the algorithm process in a mathematical program (Figure 4.23).

In this explanation, nodes in Dijkstra's algorithm are divided into two distinct sets: *unsettled* nodes (Q) and *settled* nodes (S). P stores the best estimate of the shortest distance from the source to each node. u and v represent nodes, whereas π stores the predecessor of each vertex on the shortest path from the source and *s* is the source node. Initially, the algorithm starts and all nodes are

unsettled, and then the selected nodes can move to settled set when its shortest distance has been found from this node to other. When all nodes are in the settled set, the algorithm stops computing.

```
Begin
   // initialize P to infinity, π and Q to empty
   S = Q = ( )
   add source (s) to Q
   P(s) := 0 ;                              // Distance from source to source
   Q;= the set of all nodes in Graph // they are unoptimized, thus are in Q
   while Q is not empty:                    // The main loop
      u := extract-minimum (Q);
      if P[u] = infinity
      add u to S
      relax-neighbors (u);
      end if;
   remove u from Q ;
   for each node v adjacent to u:    // where v has not yet been removed from Q, v not in S.
       if P(v) > P(u) + [u,v]          // a shorter distance exists
          P(v) = P(u) + [u,v]
          π(v) = u
          add v to Q                    // Reorder v in the Queue
       end if ;
   end for ;
   end while ;
   return P;
    extract-minimum (Q)
    find the smallest (as defined by P) node in Q
    remove it from Q and return it
end Dijkstra.
```

Figure 4.23 The set of commands for Dijkstra's algorithm

In addition, the following graph (Figure 4.24) shows the example of Dikijstra's shortest path algorithm starting at the node *a* according to the set of commands above. The first loop starts by adding the source node *a* to the set Q and Q is not empty, so extract its minimum, *a* again. Then add *a* to *S*, and then relax its neighbors, adjacent nodes of *a* referred to *b* and *c*.

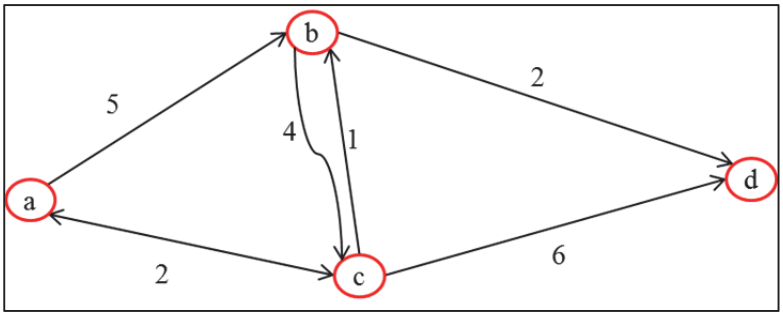


Figure 4.24 Planar graph for finding the shortest path from node *a*

The best distance estimate from *a* to *b or P*(*b*) was initialized to infinity, so the computer computes:

$$P(b) = P(a) + [a,b] = 0 + 5 = 5$$

$\pi(b)$ is set to *a*, and we add b to Q. Similarly, for *c* we assign *P*(*c*) to 2, and $\pi(c)$ to *a*. There is nothing tremendously exciting so far.

The second time run, Q contains *b* and *c*. As seen above, *c* is the node with the current shortest distance of 2. It is extracted from the queue and added to *S*, the set of settled nodes. We then relax the neighbors of *c*, which are *b*, *d* and *a*. *a* is ignored because it is found in the settled set. But it gets interesting: the first pass of the algorithm concluded that the shortest path from *a* to *b* was direct. Looking at *c*'s neighbor *b*, we realize that:

$$P(b) = 5 > P(c) + [c,b] = 2 + 1 = 3$$

Thus, it is found that a shorter path going through *c* exists between *a* and *b,* which insists P(c) to be 2. *P*(*b*) is updated to 3, and $\pi(b)$ updated to *c*. *b* is added again to Q. The next adjacent node is *d*, which we have not seen yet. *P*(*d*) is set to 8 and $\pi(d)$ to *c*.

Then, the unsettled vertex with the shortest distance is extracted from the queue, it is now *b*. We add it to the settled set and relax its neighbors (*c* and *d*). Now the shortest path is found for *d:*

$$P(d) = 8 > P(b) + [b,d] = 3 + 2 = 5$$

Therefore, P(d) can be updated to 5 and $\pi(d)$ to *b*. We add *d* to the Q set. At this point, the only node left in the unsettled set is *d*, and all its neighbors are settled. The algorithm ends and the final results are displayed in green dashed lines (Figure 4.25). In conclusion, π is the shortest path in predecessor fashion and P [*a,d*] is the shortest distance between *a* and *d* being equal to 5.

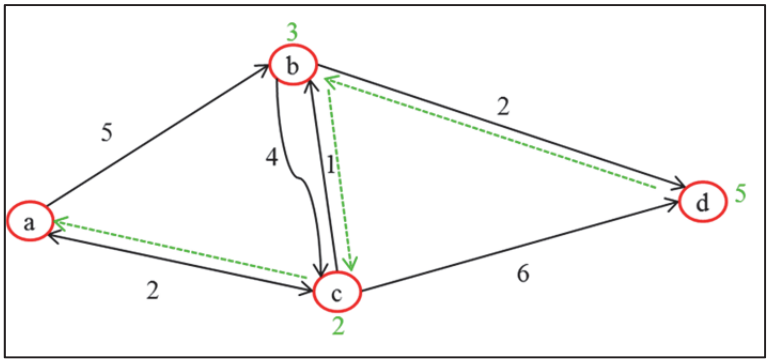


Figure 4.25 Final results of the Dijkstra's algorithm explanation

However, finding the best route is influenced by other factors that involve people, activities, policies, environment and time. For example, the shortest path analysis is limited by the turn policy of some streets. So, Turn table or Oneway may be added in the GIS model. It is a special class of the attribute table that shows which streets permit or prevent travelers from changing directions or switching to other modes of transportations. In the study, these affected factors toward tourist routes in the study area and were input into the network dataset during the generation process mentioned in the previous section. In Figure 4.26, an example of the quickest time solved by the Best Route function on Network Analyst responded to existing road networks and environments. The route was ordered to operate from Airport (No.1) to Attraction_A. This took 12 minutes, with 1600 meters at 60 km per hour.

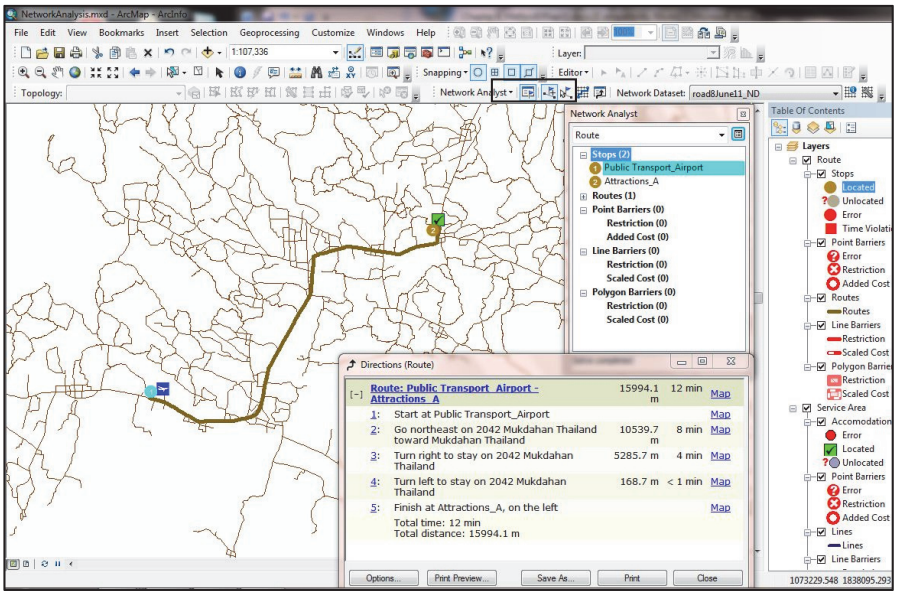


Figure 4.26 The best way driving from the Airport to Attraction_A

4.5.2.3 Service area measurement

This method assists users in finding service areas in any location on networks, particularly facilities. It can be defined as the area that can be reached from the facility within a defined time, distance or cost. In the ArcGIS package, the service area can be generated in a planar region or based on networks with various types of methods, such as circular coverage, Thiessen polygon, viewshed of observer point, and travel time zone. This study applied the travel time zone in particular to define the service area of emergency facilities under time constraints. For example, firefighters should be able to reach the emergency area within 4 minutes travel time (Indriasari et al., 2010). Since the study models service areas of tourism facilities under time and distance constraints as one variable for analyzing potential tourist attractions, the travel time zone was chosen to define the service area polygons based on street networks of the study area.

The Service Area function running in the ArcGIS package is also based on Dijkstra's algorithm to traverse the network. The service area technique selects a subset of connected edge or line features that are within the specified distance, time or other network constraints. Then, these selected lines can be bound by line or polygon boundaries. To create a service area polygon, the line geometry traversed by the Service Area tool is generated by a Triangulated Irregular Network (TIN) data structure, which represents a surface as a set of continuous and non-overlapping triangles. The network distance along the lines serves as the height of the locations inside the TIN. This service area region encompasses all accessible streets under specified conditions, such as travel time and distance (ESRI, 2010). For example, if an 8-minute service area of the hospital is defined, it means that all available streets from the hospital can be accessed within 8 minutes. The service area is useful for deciding on the accessibility of a site by evaluating the parameter limitations, such as time or distance via the road network.

In ArcGIS Network Analyst, the Service Area function can measure multiple concentric service areas in the same location, showing how accessibility changes with an increase in time or distance, such as for showing how many tourist attractions are covered by accommodation service areas within 1000, 3000 and 5000 meters (Figure 4.27a). To set the parameters of the service area analysis, users have to access the Layer Property dialog box at the  symbol button in the Network Analyst Window (Figure 4.27a). In the study, this function was thus applied to measure travelers' accessibility from tour sites to tourism facility locations. This result was used to assign the attribute values of facility factors, depending on the criteria of accessible services, for evaluating levels of tourist attraction potential. Figure 4.27b shows the output of the accommodation service area within 1, 3 and 5 kilometers.

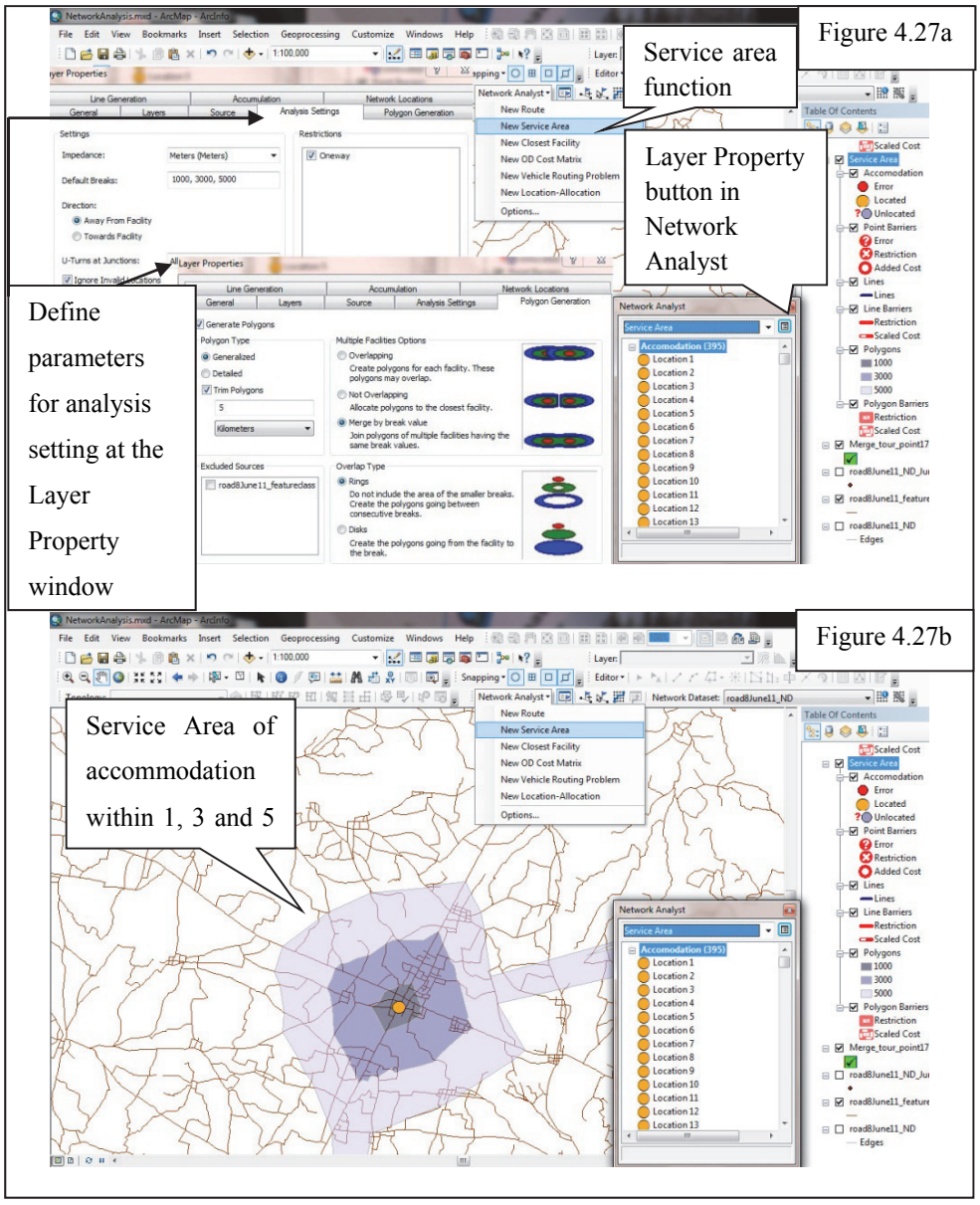


Figure 4.27 The operation of Service area functions via ArcMap module

4.5.2.4 GIS extensions supporting decision analysis

GIS has alternative functions to support the process of multi-criteria decision making, mainly with spatial decision problems. It can perform the multiple criteria analysis on attribute and geographic data, as well as on relationships between geospatial features via applicable models. Malczewski (1999a) suggested various theoretical models that could operate in the GIS framework, such as Simple Additive Weighting Methods, Utility Function Approaches, Ideal Point Method, Analytic Hierarchy Process, Fuzzy Aggregation Operations, Goal Programming and so on. Most methods are different in terms of generating criteria, decision rules and mathematically- based models, but they share the same goal of providing the best alternative for decision makers. However, choosing these models depends on the objectives, decision situations, levels of certainty and

uncertainty, as well as the number of decision makers who define decision rules and select the suitable model for each project. In addition, some projects may combine decision methods in different procedures to get the solution.

In this study, the Analytic Hierarchy Process (AHP) was chosen to apply the potential level of tourist attractions in a GIS environment. This method is a type of spatial multi-attribute decision in which the attributes are assumed to serve as both decision variables and objectives. Each objective is measured by means of a single attribute. Decision makers perform the formulating model by using information source of the attribute. Details of the AHP concept and practical processes are described in in the following section.

In conclusion, GIS is a crucial tool to develop potential options for decision support systems in spatial projects. It provides not only basic functions for storage and managing a large amount of spatial data, but also advanced functions for manipulation and analysis. The GIS analysis functions can be combined with mathematical and statistical methods, and they can also support multi-criteria decision analysis for various purposes. The capability of using GIS for alternative decision-making is based primarily on the spatial relationship principles of connectivity, contiguity, proximity, and overlay (Malczewski, 1999a).

4.6 Application process

The integration of GIS analysis functions and multi-criteria decision processes for responding to the study purposes is explained in this application process. This process was divided into three major phases. For general findings, AHP was applied to evaluate the tourist attractions' potential. Next, an application of network analysis functions was used to find the optimal tourist routes in particular long haul journeys with the Oppermann's model. The final process was tourism development, which involved investments and services. The results of the first phase were then used for to indicate areas where facility services were lacking. In addition, a spatial statistical analysis was applied to suggest alternative locations for facilities corresponding to tourist attraction sites. The methodology used in each process is outlined in more detail below.

4.6.1 Analytic Hierarchy Process (AHP) on GIS framework

The AHP was integrated with MCE and WLC to investigate the potential levels of tourist attractions in the EWEC area. Since MCE was applied to create a set of multi-criteria in the initial factor administration stage, AHP was selected to continue the process of complex decision making, which involves multiple elements (factors) of unequal importance that are difficult to quantify. The AHP is a widely used method of Spatial Multi-Criteria Decision Analysis, which consists of three

principles: decomposition, comparative judgment and synthesis of priorities (Malczewski, 1999b). Each step of the AHP process is explained in detail below.

Firstly, complex decision elements are decomposed into basic groups and hierarchies. Secondly, the comparison of the decision elements is operated on pairwise comparison matrix. This step makes comparisons between pairs of elements by using a degree of preference with a rating scale (Table 4.5) from 1 to 9. A value of 1 means "equal importance" and a value of 9 is given for those factors of "extreme importance" when compared to other factors (Saaty and Vargas, 2006).

Table 4.5 Fundamental AHP scale of absolute values 1 to 9 for comparisons

Degree of Preference	Verbal judgments
1	Equal importance
2	Almost moderate preference
3	Moderate preference
4	Almost strong preference
5	Strong preference
6	Almost very strong preference
7	Very strong preference
8	Almost extremely strong preference
9	Extremely strong preference

This comparison matrix used in the study is based on the assumption that the comparison matrix is a positive reciprocal matrix. For example, matrix X was thus generated as follows:

$$X = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{31} & x_{n2} & \cdots & x_{nn} \end{bmatrix}$$

Where $x_{ij} \in \left\{9, 8, 7, 6, 5, 4, 3, 2, 1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{6}, \frac{1}{7}, \frac{1}{8}, \frac{1}{9}\right\}$, and $x_{ii} = 1$ where $1 \leq i, j \leq n$.

If x_{ij} represents a pairwise judgment, $x_{ij} = 1/x_{ji}$. For example, if criterion i is twice as preferred to criterion j, we can conclude that criterion j is preferred only one-half as much as criterion i.

This process is given weights for each element by calcluating a comparison matrix. After the pairwise comparisons are calculated, the consistency ratio is estimated. This determines if the pairwise comparison matrix in the first step is consistent. Saaty (1990) provided the consistency vector, which is computed by values from a consistency index (CI) and an average value of the consistency vector (λ_{max}). The calculation of CI is based on the observation that λ_{max} is always greater than or equal to the number of criteria under consideration (n) for positive, reciprocal matrixes, and $\lambda_{max} = n$ if the pairwise comparison matrix is a consistent matrix. In addition, λ_{max}- n can be considered a measure of the degree of inconsistency. The consistency index CI can be shown as the formula below:

$$\text{CI} = \frac{\lambda_{max} - n}{n-1}$$

CI is the element value used to measure the consistency ratio (CR). The consistency ratio is defined as the ration of the consistency index CI to random index (RI). The formula is thus shown as follows:

$$\text{CR} = \frac{CI}{RI}$$

RI is the average of the consistency index of 50,000 randomly generated reciprocal matrices from the 17 values (1/9, 1/8,..., 1, 2…, 8, 9) of numerical judgments for different-ordered random matrices from sizes 1 to 15 (Saaty, 2008). Table 4.6 displays where RI is given, depending on the number of matrix sizes being compared.

Table 4.6 Values for RI (Saaty, 2008)

n*	2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.00	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49	1.52	1.54	1.56	1.58	1.59

* n: order of criteria in matrix

Based on expert knowledge and experience, Saaty (1995) also found that consistency ratios (CR) less than 0.10 are accepted as reasonable levels of consistency in pairwise comparisons.

The final step of AHP is to produce composite weights for synthesis of priorities. The composite weights are obtained by multiplying the relative weight matrix at each level of the hierarchy (Malczewski, 1999b). This calculation displays the relative contribution of the elements in

each hierarchical level to an element in its adjacent upper level (Rezaei-Moghaddam and Karami, 2008). Therefore, the sum of composite weights of all elements in all levels equals 1.

In the study, the composite weight was multiplied by rating a value of alternatives to produce the piority score of alternatives in each element. The overall evaluation of the available alternatives is the sum of the all elements' weight and rate values . This total sum was computed by the Weighted Linear Combination (WLC), where all elements' rating values for each alternative were standardized in a common numeric range and multiplied by composite weight. The WLC formula was shown in the following way:

$$S = \sum_{i=1}^{n} X_i * W_i$$

Where S means the potentiality index, X_i is Standardized rating value of element i and W_i is the Composite Weight of element i.

The overall score reflects the potential levels of tourist attractions for this evaluation. The higher score signifies more potential than a lower one, with respect to the overall scores of relevant factors.

4.6.2 Integrating Oppermann's Multiple Destination Model and ArcGIS Network Analysis for finding the optimal tourist routes

This process modified the Oppermann's Multiple Destination model to design the EWEC tourists' traveling models corresponding to existing road networks of the study area. These models were combined with the best potential tourist attractions from the previous application and public transportation stations. The Best Route Analysis function was then utilized to simulate the best route and order of multiple destination stops for optimum EWEC touring routes. This function has been explained in detail in the Data Analysis section. With GIS functions and network analysis, the outcomes present both touring routes and guide maps for travelers who prefer visiting this region. The guide map includes tourist attraction sites, transport infrastructure, accommodation and other tourism facilities. In addition, the optimal alternative routes for tourists traveling in the EWEC region will be presented on digital maps in the final part of this procedure.

4.6.3 Tourism development

The final analytical procedure aims to provide tourism development possibilities in the study area, combining two major phases. First, the overall criteria affecting the potential evaluation of tourist attractions were investigated. To do this, a scatterplot matrix and correlation statistics were

gathered. Second, possible ways of improving criteria to support the potential of tourism attractions and spatial development were found. Methods utilized in both phases are explained in detail below.

4.6.3.1 Phase 1: Investigation of weakness

A scatter plot was used to explore the distribution of point data. Fortheringham and et al (2000) claim that this is a rapid way of identifying any spatial point patterns, such as outliers, which are individual points located far away from the main groups. This method contributes to an understanding of an analysis on point data structures. In ArcGIS, a scatterplot matrix is available via the Graphs function on the View toolbar (Figure 4.28). It can display patterns of individual variables and relationships between various variables.

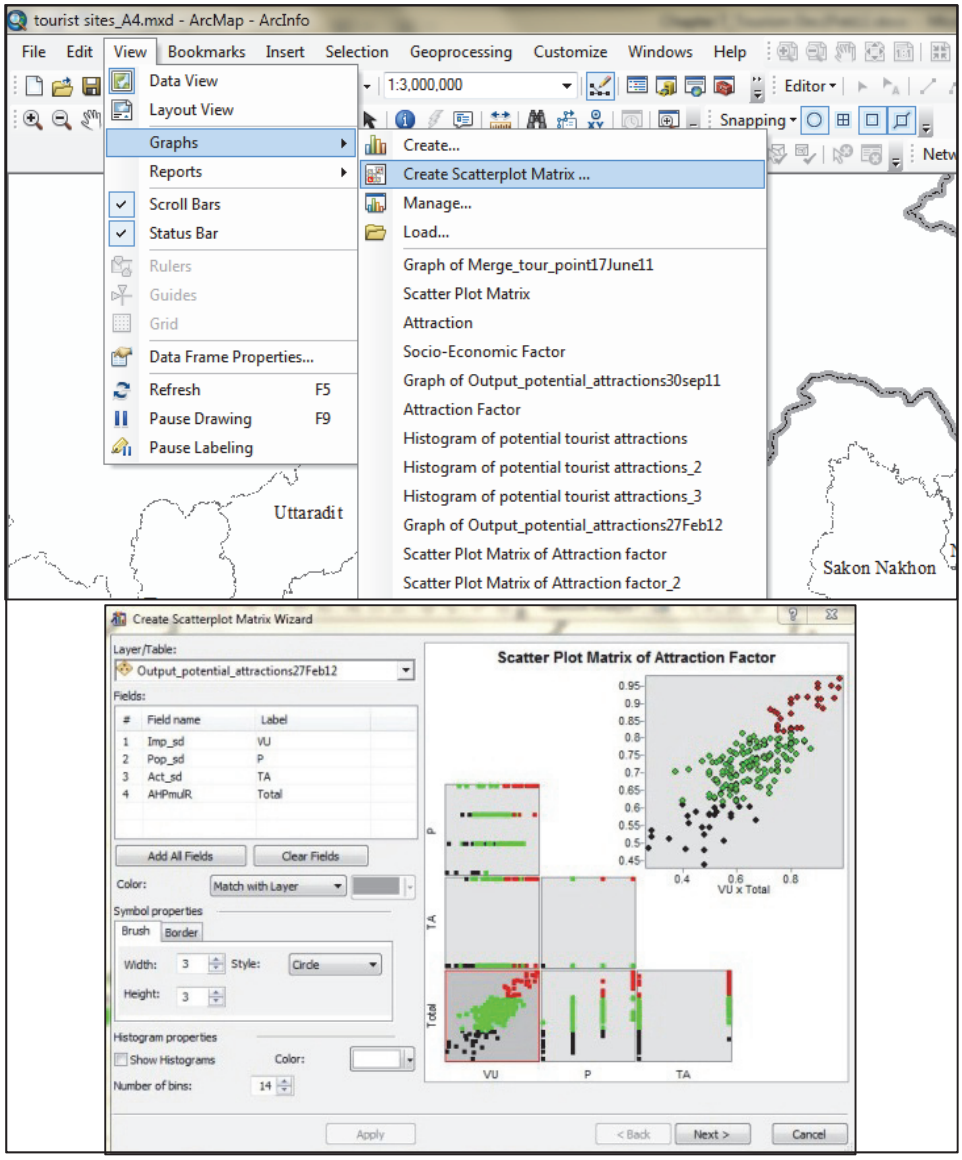


Figure 4.28 The creation of a scatterplot matrix via the Graphs functions on the View toolbar

Therefore, in the current study, the results of evaluating tourist attractions' potential obtained from the previous analysis were initially investigated by a scatter plot. Then, each comparison on scatterplot matrices was tested for correlation coefficients in statistical measurements for finding the weak points. Relationships between major factors were determined from values pooled across different potential attraction sites. The spread of data was tested for normality using the Kolmogorov-Smirnov test. If data did not show normal distribution, the correlation test was performed using the Spearman Nonparametric Correlation. The results of the correlation coefficient are limited to the range [1,-1]. If the value of correlation between two criteria is near zero, this indicates that the value of one criterion is uncorrelated with the value of another. In this study, a correlation between criterion and total potential scores of tourist attractions of nearly 1 or -1 indicated strong support of the attractions' potential.

4.6.3.2 Phase 2: Support of new posible installations for tourism services and investments

The final process was to apply Spatial Statistics Analysis tools to initially investigate potentially possible areas for providing new tourism facilities and services at tourist attractions, mainly the areas outside existing service areas. In the study, the Mean and Median Center methods were used to represent alternative locations that would minimize overall distances or costs from neighboring tourist attractions to tourism facility services. Then, these alternatives were refined by the Location-Allocation analysis to locate the optimal locations, which could service maximal tourists in the surrounding tourist attractions. In terms of shortest time travel and maximized coverage of tourist sites, these locations are the optimal alternative to construct new facilities.

Mean Center and Median Center

The Euclidean Median is one of the central tendency measures, which identifies the center, middle or average of a set of feature distributions. The major indicators of the central tendency mentioned by Burt and Barber (1996) are the Mean Center and the Median Center (Manhatton Median and Euclidean Median). In both of these formulas, weight values of each feature can be included. The Mean Center identifies the center of distribution that is influenced by outliers among the neighboring points, whereas the Median Center or Euclidean Median are less influenced by outliers which are single points far away from the cluster (ESRI, 2011b). Regarding many applications involved in feature distributions and location analysis, the Median Center is a more representative measure of central tendency than the Mean Center (ESRI, 2011b).

The Median Center identifies the location that minimizes overall Euclidean distances to other features in a dataset. The method is based on an iterative numerical algorithm developed by Kuhn and Kuenne in 1962 (Burt and Barber) as the following formula:

$$\sum_{t=1}^{n} \sqrt{(X_i - X_t)^2 + (Y_i - Y_t)^2}$$

,where i = 1, 2, …,n which are the coordinates of a set of n points. The Euclidean median has coordinates $(X_t,\ Y_t)$ and is defined as the location that minimizes distance from it to other n points in the dataset.

In addition, the Median Center can have weights for features in a dataset, which is calculated as:

$$\sum_{t=1}^{n} w_i \sqrt{(X_i - X_{wt})^2 + (Y_i - Y_{wt})^2}$$

,where $(X_i,\ Y_i),\ i$ = 1, 2, …,n, are the coordinates of a set of n points distributed in a planar system, and each of these points has attached a weight (w_i.). Therefore, the weighted Euclidean median representing $(X_{wt},\ Y_{wt})$ is the location that minimizes the Euclidean distance for all weighted points.

The weighted Euclidean median was applied to solve Alfred Weber's classic location problem of finding the optimal factory location, by minimizing the sum of transport costs between the factory and two sources of materials, as well as the market. (Burt and Barber, 1996). Since the optimal location of a set of facilities is concerned with minimizing distance or costs, the Median Center is one of the best basic solutions to be used in many purposes by quantifying the sum of distances or costs among possible points or demands. However, Weber's location problem focused on a single facility or factor. Therefore the method has developed into complex models from single to multiple problems for practical applications in planar graphs and network systems, such as multi-facilities location-allocation problems and P-median Problems, in which multiple sets of problems can be calculated (Jamshidi, 2009).

Location-Allocation analysis

In this study, alternative locations obtained from Mean Center and Median Center were further applied in complex problems and practical scenarios by using the Location-Allocation model. The Maximize Coverage solver of Location-Allocation analysis was chosen to identify the new optimal facility locations, which can service the most number of tourist sites within specific distance

or time. This model solver operates on the ArcGIS Network Analyst function to determine the best location for new facilities which can capture or service demand points or tourist sites to the closet facilities through infrastructure networks. In addition, it can be used to investigate the percentage of tourist sites that will be covered and uncovered by each tourism facility within desired distance or time constraints.

There are four major components considered in this model: 1) Facility or object which services demand points, 2) Demand (people/commodities) or tourist sites which need access to reach the facility services, and 3) Location space which is a road network dataset for this study, and 4) Impedance cutoff (specific or standard threshold of service boundary). The Maximize Coverage model is based on the MCLP mathematical formula(Church and ReVelle, 1974) as follows:

Maximize $$Z = \sum_{i \in I} a_i \, y_i$$

Subject to: $$\sum_{j \in N_i} x_i \geq y_i \qquad \forall i \in I \sum_{j \in J} x_j = P$$

$$x_j = (0,1) \qquad \forall j \in J$$

$$y_i = (0,1) \qquad \forall i \in I$$

where, notations are defined as follows:

I = The set of demand nodes;

J = The set of facility sites;

S = The maximal service distance or time for coverage;

P = The number of facilities to be located;

d_{ij} = The shortage distance from node i to node j;

x_i = 1 if a facility is allocated to site j, 0 otherwise;

y_i= 1 if a demand from I is covered by a facility, 0 otherwise;

$N_i = \{j \in J | d_{ij} \leq S\}$ a set of alternative facilities which are eligible to provide cover to demand i;

a_i= The population or number of tourists to be served at demand node i.

According to the formula, the objective is to maximize the number of tourist sites serviced or covered within the maximum coverage of service distance or time (S). The number of facilities allocated is restricted to equal P in constraint. Therefore, the solution to this objective specifies not

only the largest number of tourist sites that can be serviced but the *P* facilities that achieve the maximal coverage. It was a useful tool for improving the potential of tourist attractions in the service areas that were lacking facilities. In addition, it is quite flexible and can be applied to various coverage and dynamic circumstances, for both private and public institutions, such as schools, post offices, superstores and fire stations.

4.7 Summary

This chapter combined a wide range of methods and processes to investigate the study objectives of developing tourism development in the EWEC region. These various methods and different data were integrated within the GIS framework. The capacities of GIS support the study from the beginning to end. In the following chapters, data is analyzed through specific models and the study's findings are presented.

Chapter 5

Development of Analytic Hierarchy Process under GIS Framework

This chapter implements the development of AHP operating in the GIS framework, corresponding to the primary objectives of this research, i.e. "The evaluation of tourist attractions' potential". The beginning of the AHP process entails constructing a decision hierarchy for supporting the evaluation target. The second step is to conduct pairwise comparisons of criteria for determining their weights. Then, the criteria are used to generate the relevant spatial and attribute information in the GIS database. In the next step, the ranges of rating values are designed to measure all alternatives, depending on each criterion's rule. The final step is to combine weights and rating scores by using Weighted Linear Combination (WLC) analysis. The overall scores are classified into potential levels of tourist attractions and these tourist sites are then visualized as a point data set.

5.1 Construction of Decision Hierarchy

The potential tourist attraction evaluation was segmented into a hierarchical structure of objectives and criteria (Figure 5.1). These objectives support the goal of evaluating the potential of tourist attractions, which were classified into three clusters at the top of the hierarchy: Physical, Attraction and Socio-economic aspects. Then, they were further segmented into two or three lower level subsets or criteria. In addition, one of these criteria, Facility, was also divided into three sub-criteria suspended in the lowest level of the hierarchy: Accommodation, Petrol station, Public transportation station, and Hospital service area (Figure 5.1).

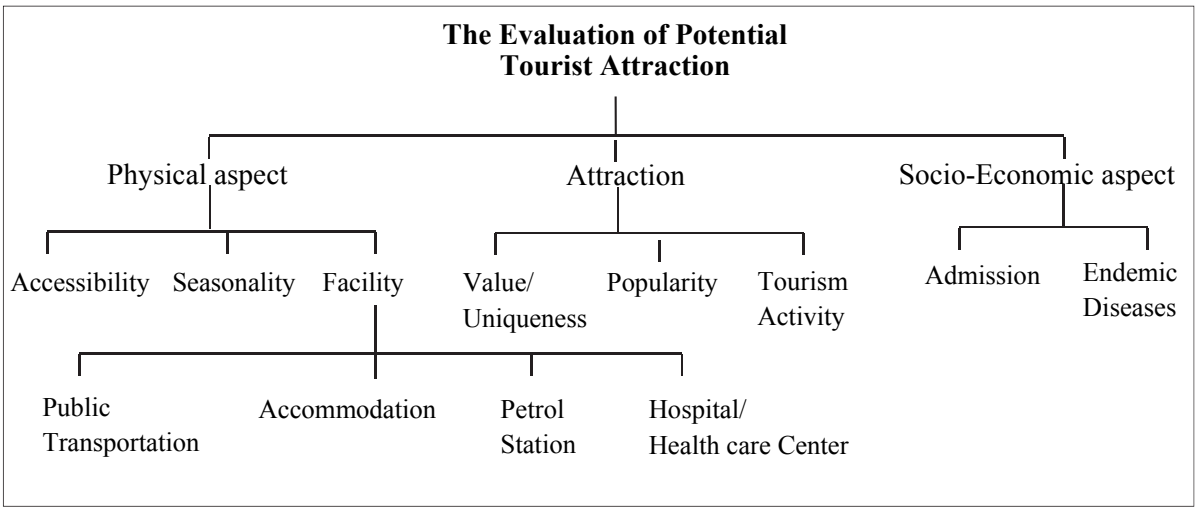


Figure 5.1 Design of the criteria decision hierarchy

5.2 Pairwise Comparison Process

A pairwise comparison process was used to produce the relative criteria weights via a ratio matrix. Most criteria comparison used in this study was formed in a matrix of order 3 (3×3 matrix). This process was conducted in three steps: 1) Development of pairwise comparison matrix, 2) Computation of criterion weights, and 3) Test of the consistency ratio. The three main pairwise comparison matrix processes for this study are presented below.

5.2.1 Development of pairwise comparison matrix

The criteria at the top of the hierarchy (see Figure 5.1) were initially used to calculate the pairwise comparison in order to find the AHP relative weights. Then, each subset was used to compute the comparison matrix. For example, the subsets of Physical Aspect in the second level, consisting of Accessibility, Seasonality, and Facility, were compared against each other. In addition, these subset criterion weights were calculated for normalized distribution related to the weights of their top clusters.

According to the Pairwise Comparison method by Saaty (1980), a numerical scale with values from 1 to 9 rates the relative preferences of two criteria in a comparison matrix. Each decision maker is asked to give a degree of preference value based on a scaling ratio between 1 and 9 (see Table 4.5 in the previous chapter). For example, a value of 1 refers to an indifferent preference between two criteria, which means that these two criteria contribute equally to the objectives, whereas the highest value of 9 indicates an extremely strong preference. In this case, the decision maker is entirely focused on one particular criterion over the others in that matrix (Deng et al., 2002).

Regarding the preference values used in this study, each number in the Pairwise Comparison matrix was assigned by tourism experts in the EWEC member countries who are involved in the tourism sector. They were comprised of tourism professionals, academic scholars, tourism agencies, and tourism authorities. The assigned values expressed the median values and were subsequently used to represent the opinions of decision makers for each comparison.

The results of represented preference values in this study were constructed in a square matrix for each level of the AHP hierarchy in the following tables.

Level 1: Comparison among major objectives for evaluating the potential of tourist attractions is displayed in Table 5.1. This matrix expresses comparable elements among Physical, Attraction and Socio-Economic aspects.

Table 5.1 Comparison matrix of major objectives

Criterion	Physical Aspect (Phy)	Attraction (Att)	Socio-Economic Aspect (SoE)
Physical Aspect (Phy)	1	1/3	3
Attraction (Att)	3	1	5
Socio-Economic Aspect (SoE)	1/3	1/5	1

Level 2: This step displays the comparison among subsets of each major cluster (objective). They are classified into three clusters of comparison matrices shown in Level 2a, 2b and 2c.

Level 2a: The comparison of the degrees of preference in the Physical Aspect subsets are shown in Table 5.2. The subsets consisted of three elements: Accessibility, Facility, and Seasonality.

Table 5.2 Comparison matrix in the Physical Aspect subsets

Criterion	Accessibility (AC)	Facility (F)	Seasonality (S)
Accessibility (AC)	1	2	4
Facility (F)	1/2	1	3
Seasonality (S)	1/4	1/3	1

Level 2b: The degrees of preference in the Attraction subsets are compared in Table 5.3. The subsets consisted of three elements: Value/Uniqueness, Popularity, and Tourism Activity.

Table 5.3 Comparison matrix in the subsets of Attraction

Criterion	Value/Uniqueness (VU)	Popularity (P)	Tourism Activity (TA)
Value/Uniqueness (VU)	1	3	5
Popularity (P)	1/3	1	3
Tourism Activity (TA)	1/5	1/3	1

Level 2c: The degrees of preference in the Socio-Economic Aspect subsets are compared in Table 5.4. The subsets consist of two elements: Admission Fee and Risk of Endemic Disease

Table 5.4 Comparison matrix in the Socio-Economic Aspect subsets

	Admission (A)	Endemic disease (RD)
Admission (A)	1	1/5
Endemic disease (RD)	5	1

However the subsets of Facility (i.e. Accommodation, Petrol Station, Public Transportation Station, and Hospital/Healthcare Service Area) which are in the lowest level of the hierarchy are not

compared by experts as all of them represent the basic needs for tourism development and are not sufficiently sensitive for comparison. They also equally support for servicing tourists in the study area. However, rating scores of each facility were quantified in different sets of criteria, with respect to their service area calculation, which will be mentioned in section 5.3.

5.2.2 Computation of Criterion Weights

In the previous step, the pairwise comparison values among groups of criteria were completely assigned into matrices. These matrices thus allowed the criterion priorities to be synthesized and produce the relative weight. The computation uses the principal eigenvector to determine the comparative importance of various criteria in the comparison matrix. Three steps were involved in obtaining the relative weights or priorities for each criterion (Malczewski, 1999a, Deng et al., 2002):

1) Calculate the sum of values in each column of the pairwise comparison matrix (Table 5.6 in Step I).
2) Operate the normalized pairwise comparison matrix. Each element in the matrix was normalized by its' total score, which was calculated from step I (Table 5.6 Step II).
3) Compute the average of the element values in each row of the normalized matrix (Table 5.6 Step III). For example, the normalized matrix of Level 1 in step II (Table 5.6) was 0.231, 0.217 and 0.333 in the first row. Therefore, the average of the first row was calculated by the sum of all elements in the first, divided by 3, which is the number of criteria, that is [(0.231 + 0.217 + 0.333)/3] = 0.261. These averages provided an estimate of the relative weights of the criteria being compared.

Thus, the following weights for all criteria in this study were calculated according to these three steps. Table 5.5 presents the entire steps for criterion weight operations in detail, and the groups of criteria are shown separately in the table. The criterion weights of each matrix are shown in the final column in Step III.

Table 5.5 The final computation of Pairwise Comparison matrices

Level 1: Comparison of major objectives for evaluation

	Step I			Step II†			Step III	
Criterion	Phy	Att	SoE	Phy	Att	SoE	Row	Weight*
Phy	1	0.333	3	0.231	0.217	0.333	0.781	0.261
Att	3	1	5	0.692	0.652	0.556	1.900	0.633
SoE	0.333	0.200	1	0.077	0.130	0.111	0.318	0.106
Total (column)	4.333	1.533	9.000	1.000	1.000	1.000		1.000

Level 2a: Subsets of Physical Aspect

	Step I			Step II			Step III	
Criterion	AC	F	S	AC	F	S	Row	Weight
AC	1.000	2.000	4.000	0.571	0.600	0.500	1.671	0.557
F	0.500	1.000	3.000	0.286	0.300	0.375	0.961	0.320
S	0.250	0.333	1.000	0.143	0.100	0.125	0.368	0.123
Total (column)	1.750	3.333	8.000	1.000	1.000	1.000		1.000

Level 2b: Subsets of Attraction

	Step I			Step II			Step III	
Criterion	VU	P	TA	VU	P	TA	Row	Weight
VU	1.000	3.000	5.000	0.652	0.692	0.556	1.900	0.633
P	0.333	1.000	3.000	0.217	0.231	0.333	0.781	0.261
TA	0.200	0.333	1.000	0.130	0.077	0.111	0.318	0.106
Total (column)	1.533	4.333	9.000	1.000	1.000	1.000		1.000

Level 2c: Subsets of Socio-Economic Aspect

	Step I		Step II		Step III	
Criterion	A	RD	A	RD	Row	Weight
A	1.000	0.200	0.167	0.167	0.333	0.167
RD	5.000	1.000	0.833	0.833	1.667	0.833
Total (column)	6.000	1.200	1.000	1.000		1.000

†: each element value / its total column; *: Average Row Sum

According to the computation processes in Table 5.5, criterion weights from two levels of the hierarchy are outlined in the Table 5.6. The results revealed that the Attraction factor is the most preferred objective for evaluating the potential of tourist attractions in level 1. This was preferred 3 times greater than the Physical Aspect and up to 6 times more than the Socio-Economic Aspect, while the Physical Factor was preferred twice more than the Socio-Economic factor. In level 2a, Accessibility was moderately preferred to Facility and highly preferred to Seasonality. In addition, Facility was preferred almost 3 times to Seasonality. Value/Uniqueness was the most preferred in level 2b, followed by Popularity and Activity. For the last level (2c), the Risk of Endemic Disease was preferred to Admission.

Table 5.6 The final criterion weights used in the study

Level of hierarchy		Criteria	Criterion weights
		Physical Aspect	0.26
		Attraction	0.63
		Socio-Economic Aspect	0.11
Level 2			
	a	Accessibility	0.56
		Facility	0.32
		Seasonality	0.12
	b	Value/Uniqueness	0.63
		Popularity	0.26
		Activity	0.11
	c	Admission	0.20
		Endemic disease	0.80

5.2.3 Checking the consistency ratio

The AHP technique provides feedback to decision makers on the consistency of the entered judgments in each comparison matrix. A method to check the consistency is called the Consistency Ratio (CR), which measures whether the comparison is acceptable. Saaty (1995) suggested that Consistency Ratio should be less than 10% (in fact 5% for a matrix of order 3 by 3, 9% for a matrix

of order 4 by 4, and 10% for matrices of a higher order). Basically, if the matrices are above 10% or 0.1, they are omitted for further analysis, and the comparison is revised in order to reduce inconsistency (Ishizaka and Labib, 2011).

To determine whether the comparisons for producing relative weights in this study were consistent, three steps of the CR computation were followed:

1) The computation of the Weight Sum Vector of the matrix was the first parameter for checking the consistency vector. To implement this, all members of the original pairwise comparison matrix (see step I in Table 5.5) had to be transformed into decimal form. Then, the first column of the matrix was multiplied by the first row of criterion weights in that matrix. (see step III in Table 5.5.). The second column was multiplied by the second row of the weight and the third column was also multiplied by the third row of the weight. Finally, the sum of these values over the rows was used to produce the Weight Sum Vector. For the example shown in Table 5.5, the matrix of level 1 determined criteria weights for each criterion as 0.261 (Physical Aspect), 0.633 (Attraction) and 0.106 (Socio-Economic Aspect). Thus, the Weight Sum Vectors of level 1 were evaluated by multiplying the components of the level 1 matrix with the criterion weights related to their positions (see Table 5.7).

Table 5.7 An example of the Weight Sum Vector in matrix level 1

Criterion of Level 1	Phy (0.261)		Att (0.633)		SoE (0.106)		Row Total (Weight Sum Vector)
Phy	(1 × 0.261)	+	(0.333 × 0.633)	+	(3 × 0.106)	=	0.791
Att	(3 × 0.261)	+	(1 × 0.633)	+	(5 × 0.106)	=	1.947
SoE	(0.333 × 0.261)	+	(0.200 × 0.633)	+	(1 × 0.106)	=	0.320

2) The average value of the consistency vector or lambda max (λ_{max}), sometimes called the largest eigenvalue of each matrix, was calculated. The value of λ_{max} was computed in two steps. First, the total row column (Weight Sum Vector) derived previously was divided by the corresponding criterion weight vector. An example of this calculation which used the result of the row total of matrix level 1, calculated on the table above, (Table 5.9) is shown as follows:

$$\begin{vmatrix}0.791\\1.947\\0.320\end{vmatrix} \div \begin{vmatrix}0.261\\0.633\\0.106)\end{vmatrix} = \begin{vmatrix}3.029\\3.074\\3.013\end{vmatrix}$$

Second, the result of the first step was averaged, as the example shows below:

$$\lambda_{max} = \frac{3.029 + 3.074 + 3.013}{3} = \frac{9.116}{3} \approx 3.039$$

3) Calculation of consistency Index (CI) and Consistency Ratio (CR): The Consistency Index (CI) was performed by using the formula:

$$\text{CI} = \frac{\lambda_{max} - n}{n-1}$$

The example below shows the previous result of λ_{max} for the matrix level 1, which equals 3.039). Thus, the CI value was:

$$\frac{3.039-3}{2} \approx 0.020$$

The Random Index (RI) of the CR for n = 3 is 0.52 (see Table 4.6 in the previous chapter). For the Consistency Ratio (CR), it was performed by:

$$\frac{\text{CI}}{\text{RI}} = \frac{0.020}{0.52} \approx 0.038$$

Therefore, the Consistency Ratio (CR) of the matrix level 1 in this study is 0.038.

According to these three steps, all comparison matrices of criteria in the study were tested for a Consistency Ratio. The results showed that all CR values that were less than 0.1 ranged from 0 to 0.038 (see Table 5.8). Comparing this with the acceptable CR value of less than 5 % (0.05) for a 3 by 3 matrix, all calculated CR values in this study were shown to be below the tolerance level. Thus, the numerical judgments given by the experts in this study were acceptable for further analysis of potential tourist attractions.

Table 5.8 The estimation of the consistency ratio for every matrix used in the study

Matrix of checking consistency ratio (CR)	λ_max	CI	CR = CI/RI*
Matrix Level 1 (n = 3)	3.039	0.020	0.038
Matrix Level 2a (n = 3)	3.018	0.009	0.018
Matrix Level 2b (*n* = 3)	3.039	0.020	0.038
Matrix Level 2c (*n* = 2)	2.000	0.000	0.000

*RI = 0.52 for n = 3 and RI = 0 for n= 2

5.2.4 Development of Weights corresponding to decision hierarchy

In this step, the relative importance of each criterion was identified, corresponding to the AHP decision hierarchy. According to decision structure in Figure 5.1, the criterion weights were processed from the top to the bottom levels. As the top level of this decision structure was first assigned weights, the results were 0.63, 0.26, and 0.11, for Attraction, Physical Aspect, and Socio-Economic Aspect respectively. This variation in importance influenced the assigned weights of lower criteria, which were sub-elements of each objective, since each objective was structured by multiple criteria in the lower level. Consequently, the weight of each top cluster (objective) was distributed to its lower criteria, corresponding to local criterion weights derived from the Pairwise Comparison approach. Therefore, the new assigned weights of each criterion or global normalized weights were normalized as the model below:

$$NW = (CW \times OW) / 1$$

,where NW means the global normalized weight, CW is a local criterion weight, and OW is a top weight of the objective obtained by the Pairwise Comparison matrix in Level 1.

The resulting normalized weight of every criterion is outlined in the chart below (Figure 5.2). The sum of the total normalized weights of all criteria was 1.

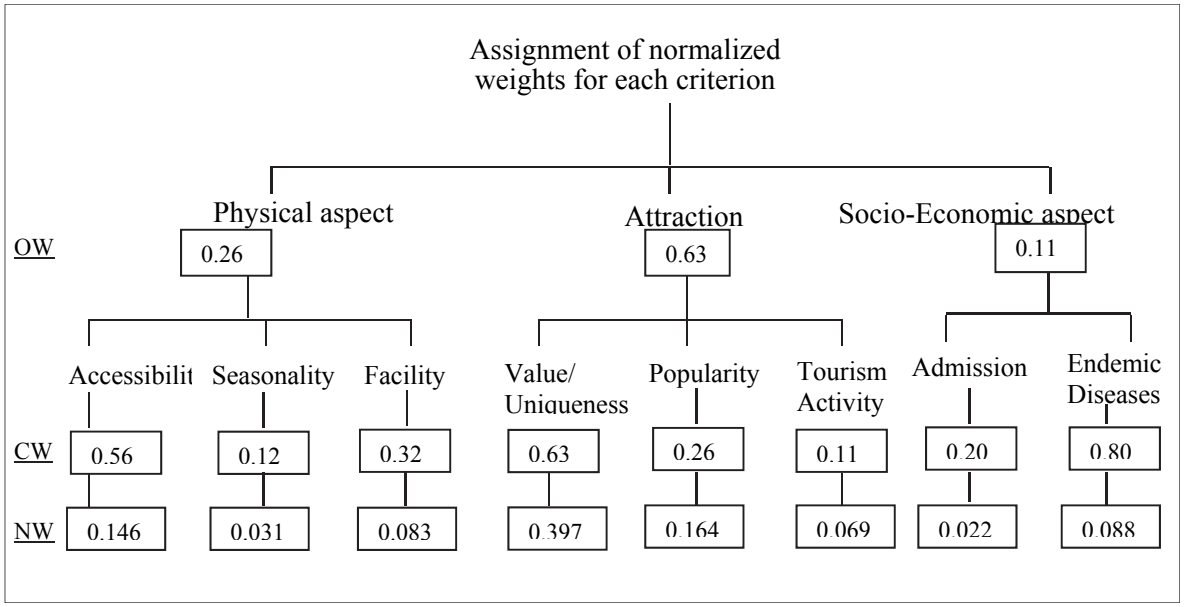


Figure 5.2 The assignment of normalized weights according to the decision hierarchy

5.3 Sets of rating scales for each criterion

Sets of criterion rating scales were constructed following the definition of each factor in chapter 4. Each factor developed a rating set of criteria, which was capable of quantifying the potential levels of each alternative tourist site. The sets of decision criteria were assigned into numeric values that were ranked by scores starting from 1. The higher the rating score, the more potential it has. Among the factors, some sets of their decision criteria had different value ranges from others. Therefore, these values were standardized into an equal range of rating scores, with a maximum value of 1 before transferring to the analysis process. In this study, eleven sets of criteria were chosen for evaluating the potential ranges of tourist attractions along the EWEC. The considered criteria consisted of eight main parameters: Accessibility, Seasonality, Value/Uniqueness, Popularity, Tourism Activity, Admission, Risk of Endemic Disease and Facility. However, one parameter, Facility, was sub-divided into four sub-parameters: Public Transportation Station, Accommodation, Petrol Station, and Hospital/Health Care Center. All rating sets of criteria are presented in detail as follows:

- Accessibility (AC): the AC set of decision criteria was ranked into four values to measure the ability to access the tour sites. These rating scales were classified as:

  (1) Difficult (long walk/more than half an hour, mostly hard access)
  (2) Adequate (mostly bad road/ specific automobile /limited entrance)
  (3) Good (mostly good, at least provided one entrance and way out/ most autos access but no public transport service)
  (4) Excellent (excellent access by various modes of transportation, including public transport services/ at least provided one entrance and way out.)

- Seasonality (S): the S set of decision criteria was divided into four periods of visiting times:

  (1) Less than 1 month
  (2) Up to 3 months
  (3) Up to 6 months
  (4) More than 6 months to year-round

- Value/Uniqueness (VU): the VU set of decision criteria was assigned corresponding to the standard assessment of valuable tourist attractions organized by Environmental Research Institute, Thailand (2006). The standard assessment was modified to apply multi-categories of tourist attractions, which were divided into 6 categories (see Appendix II):

  a) Natural tourist attraction/ Eco-tourism (e.g. national park, forest park, arboretum and thermal bath);
  b) cultural tourist attraction (e.g. Lao silk-cotton weaving center, local tradition and culture, folklore and handicraft);
  c) Historical tourist attraction (e.g. World Heritage sites, religious places, wartime heritages places and monuments);
  d) Recreation / entertainment tourist attraction (e.g. shopping, dam, man-made beach, viewpoint and casino);
  e) Arts and sciences educational tourist attraction (e.g. research center, city tower, experimental station, convention center and theme museum) and;
  f) Waterfall tourist attraction

- Popularity (P): the P set of decision criteria was assigned to measure the degree of popularity by the percentage of international tourists who visit the tour sites each year.

  (1) Only local residents/specific groups of visitors
  (2) Only domestic visitors

(3) Both domestic and international tourists (the percentage of international tourists is ≤ 50 percent)

(4) Domestic and international tourists (the percentage of international tourists is > 50 percent)

- Tourism Activity (TA): the TA set of decision criteria was divided into 2 ranks of assigned values which indicates:

(1) Single activity

(2) Multiple-activities

- Admission (A): the A set of decision criteria was assigned to measure how difficult it is for a tourist to have access and what fee must be paid to visit.

(1) Advance or written application is necessary/ large fee (more than 500 Thai Baht (about 10 Euro))

(2) Permit obtainable locally or small entrance fee (less than or equal to 500 Thai Baht)

(3) Easy entry/ free entrance

- Risk of Endemic Disease (RD): the RD set of decision criteria was designed from multiple sources of endemic disease reports. The reports were informed by the Centers for Disease Control and Prevention (CDC) about health information for travelers, endemic diseases and outbreak reports of the World Health Organization (WHO), and Avian Influenza reports of the World Organisation for Animal Health (OIE). Then, these reports were integrated to generate the risk area map in ArcGIS (Figure 5.3). A set of RD criteria was thus designed according to the intensity of risk as follows:

(1) High-risk area: The tour site is in a risk area where two or more endemic diseases have still appeared within the last two years until present (2011). Vaccination programs are recommended.

(2) Medium-risk area: The tour site is in an area where only one endemic disease has been reported over the last two years (2009). Vaccination programs are recommended in specific cases, such as long stays in mountainous or remote areas.

(3) Low-risk area: The tour site is in an area where some endemic diseases have been reported over the last two years, but they have already been eradicated from the areas.

(4) No risk area of endemic diseases: No endemic diseases or outbreaks have been reported within the last two years.

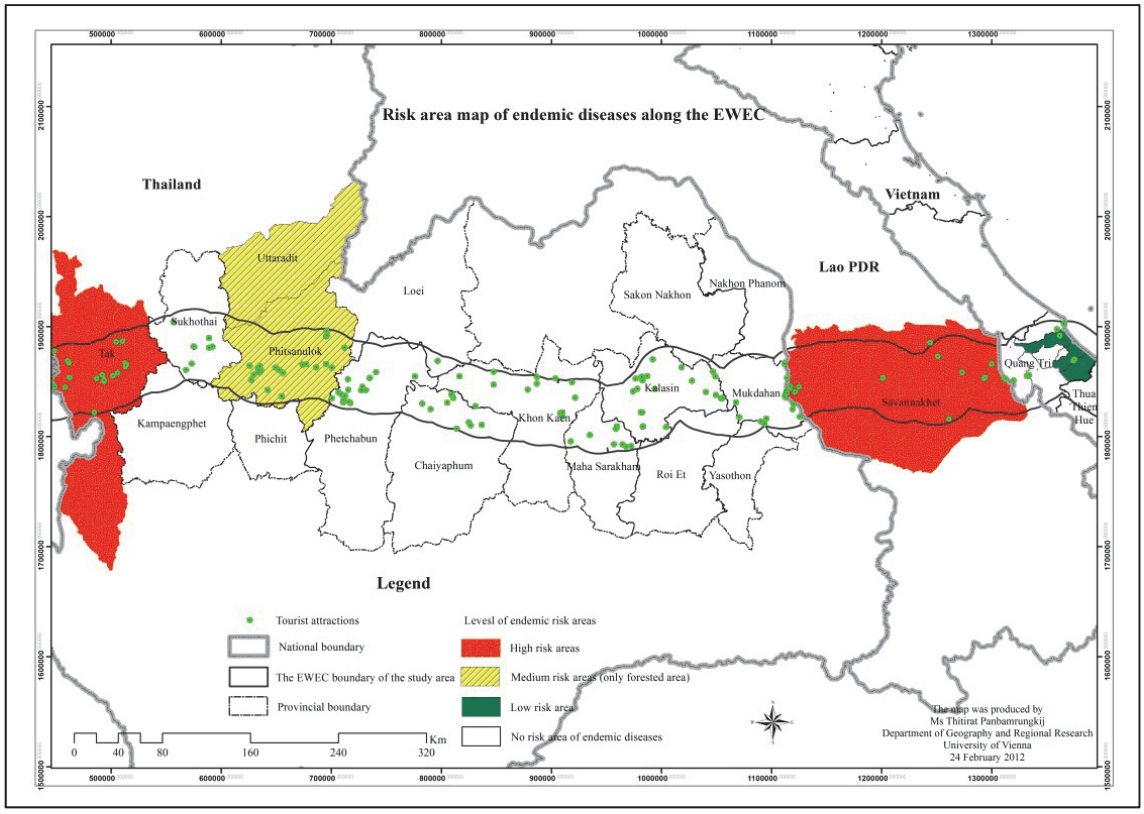


Figure 5.3 The risk area map of endemic diseases along the EWEC

According to the map (Figure 5.3), a high-risk area was found in Tak, Thailand and Savannakhet, Lao PDR. These provinces have had an ongoing transmission risk of malaria and Japanese Encephalitis. Therefore, pre-vaccinations are recommended for travelers, in particular, long-holiday tourists in the forest and rural areas. A medium risk area was found in Uttradit and Phitsanulok, Thailand. These areas have been presumed to be endemic areas of malaria in the highlands and forests, as well as in the border areas close to Lao PDR. Next, the districts of Gio Linh, Hai Lang and Trieu Phong in Quang Tri, Vietnam were indicated as low risk areas, where incidences of Avian Influenza were reported but have already been resolved. Finally, the remaining areas are at no risk, where infectious diseases have not been reported.

- Facility (F): it measures the available transport networks to deliver travelers from tourist places to each facility and back within defined times or distances. The author applied a Service Area function of ArcGIS Network Analyst to examine accessibility in terms of travel time and distance on road networks. The Service Area operation generates service area polygons responding to travel time zones or distance zones. Basically, the closer the tourist sites are to service areas, the more advantages the facility services have. The criteria details for Facility were classified into four subsets from F1 to F4:

➢ F1: Public Transport Station: the criteria set was generated based on the basic requirement for a pedestrian link to public transportation networks and spacing between transport nodes. The acceptable walking distance to public transit, particularly bus stops, is typically considered to be 400 meters (Central Ohio Transit Authority, 1999, Murray et al., 1998). The average pedestrian covers this distance in about 5 minutes under normal conditions (Murray and Wu, 2003). In low residential areas, accessing public transit can be as long as 800 meters (or 10 minutes) (Central Ohio Transit Authority, 1999). As the study area in this research is mainly in rural areas, the criteria for access to Public Transport Stations were initially set at the lowest threshold within 800 meters. However, the accessible distances can be extended for regional public transportation by using private automobiles, subways, trains and regional buses. Regarding the study of Immers, Egeter and van Nes (2004), the distance between access nodes is commonly less than 1 kilometer for a local bus, up to 5 kilometers for a commuter train service and up to 30 kilometers for regional bus services and long-distance trains. Thus, the range of the service areas in this study was identified as 0.8, 5 and 30 kilometers (Figure 5.4), as detailed below.

(1) Visitors can reach the public transport station further than 30 kilometers.
(2) Visitors can reach the public transport station within 5 to 30 kilometers.
(3) Visitors can reach the public transport station within 0.8 to 5 kilometers.
(4) Visitors can reach the public transport station within 0.8 kilometers.

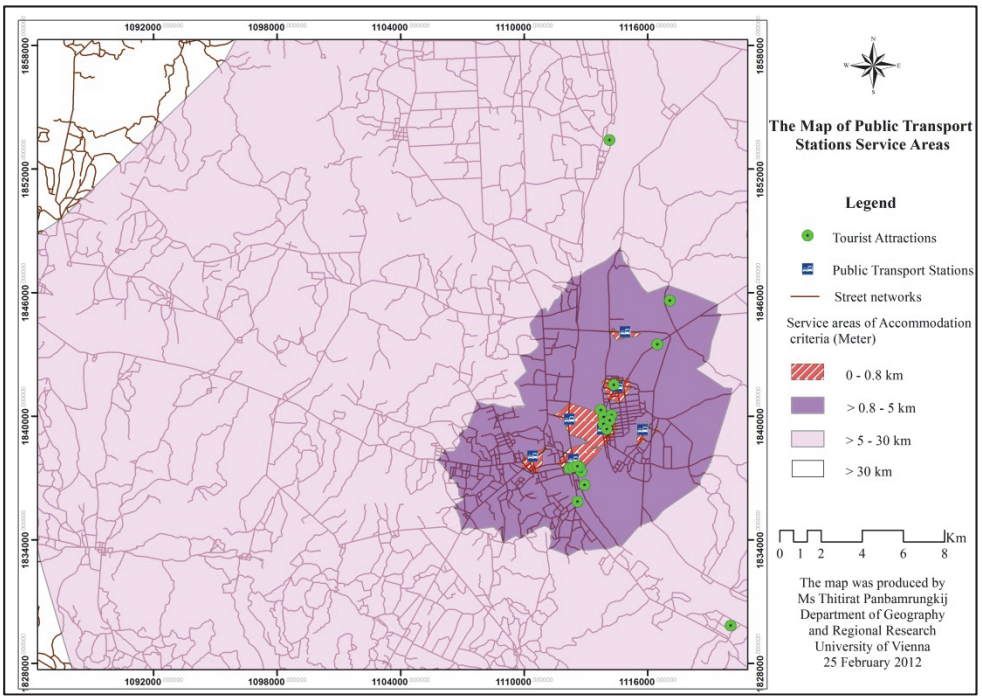


Figure 5.4 Service Area of Public Transport Stations

➢ F2: Accommodation; the criteria set was formed by considering reasonable walking distance and distance decay, which was dependent on the lodging location. According to a basic distance decay model, distance has impacted tourism movements and the decision of stopping at destinations, as well as on choosing accommodation. Shoval et al. (2011) presented the relationship between the daily time spent at any tourist attraction and the distance from the hotel location. Typically, the demand curve of time spent is high in areas close to hotel sites, and declines sharply after a 2 kilometer radius away from the hotel. However, the relationship pattern changes when hotels provide additional services, such as a shuttle bus to main attractions or major public transportation. In the present study, we assumed that the closest accommodation were proportional to the number of opportunities available to tourists. The service area of Accommodations were extended from a walking distance boundary (< 1 kilometer (Immers et al., 2004)) to 10 kilometers, which should be supported by an automobile. In Figure 5.5, the Accommodation criteria were generated in detail below:

(1) Visitors can reach the accommodation further than 10 kilometers.
(2) Visitors can reach the accommodation within 5 to 10 kilometers
(3) Visitors can reach the accommodation within 2 to 5 kilometers
(4) Visitors can reach the accommodation within 1 to 2 kilometers
(5) Visitors can reach the accommodation within 1 kilometer

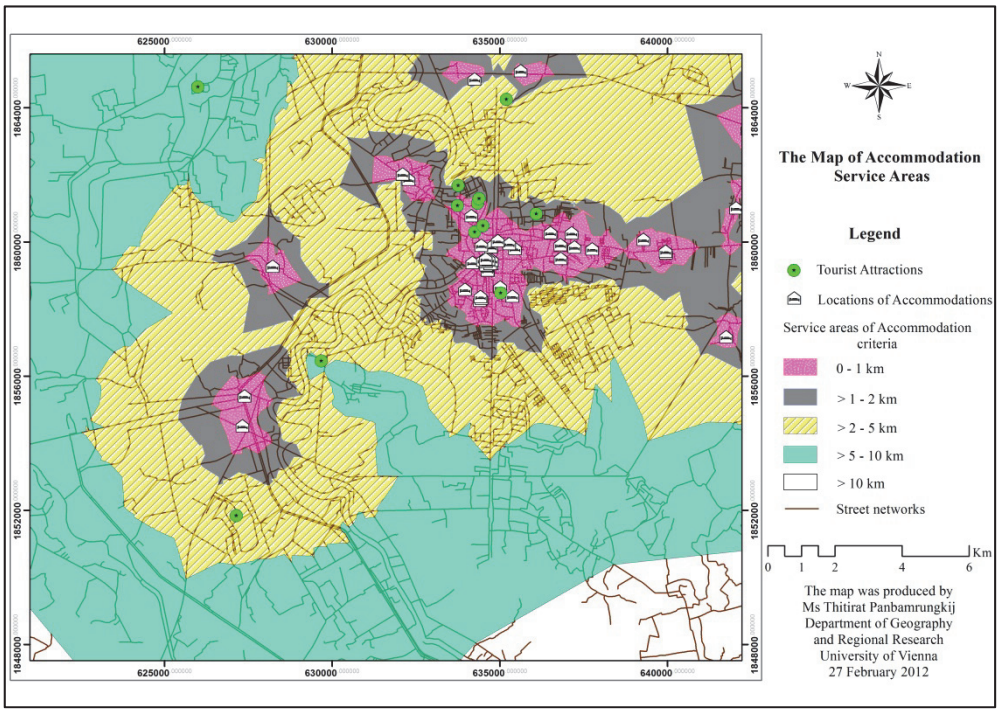


Figure 5.5 A set of accommodation criteria operated in ArcGIS package

➢ F3: Petrol Station; the criteria set was calculated by analyzing the access from streets to petrol stations within a distance boundary. This distance was determined by the average distance a car drives before fuel is empty. Generally, automobiles have an average distance of 30-40 miles (or about 48 – 64 kilometers) after the petrol tank light turns on (Stossel, 2008). However, the average distance varies depending on the type of car and condition. In this study, the boundary line of the petrol service area was marked between 30 and 60 kilometers (Figure 5.6), which does not exceed the average driving distance before running out of fuel. This is because if the traveler continues to drive over 60 kilometers, the automobile risks stopping if fuel runs out. In addition, the general service areas on an autobahn or highway in Germany for re-fueling, which include petrol stations, restaurants, restrooms, convenience stores and other travel facilities, is between 40 and 60 kilometers (Purcell, 2012). This study modified the lowest range of service areas to 30 kilometers, which allows for breaks during tourists' journey along the EWEC. The final criteria were arranged as follows:

(1) Travelers can reach the petrol station further than 60 kilometers.
(2) Travelers can reach the petrol station between 30 - 60 kilometers.
(3) Travelers can reach the petrol station within 30 kilometers.

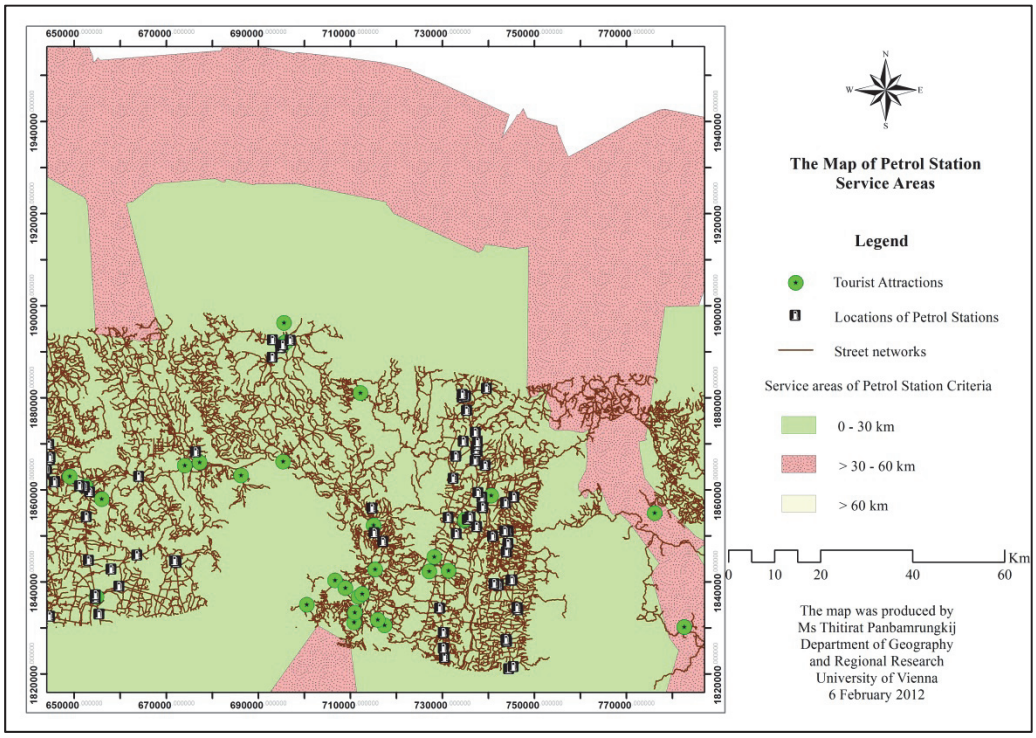


Figure 5.6 A set of Petrol Station criteria operated in ArcGIS package

➢ F4: Hospital or Local Healthcare Center: the criteria set was calculated to measure the accessible area to reach a hospital or local healthcare center within 8 and 19 minutes (Figure 5.7). The criteria were based on the common benchmark of Emergency Medical Service (EMS) providers which indicate 8 minutes or less for an ambulance service to an incident (David and Harrington, 2010). According to the National Health Services in England, the benchmark is a standard general response time for arriving at the scene of an incident for all emergencies, which is expected to reach 75% of immediately life threatening emergency calls within 8 minutes. This response time can be extended to 14 minutes and 19 minutes in 95% of other emergency calls in urban and rural areas respectively (Health and Social Care Information Center, 2005). Accordingly, most of the study area is rural, and the response of arrival time was therefore extended to 19 minutes. In the present study, the healthcare's service area criteria were put into 3 categories:

(1) Service areas that have an emergency response arrival to tourist attractions of more than 19 minutes.
(2) Service areas that have an emergency response arrival to tourist attractions between 8 to 19 minutes.
(3) Service areas that have an emergency response arrival to the tourist attractions within 8 minutes.

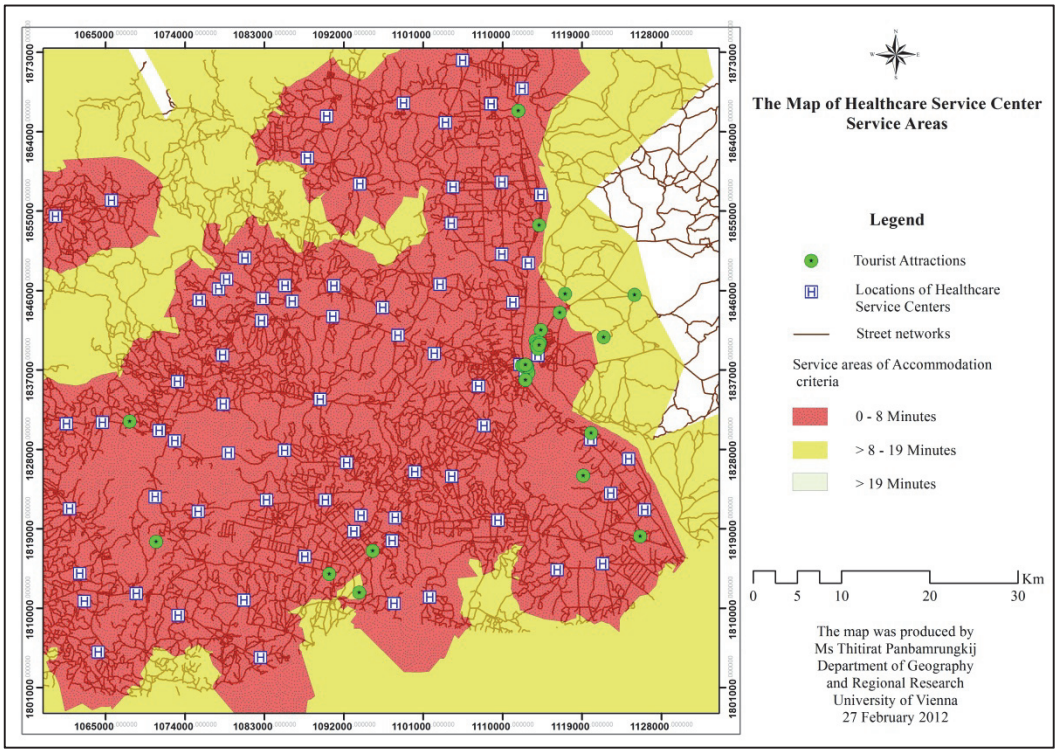


Figure 5.7 A set of healthcare service center criteria operated on ArcGIS package

5.4 Integration of AHP in a GIS framework

The GIS can facilitate AHP to input, store and calculate multiple criteria used in a data model, as well as visualize a digital map. Multi-criteria evaluation used in the AHP comprised large number sets of criteria and alternatives to identify potential levels of tourist attractions. This was achieved by applying the overlay functions of GIS. Some sets of criteria mentioned in previous steps were determined by integrating spatial and network analysis functions, particularly in tourism facilities.

In Figure 5.8, the major steps of AHP processed in GIS are outlined. In the first process, all criteria (factors) were used to generate spatial map layers, including their attribute data in a GIS database. Also, alternatives (tourist attractions) were formed in point data structures. Then, attribute values of every criterion were standardized and assigned values in the attribute data of all tourist attractions. Next, all standard values were multiplied by each criterion weight and then the Weighted Linear Combination (WLC) was applied to combine the average standardized criteria values with their weights to produce overall scores of each tourist attraction. In the final step, these total scores were transferred into a potential index and classified into three categories of potential tourist attractions. The results are displayed in a map of tourist attractions' potential.

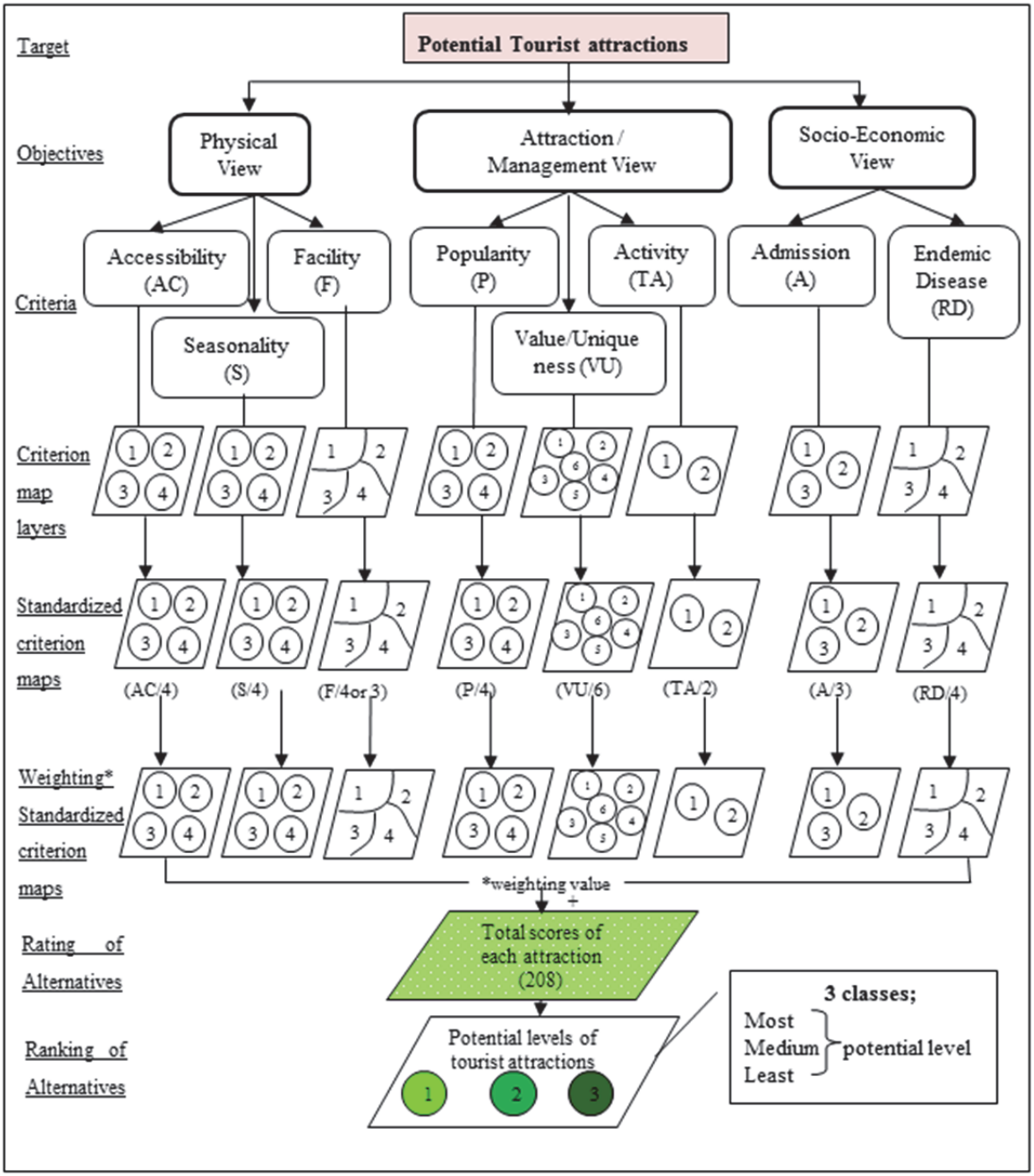


Figure 5.8 GIS-based AHP procedures

5.5 Linear scale transformation for standardization

Regarding AHP procedures in the GIS framework, standardized criterion transformation converted the rating scores of all alternatives for every criterion in different ranges of linear scale measurement into the same standard scale. This transforming process used the formula below:

$$SR_{ij} = \frac{x_{ij}}{x_i^{max}}$$

, where SR_{ij} means the standardized rating score for the i^{th} alternative (tourist site) and the j^{th} attribute. The x_{ij} is the raw score, and x_i^{max} is the maximum score for the j^{th}attribute.

The result showed a common numeric scale of each criteria for assigning standardized rating scores for every alternative (Table 5.9). The maximum standardized rating score of every criterion equaled 1. The amount of all alternatives, i.e. tourist attractions selected for evaluation, was 208 sites.

Table 5.9 The Standardized Criteria Scores

Criteria	**Value**	**Rating score (R)**	**Standardized Rating score (SR)**
1. Accessibility (AC)	Mostly hard access Adequate Good Excellent	1 2 3 4	0.25 0.5 0.75 1
2. Seasonality (S)	Less than 1 month Up to 3 months Up to 6 months More than 6 months	1 2 3 4	0.25 0.5 0.75 1
3. Value/Uniqueness (VU)* ▪ National/Eco-tourist attraction ▪ Historical / culture attraction ▪ Relaxation/ Entertainment attraction ▪ Arts and Sciences tourist attraction ▪ Waterfall	Using standard assessment of importance/value tourist attraction	 between 1 and 40 between 1 and 50 between 1 and 40 between 1 and 40 between 1 and 85	 0.025-1 0.02-1 0.025-1 0.025-1 0.012-1

Criteria	Value	Rating score (R)	Standardized Rating score (SR)
4. Popularity (P)	Only local resident/ specific group	1	0.25
	Only domestic visitors	2	0.50
	Domestic and international visitors (<50%)	3	0.75
	Domestic and international visitors (>50%)	4	1
5. Tourism Activity (A)	Single activity	1	0.5
	Multi-activity	2	1
6. Admission (A)	Difficult/High cost fee	1	0.3333
	Permit with little cost fee	2	0.6667
	Easy/entrance free	3	1
7. Risk of Endemic disease (RD)	High risk area	1	0.25
	Medium risk area	2	0.50
	Low risk area	3	0.75
	No risk area	4	1
8. Facility service area (F)**			
8.1 Public transportation station (F1)	Outside service area of 30 km.	1	0.25
	Service area from 5 to 30 km.	2	0.50
	Service area from 0.8 to 5 km.	3	0.75
	Service area within 0.8 km.	4	1
8.2 Accommodation (F2)	Outside service area of 10 km.	1	0.20
	Service area from 5 to 10 km.	2	0.40
	Service area from 2 to 5 km.	3	0.60
	Service area from 1 to 2 km.	4	0.80
	Service area within 1 km.	5	1
8.3 Petrol station (F3)	Outside service area of 60 km.	1	0.3333
	Service area from 30 to 60 km.	2	0.6667
	Service area within 30 km.	3	1
8.2 Hospital/Health care center (F4)	Outside service area of 19 min	1	0.3333
	Service area from 8 to 19 min	2	0.6667
	Service area within 8 min	3	0.1

* These criteria were calculated standardized according to the uniqueness/important value derived from the standard assessment of tourist attractions classified by types of attractions above.

** All standardized rating scores of Facility components (from F1-F4) were summed together and then averaged for every alternative (tourist sites) to produce the representative score of the Facility factor, before processing in the potential evaluation model of tourist attractions.

5.6 The potential evaluation of tourist attractions

The final process of AHP for evaluating potential levels of tourist attractions utilized the Weighted Linear Combination (WLC) method. This method caculated the overall standardized scores of each criterion multiplied by its weight for every alternative, according to the equation below:

$$P = \sum_{i=1}^{n} SR_i \times NW_i$$

where P means the potential index of tourist attractions
X_i is Standardized Rating score for value of criteria i, and
NW_i is Normalized Weight of criteria i

Therefore, all criteria and weights for this study were calculated to achieve the potential tourist attractions corresponding to the model above as this applicable model:

$$P = [(SR_{AC} \times NW_{AC}) + (SR_S \times NW_S) + (SR_{VU} \times NW_{VU}) + (SR_P \times NW_P) + (SR_{TA} \times NW_{TA}) + (SR_A \times NW_A) + (SR_{RD} \times NW_{RD}) + (SR_F \times NW_F)]$$

The potential index of 208 tourist attractions in this context were ranked and then classified into 3 categories low, medium, and high potential levels, by using the standard deviation method (Figure 5.9) which Deng et al. (2002) supported to classify groups of alternatives.

Regarding the standard deviation classification, a histogram of the potential index was simultaneously calculated (Figure 5.9). The present results showed that the average value of overall potential scores was 0.7230, and the standard deviation was 0.0966. The maximum value was 0.9703, while the minimum value was 0.4372 for all 208 tourist attraction sites.

Based on the average scores and the relevant standard deviations, 3 categories of the potential index were proposed as:

1) Low potential category (values are between 0.4372 and 0.6264)
2) Medium potential category (values are between 0.6265 and 0.8196)
3) High potential category (values are between 0.8197 and 0.9703)

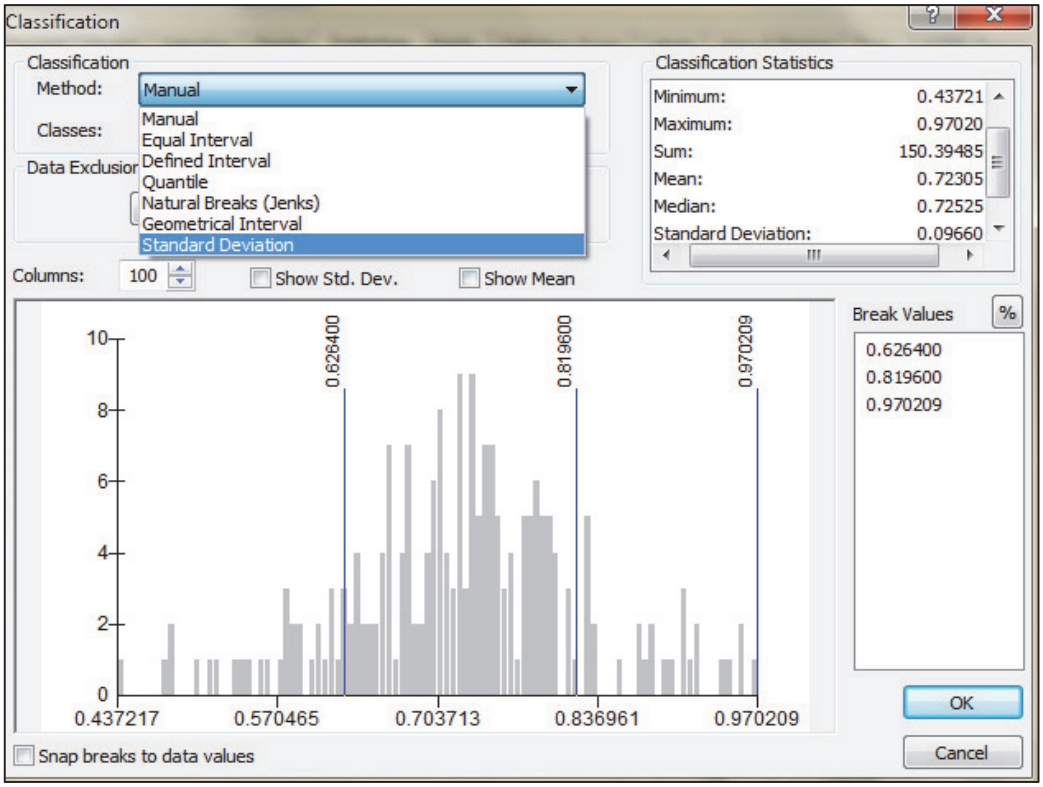


Figure 5.9 Histogram of potential index. (Note that the vertical lines represent standard deviations.)

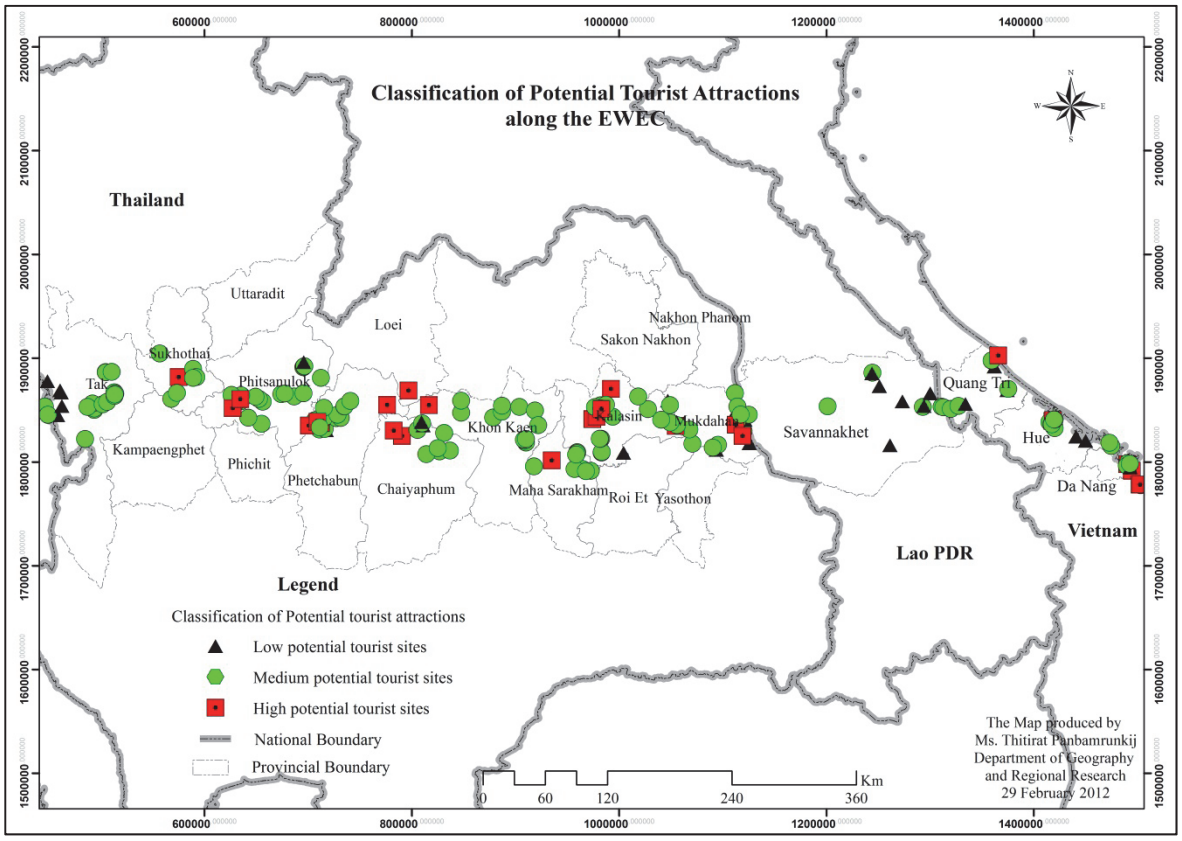


Figure 5.10 The map of potential levels of tourist attractions

Regarding the classification, the results showed that 26 tourist attractions fall within the highest potential levels, 152 have moderate potential levels and 30 sites are in the lowest level. All potential groups of tourist attractions are displayed as a point data structure in Figure 5.10.

In table 5.10, the group with high potential is described, with the highest score of 19 tourist sites located in Thailand. The rest in the high potential group was in Vietnam, accounting for 7 sites. Among this group, there are 10 natural tourist attractions (NT), 6 historical and cultural places (HC), 6 arts and science educational attractions/ museums (AS), 3 recreational sites (REC) and 1 viewpoint (VP).

Table 5.10 The highest potential levels of tourist attractions along the EWEC

No.	Describe	Category	Province	Country
1	Phu Khieo Wildlife Reserve	NT	Chaiyaphum	Thailand
2	Chulabhorn Dam	REC	Chaiyaphum	Thailand
3	Pu Thai Cultural Village, Ban Khok Kong	HC	Kalasin	Thailand
4	Lam Pao Dam	REC	Kalasin	Thailand
5	Lam Pao Wildlife Conservation Development and Promotion Station	NT	Kalasin	Thailand
6	Ban Phon Phrae Wa (Silk Weaving Group)	HC	Kalasin	Thailand
7	Sirindhorn Museum and Phu Kum Khao Dinosaurs Museum	AS	Kalasin	Thailand
8	Phu Pha Man National Park	NT	Khon Kaen	Thailand
9	Phu Kradueng National Park	NT	Loei	Thailand
10	Kosamphi Forest Park (National Parks & Marine Reserves)	NT	Maha Sarakham	Thailand
11	Ho Kaeo Mukdahan (Mukdahan tower) Hall	AS	Mukdahan	Thailand
12	Mukdahan National Park (Phu Pha Therb)	NT	Mukdahan	Thailand
13	Thung Salaeng Luang National Park (Nong Mae Na)	NT	Phetchabun	Thailand
14	Khao Kho	NT	Phetchabun	Thailand
15	Nam Nao National Park	NT	Phetchabun	Thailand
16	Khao Kho Wildlife Aquaculture Station and Conservation Research	NT	Phetchabun	Thailand
17	Textile Museum and Life Museum	AS	Phetchabun	Thailand

No.	Describe	Category	Province	Country
18	Phra Si Mahathat Woramahawihan	AS	Phitsanulok	Thailand
	(Phra Budha Chinnarat temple)	HC	Phitsanulok	Thailand
19	Sukhothai Historical Park (Old Sukhothai city)			
20	Da Nang Museum of Cham Sculpture	HC	Sukhothai	Thailand
21	Marble Mountain and cave	AS	Danang	Vietnam
22	Hoi An city	NT	Danang	Vietnam
23	Hoi An Ancient City	REC	Danang	Vietnam
24	7 colors bridge (New bridge)	VP	Hue	Vietnam
25	Dai Noi (Imperial City or Old Citadel)	HC	Hue	Vietnam
26	Vinh Moc Tunnels	AS	Quang Tri	Vietnam

The proportions of the potential tourist attractions' classification are outlined by country in Figure 5.11. The highest proportion of high potential tourist attractions (19%) is Vietnam followed by Thailand (13%), while there is no percentage of high potential tourist attractions in Lao PDR.

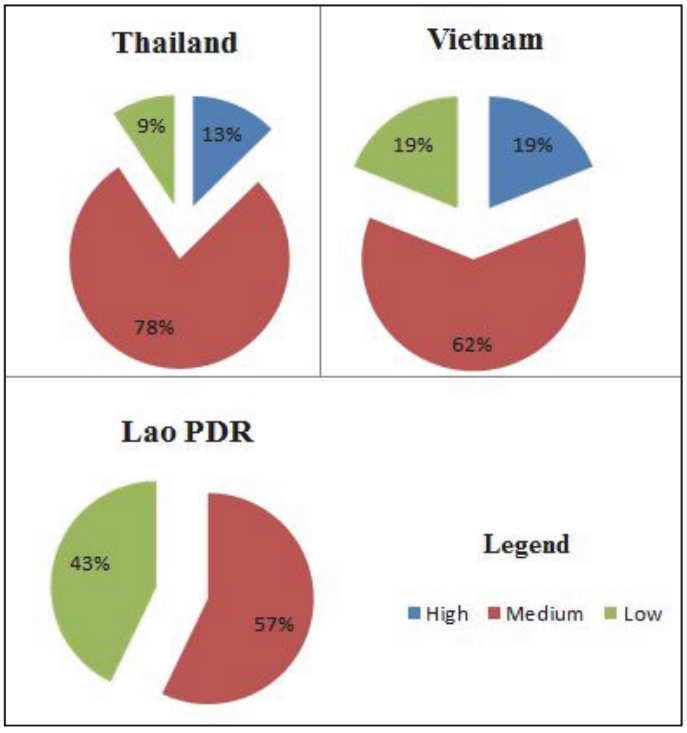


Figure 5.11 Proportion of potential tourist attraction ranges classified by country

In addition, Table 5.11 describes the top ten sites with the highest potential index. All the tourist sites provide outstanding attractiveness and were reported to have prompt tourism facilities, serving as the leading destinations in this region.

Table 5.11 The top ten high potential tourist attractions

Top 10 sites	Name of Tourist attraction	Description	Province	Country
1	Sukhothai Historical Park or Old Sukhothai City	Glorious ruins of ancient cities, representing historical art and architecture, as well as religious faith.	Sukhothai	Thailand
2	Phu Kradueng National Park	A flat-top sandstone mountain that is still unspoiled, with a diverse ecological system, geographical features, evergreen forests, waterfalls and viewpoints.	Loei	Thailand
3	Phra Si Mahathat Woramahawihan (Phra Budha Chinnarat)	The most beautiful Buddha image enshrined in the marvellously decorated hall in this historical temple.	Phitsanulok	Thailand
4	Dai Noi (Imperial City or Old Citadel)	The best of Vietnam's ancient architecture of the Nguyen dynasty (The unique eastern feudal royal capital and religion).	Hue	Vietnam
5	Da Nang Museum of Cham Sculpture	The largest collection of Cham artefacts is placed in French-colonial architecture with Cham elements.	Danang	Vietnam
6	Phu Pha Man National Park	A stunning natural landmark of the park is the towering limestone cliff that looks like a huge curtain. It is composed of various geologic landscape and biodiversity.	Khon Kaen	Thailand

Top 10 sites	Name of Tourist attraction	Description	Province	Country
7	Ho Kaeo Mukdahan (Mukdahan tower) Hall	A 65-meter-high tower with panoramic views of the Mekong River. It also shows the exhibition of Mukdahan and Mekong history, culture, arts, lifestyle.	Mukdahan	Thailand
8	Phu Khieo Wildlife Reserve	A reserve ideal for studying flora and fauna because it has an abundance of wild animals and over 350 bird species. The highlight is Thung Kamang, a vast green grass field surrounded by mountains, which is a project of her majesty the Thai Queen for wildlife sanctuary.	Chaiyaphum	Thailand
9	Hoi An city	A calm and peaceful landscape and lifestyle which explains its fusion of different cultures such as Japanese, Cantonese.	Danang (Hoi An)	Vietnam
10	Mukdahan National Park (Phu Pha Therb)	An area scattered with outstanding rock formations in particular mushroom-shapes, It provides beautiful landscapes of deciduous forests, caves, cliffs, and waterfalls.	Mukdahan	Thailand

5.7 Summary

This chapter integrated multiple techniques mainly in AHP to rate the potential of tourist attractions on three levels; low, medium and high. The processes were operated in a GIS framework, which provided the ability to combine multi-functions and techniques for analyis processes and to visualise the result on both attribute and spatial outcomes. Our findings revealed the degrees of potential that tourist attractions have along the EWEC. The vast majority of high potential tourist attractions are located in Thailand. Whereas the proportion of high potential tourist attractions accounted for 13 % of the total numbers of attractions in Thailand, it reaches up to 19 % in Vietnam. There are no high potential tourist sites found in the Lao PDR area. In the following chapters, these results will be addressed to identify optimal ways of developing tourism along the EWEC in Southeast Asia.

Chapter 6

Itinerary models for the East-West Economic Corridor

This chapter presents the itinerary models created by applying Network Analysis and Oppermann's traveling models. The Oppermann Multiple Destination model was adapted to accommodate the optimal tour itinerary patterns in the EWEC area. Through GIS functions and Network Analysis, the outcomes presented multiple tourist traveling models and guide maps for travelers, specifically for those who visit this region for the first time. The guide map has drawn together tourism information among tourist attraction sites, transport infrastructure, accommodation and other tourism facilities. In addition, each itinerary model provides a visual example scenario, which combines current origin stops and destinations along the EWEC.

6.1 Elements of itinerary models

Generally, destinations are at an unfamiliar time zone and environment for tourists (Jafari, 1987). Tourists' imagination and knowledge are imperfect and sometimes far from reality (existing status), even if they gather information before starting a journey. Lew and McKercher (2006) offered two major groups of elements that influence local destination movements. The first group constitutes destination characteristics, which involve tourism infrastructure, attraction sites, and transportation accessibility, while the second group represents behavior (tourist characteristics) independent of the destination. These characteristics include tourists' time budget, motivation, interest and knowledge of destination. This model only influences the intradestination movement patterns of tourists. However, this study area is an international connection among four countries, which has an oblong shape and is 1,350 kilometers long. It is thus suitable for long-haul journeys and long linear patterns of road networks. The itinerary model was developed as a multiple destinations model, which is not only for domestic travel but also for regional international travel.

Moreover, some elements of Oppermann's travel model were considered in this model - origin places/home and differentiation of arrival and departure points. In addition, the itinerary patterns are different between the home locations of travelers. Travelers starting from far away to a destination are likely to stop somewhere as a gateway destination or transit point (Lew and Mckercher, 2002), whereas travelers from neighboring places are likely to continue directly to the main destinations. These gateway destinations function as the non-home experience to reduce culture

shock from an exotic main attraction in the touring routes (Lew and Mckercher, 2002). Therefore, they perform important physical and psychological functions. Although they are not direct destinations, they indicate a journey's beginning and end (Dredge, 1999).

Furthermore, Oppermann also suggested that some traveling patterns are composed of different destination characteristics or geographical regions which can be seen in M4 (Open jaw loop) and M5 (Multidestination area loop) of the Oppermann model (Figure 6.2). Although this study modified the Oppermann multiple destination model to implement the tourist itinerary models along East-West Economic Corridor, his models did not identify the specific arrival and departure points between home and destinations, or between hubs and gateway destinations. The gateways are included in the arrival zones of the destination region and usually located along inter-regional circulation routes.

Therefore, the present study extends some elements to fulfill the EWEC itinerary models. The EWEC itinerary models are composed of six relevant elements for setting tourist itinerary patterns as the model below shows (Figure 6.1).

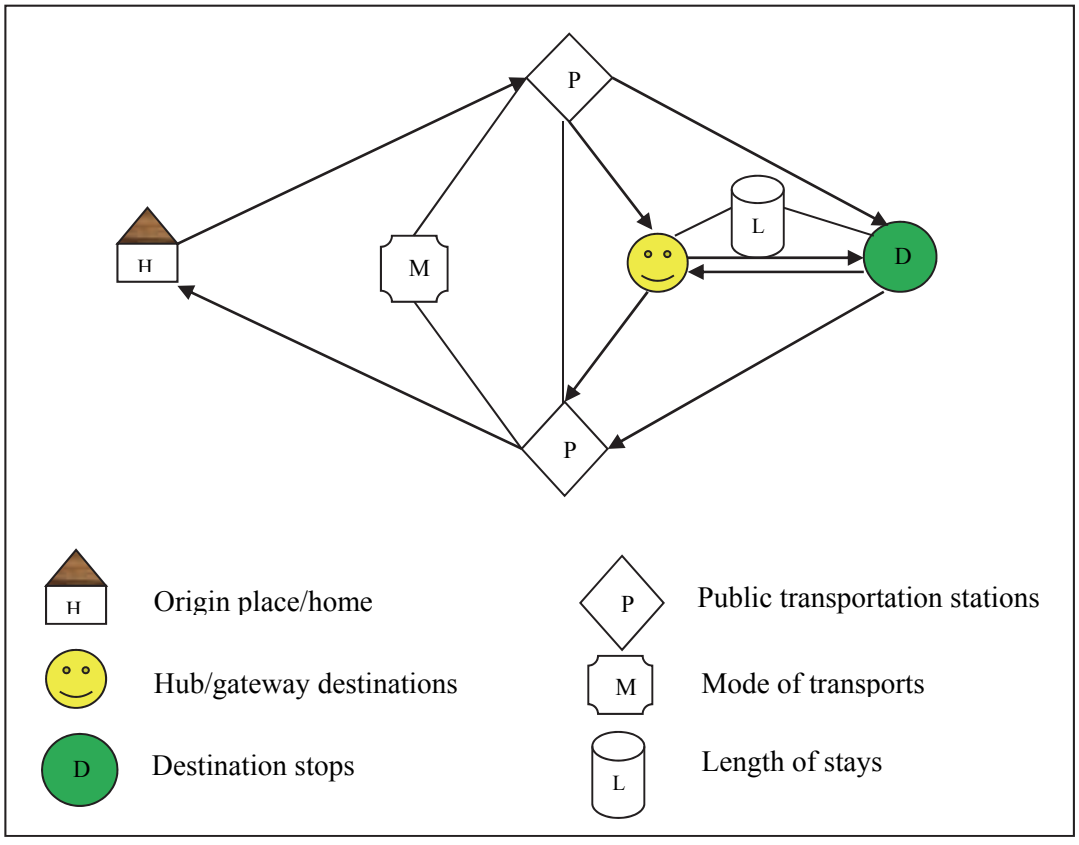


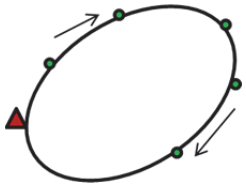
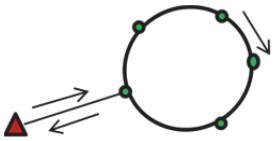
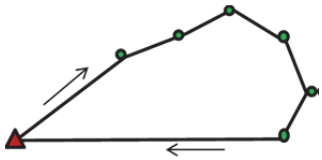
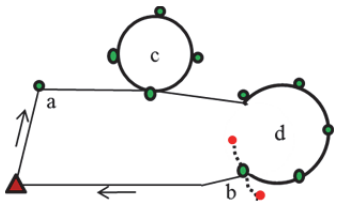
Figure 6.1 Elements of itinerary models

The EWEC itinerary models start from origin place or home and flow through public transportation stations, which allow tourists to select modes of transport to the gateway or hub destinations before continuing to other destinations. In the study area, hub destinations act as potential stops for tourists who travel from other continents such as America, Europe and Africa. These tourists are not familiar with the culture and lifestyle of the Indochina region or even Southeast Asia, particularly first-time tourists. Therefore, hub or gateway destinations assist international tourists to prepare them for new places. Many provinces in Thailand serve as hub areas, such as KhonKaen and Phitsanulok, which are serviced by full tourism facilities including international airports. On the other hand, some tourists are able to travel directly to main destinations without stopping at hub or gateway places. During the trip, travelers travel on land transportations, which primarily based on car, coach and bus and they decide on the length of stay. Some tourists may stay at the hub destination for few days, whereas others may choose to stay overnight only in places neighboring the main destinations. However, the model was created for tourists who spend their trip with an overnight stay. After finishing their trips, the tourists are able to select types of transportation for traveling back to their homes. In this stage, some tourists travel to hub or gateway destinations to take a break before going directly to their place of origin or to public transportation stations. In addition, some tourists prefer to travel back by using the same arrival station, whereas others prefer to use different public transportation stations when the arrival and departure stations are quite far away.

6.2 Oppermann's multi-destination touring models

Oppermann (1995) presented the travel itineraries from a sample of 1,000 international travelers to Malaysia. This research presented 5 models of multi-destination travel patterns (Table 6.1). However, models M1 to M3 were adopted from the classic tourist itinerary models identified by Ming and McHugh (1992), and Lue et al (1993). Then, M4 and M5 were added during the study. The M4 (Open Jaw Loop) indicates a type of long-haul travel in which arrival and departure points do not need to be the same. Alternatively, the M5 (Multiple Destination Area Loop) model, combines M3 and M4 patterns and it indicates when travelers visit destinations in more than one country. So, this model includes either intranational or international travel itineraries. In his study, the M5 travelers also showed the largest proportions of respondents. This reflects that long-haul journeys and multi-countries travel became more interesting for travelers.

Table 6.1 Oppermann's multi-destinations of travel itinerary models

Oppermann's multi-destinations of travel itinerary models	**Model description**
	**M1 (Stopover pattern):** Overland travel model in which the start of the trip and return are on the same route.
	**M2 (Full Loop):** Overland travel in which the trip starts and returns in different ways, as a circular route.
	**M3 (Destination Area Loop):** Air and land travel in which travelers may fly to visit a series of destinations in the area or region as a loop before returning to the origin.
	**M4 (Open Jaw Loop):** Air and land travel in which the arrival and departure stations in the destination area are different.
	**M5 (Multiple Destination Area Loop):** Mixed modes of travel in which tourists travel to multiple countries and mix their trips with the above models.

Note: ▲ Home, ● Overnight destination, ● Daytrip Destination

6.2 Development of the EWEC tourist itinerary models

The EWEC is a recent international continuous land route in Southeast Asia. As far as reviews on tourist travel models show, there has been no research conducted on the patterns of tourist movement and practical guide maps on this route. Regarding the literature review, Oppermann's classical multiple destinations itinerary models (1995) provided an entirely flexible application to implement itinerary models along the EWEC. Therefore, the EWEC tourist itinerary models were conducted based mainly on his models. In addition, the geographic characteristics and locations of tourist attractions along the EWEC route influenced the opportunities for development of tourist itinerary patterns. So, two models were newly added to the EWEC itinerary models - the Möbius Loop and Complex Touring. The EWEC tourist itinerary models were then classified into the following six models to guide tourists in starting and managing their travel across this region (Figure 6.2):

1) **Fish Bone or En-route pattern**

The Fish Bone or En-route pattern refers to an overland route from origin/home, in which a main destination is the focus of the trip. However, tourists visit or stay overnight at an interesting place on the way to or returning from the primary destination. This pattern also encourages government tourism policy, which makes visits to secondary or alternative attractions easier along the route (Lue et al., 1993). In addition, the En-route pattern predominates in the areas where tourist attractions are available as deviations from a single highway (Taplin and McGinley, 2000).

2) **Radius Destination**

This pattern integrates the Base Camp pattern mentioned by Lue et al. (1993) and Oppermann (1995), and Multiple Base site identified by Lau and McKercher (1995). The Radius Destination pattern was adapted for travelers who spend time at primary destinations as base camps throughout their holiday within the particular area. Then, they use the base camp as a starting point to visit other satellite destinations the next day. In addition, they allow having sub-base camps in the same radius areas. In some large regions, there are various primary tourist attractions, which provide facility services for overnight stay in sub-base camps, so tourists do not necessarily have to go back to the main base camp during the trip. However, tourists need to use the same public transportation station or origin place between departure and arrival as the Fish Bone or En-route pattern.

3) **Destination Area Loop**

In this pattern, tourists travel to multiple tourist attractions in the primary destination region as a circuitous route. This pattern is similar to the regional tours pattern of Lue et al. (1993), in which tourists travel to visit and stay overnight at a series of destinations in the region before returning to the same public transportation station or origin place. The route is formed as a circular chain of destinations in the same geographical area. Although destinations in this pattern are in similar geographic proximity, they offer a variety of attractions to invite visitors. For example, in the Isan (Northeast) region of Thailand, the Isan sandstone plateau provides a variety of tourism resources such as archaeological places, silk-waving handcraft centers and national parks.

4) **Möbius Loop**

The Möbius Loop was newly created to support the EWEC route, which is an oblong shape and has potential cities serving as hubs in the middle of the route. This model offers tourists the chance to arrive at the destination hub area in the middle of the route before traveling to tourist sites on either side of the hub and to finish their trip here. Like the Destination Area Loop, tourists can decide to visit the left side first and go to the right or vice versa, and then they return to the origin place or home from the destination hub. Therefore, the public transportation stations near the hub will be both arrival and departure stations. This pattern supports long-haul journeys in which tourists are able to stop for a few days at the hub destination before starting and returning. In addition, tourists are able to catch various modes of transportation at the hub for departure and arrival to destinations. This model is easier to apply on tourist itineraries in which the destination hubs are indicated in commercial and high potential cities in Thailand, such as Phitsanulok, Khon Kaen and Mukdahan. In addition, these destination hubs normally service tourists to national airports, connecting them with the Suvarnabhumi International Airport hub of Southeast Asia in Bangkok, Thailand. It is very convenient for international tourists to have transit flights from this international airport to destination hubs and return to the main airport.

5) **Open Jaw Loop**

The Open Jaw Loop supports long-distance journeys and multiple-focal destinations in international regions, particularly the EWEC region. If tourists start their journey in the central part of the EWEC route in the Khon Kaen province and continue to the final destination in DaNang City, Vietnam, the starting point of travel is far away from the final stopover. Therefore, this pattern provides convenient alternative gateways for travelers who decide to use different modes of transportation or public transportation stations to depart and reach the destination area. Moreover,

some tourists are able to stop at different gateway or hub destinations during the trip before returning to the origin place or home.

6) **Complex Touring**

In this pattern, tourists travel to multiple destination areas without repeating a travel leg. The starting point of the trip is not necessarily the same as the final station upon returning. This pattern supports long-haul travel in both domestic and international regions and it is able to combine some or all patterns mentioned above. Therefore, it is quite flexible for choosing itinerary patterns. Complex Touring was modified from the Multidestination area loop by Oppermann who suggested that this route was the most typical case for the round-the-world tour that has become more popular. It can be extended to many destination regions, especially to areas which have a national collaboration on tourism. The farther people travel, the more interesting places and countries they want to visit, and the longer they want to stay (Oppermann, 1995). It thus encourages an increase in tourists and a growth in the international economic sector in destination areas.

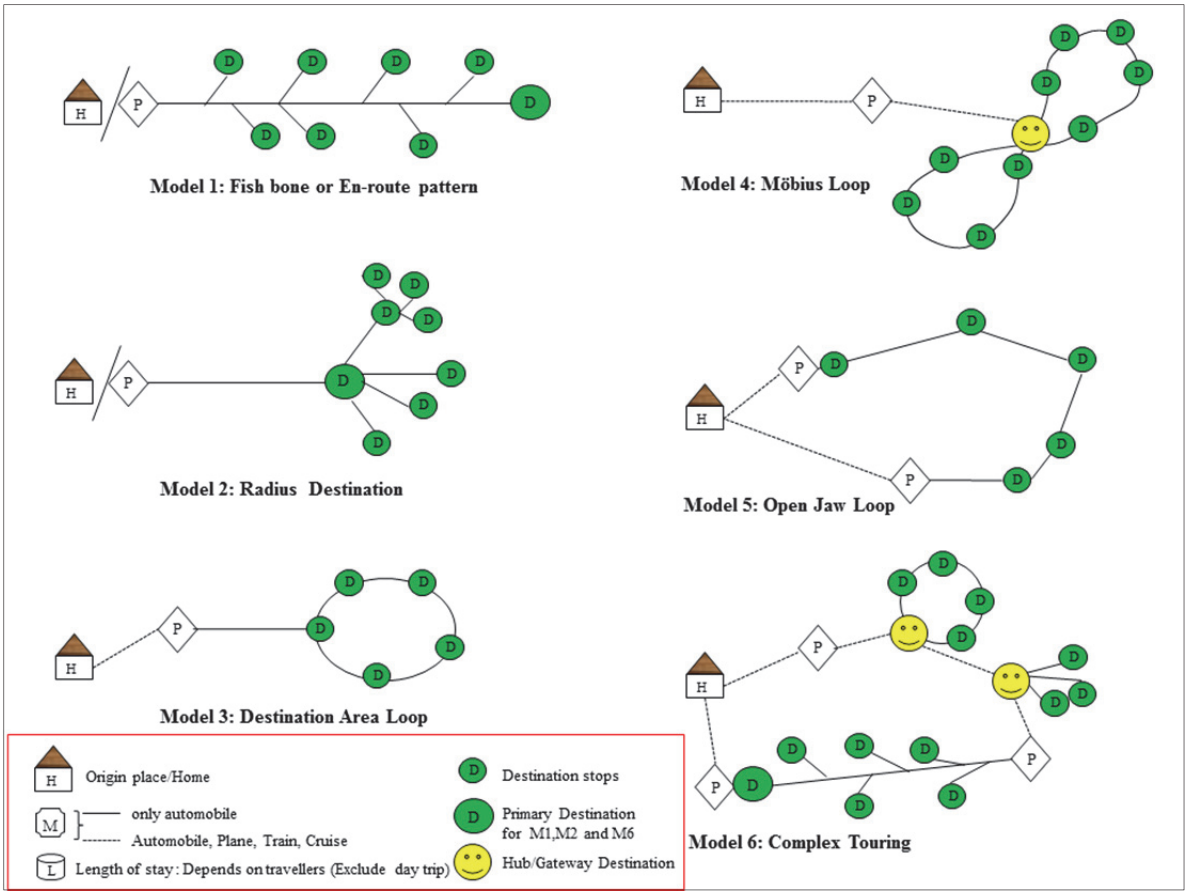


Figure 6.2 Itinerary models

6.3 Generating Guide maps with example scenarios of the EWEC tourist itinerary models

This section aimed to implement the EWEC tourist itinerary models into practical scenarios using the Network Analysis in the ArcGIS 10 package. Each scenario was primarily applied to national neighboring tourists of the EWEC countries and international tourists who intend to take medium (between 1000-3000 kilometers) or long haul journeys (more than 3000 kilometers). In addition, these groups of tourists were assumed to start and end their journey at the public transportation stations or hubs within the EWEC destination region. These models allow tourists to freely decide places and periods to stop overnight around the hubs or destination stops during their traveling route. For instance, some groups of tourists may choose to stay longer in the hubs which provide various facilities and tourism activities. On the other hand, other groups may stay at national parks which are obviously closed to the nature and peaceful. However, the models cannot support every individual requirement of tourists, but they display possible itineraries for travelers who share travel itinerary patterns and interests along the EWEC route.

The results of the high potential tourist attractions in Chapter 5 were used to integrate in these itinerary scenarios for destination stops. These tourist places are high rating priorities with 26 top ranking attractions, which all of them provide at least one accommodation within the 10-km basic boundary of accommodation service areas.

Choices of holidaymakers are frequently modeled by mathematical algorithms, which intend to support travelers' satisfactions. One of them was made to minimize cost and travel time (Ortúzar Salar and Willumsen, 2011). In this study, the Best Route functions were used to arrange the optimal routes and stopovers corresponding to assigned models. In addition, the main parameters used in this study to define the optimal routes were Impedance, Arrangement of stops, One-way, U-turn, Direction, and Network dataset (Figure 6.3). In the Directions frame, Distance Units and Time Attribute were set as meters and minute, respectively.

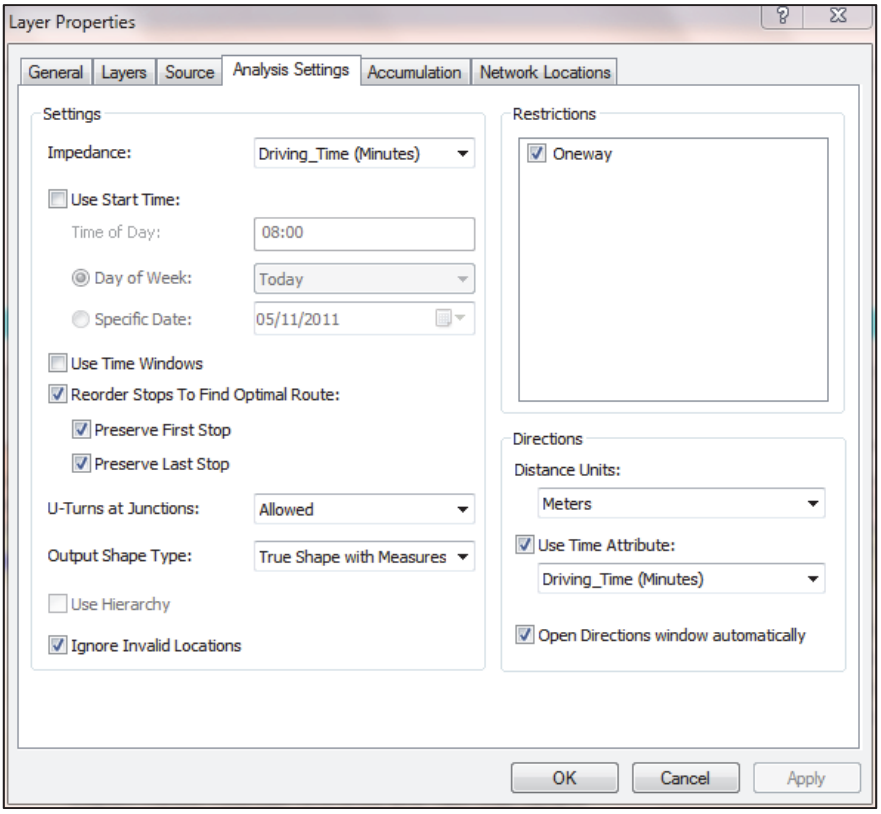


Figure 6.3 Analysis setting for the Best Route function

The example scenarios of the EWEC itinerary models were generated on current road networks, tourist sites, hubs, public transportation stations and other tourism facilities. The total time/distance generated in these itinerary scenarios are counted only from one destination to others but it is not included time spending at the tourist sites and the duration of stopover. These models provided tourists optimal routes of visitation in term of time/distance saving by following these suggested itineraries to cover the range of highly potential tourist attractions. Furthermore, some itinerary scenarios were suggested to apply on specific EWEC spectacle themes of tourists' routes such as Wartime heritage tourist attractions, Isan region-Mekong civilization, and Buddhist pilgrimage/World heritage tour.

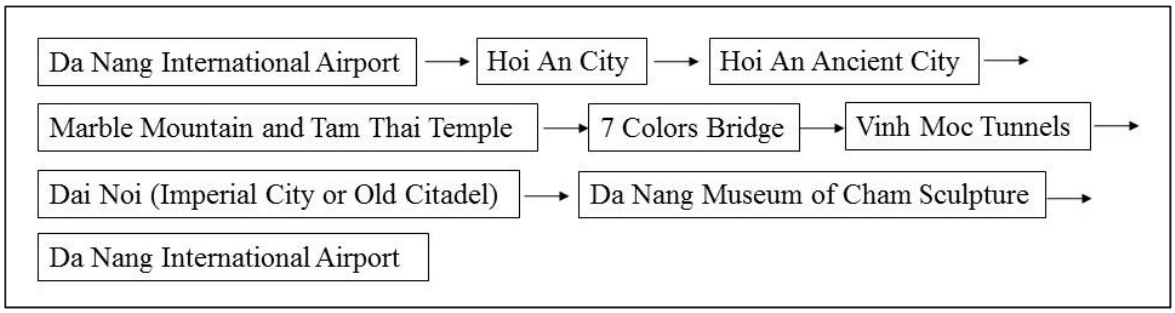
These example scenarios represent the optimal itineraries which may be considered as alternative guidebooks for tourists' travel plans to this region. Each itinerary scenario is shown in details as the following sub-sections.

6.3.1 Fish Bone or En-route pattern

The highest potential tourist attraction of Vietnam was selected to display the implementation of Fish Bone scenario. In this scenario, all 7 best potential tourist sites in Vietnam were included to be visited as an overland route. Tourists were assumed to visit some primary destinations in Hoi An,

Hue and Vinh Moc tunnel and stay overnight there. Travelers are able to use the rental car or private automobile from the origin places, which are available in both Da Nang International Airport and Tien Sa Seaport. Therefore, this scenario was divided into 2 examples. The first example operates from Da Nang International Airport and supports international tourists who arrive and depart destinations by plane. The second example supports tourists who travel to Da Nang by cruise ship before starting their journeys. The model was operated by the Best Route analysis function, which was set to find out the optimal route in terms of shortest distance and travel time. The starting and ending points were specified at the same site. The available 7 attraction stops were reordered responding to the Best Route algorithm. The results of the Fish Bone scenario are shown in the traveling stops and maps below.

Scenario of Example 1: The trip starts from Da Nang International Airport to Hoi An City, Hue, and Vinh Moc tunnel via Marble Mountain and Da Nang City. The final station is the same origin station.



The total distance for this pattern was calculated as 481,727.5 meters (approximately 482 kilometers) with 8 hours and 2 minutes for return trip. The optimal route is displayed as a map in Figure 6.4.

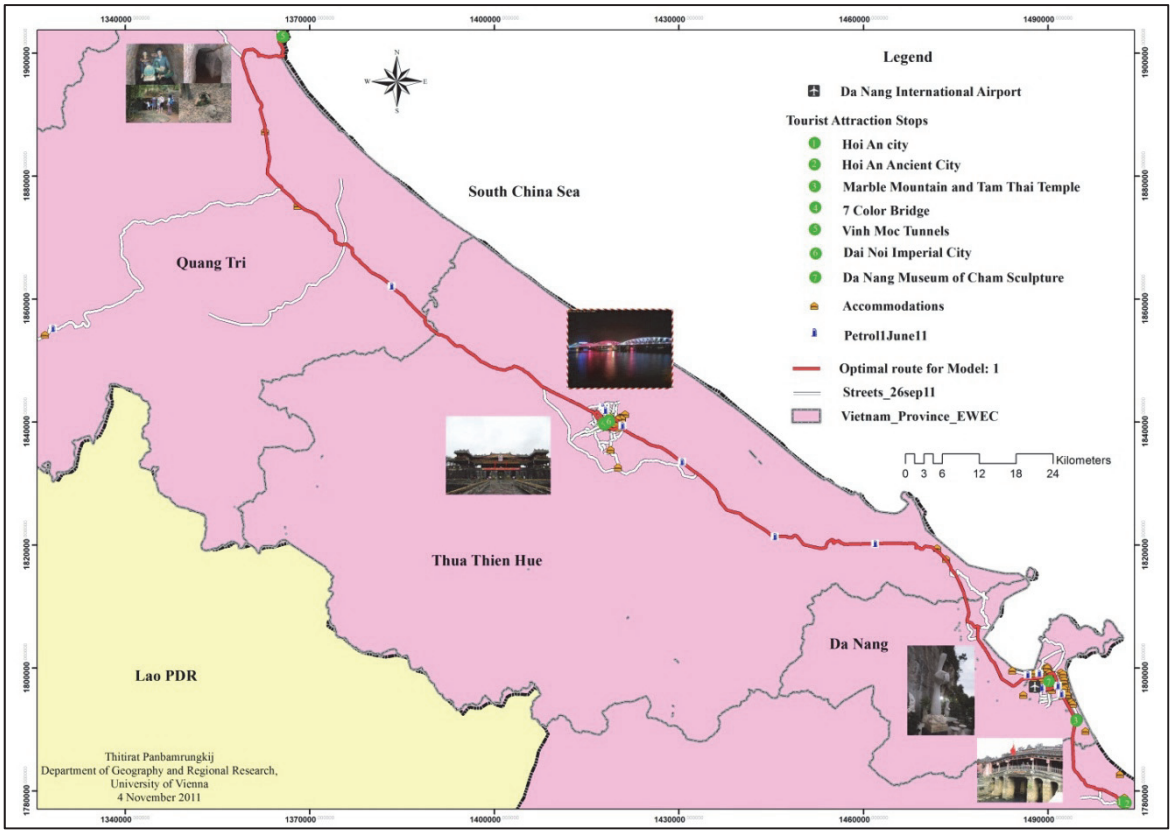
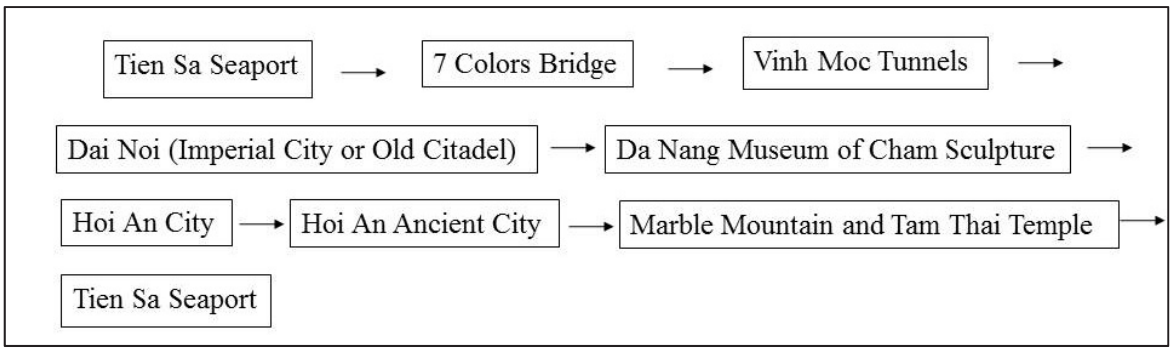


Figure 6.4 Map of the itinerary for Example 1of Fish Bone Scenario

Scenario of Example 2: The trip starts from Tien Sa Seaport to Vinh Moc tunnel, Hue and Hoi An City via 7 Colors Bridge, Da Nang City and Marble Mountain. The final station was the same as the origin.



The total distance for this pattern was calculated as 494473.6 meters (approximately 494 kilometers) with 8 hours and 14 minutes for the return trip. The optimal route is displayed as a map in Figure 6.5.

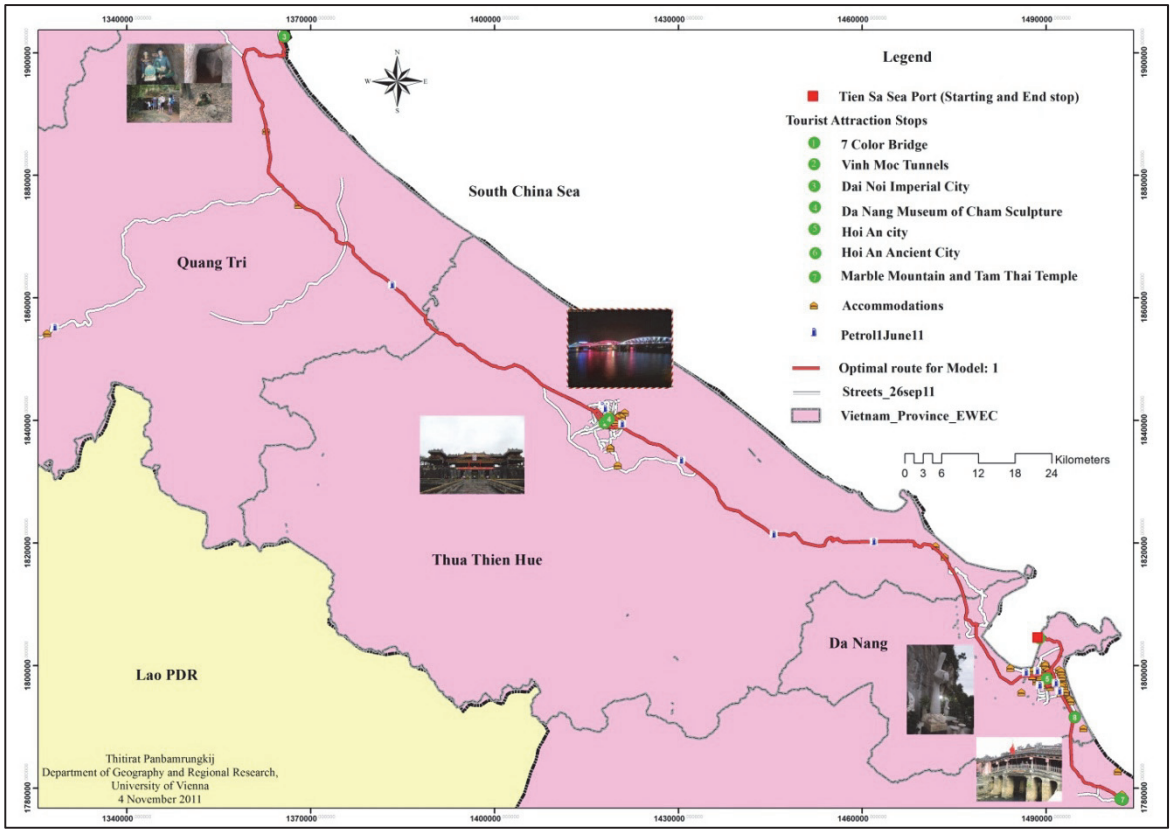


Figure 6.5 Map of the itinerary for Example 2 of Model 1

In addition, this En-route pattern is able to apply to groups of wartime heritage tourist attractions along the EWEC main road in Lao PDR and Vietnam. This traveling route may be used to promote special tourism products (niche tourism) in this region. Tourists can start from Savannakhet bus station (at Savanxay market) to Da Nang city via Hue and they travel back to the starting point at the same route. On the other hand, they may start from Da Nang International airport to Savannakhet via Hue. Heritage sites related to war in Lao PDR combined Savannakhet historic downtown (old French colonial architecture), battlefields and bomb craters (Sepon districts), Ho Chi Minh Trail, Tad Hay bomb-destroyed Bridge, and Lao-Viet (Lam Son 719) War museum (Phin district). In Vietnam, they compose of Quang Tri citadel, Khe Sanh Combat Base, Soldier monument, Mother and Children waiting for Father Museum, Division Bridge between North and South Vietnam, Blood monument, Vinh Moc tunnels and bombing area, and American Aircraft Shelter. In addition, tourists can explore rural lifestyle in Lao PDR which some daily utensils were made from bomb material such as fishing boat, flowerpot, and house fence. The special visualization of wartime heritage route is shown in Figure 6.6.

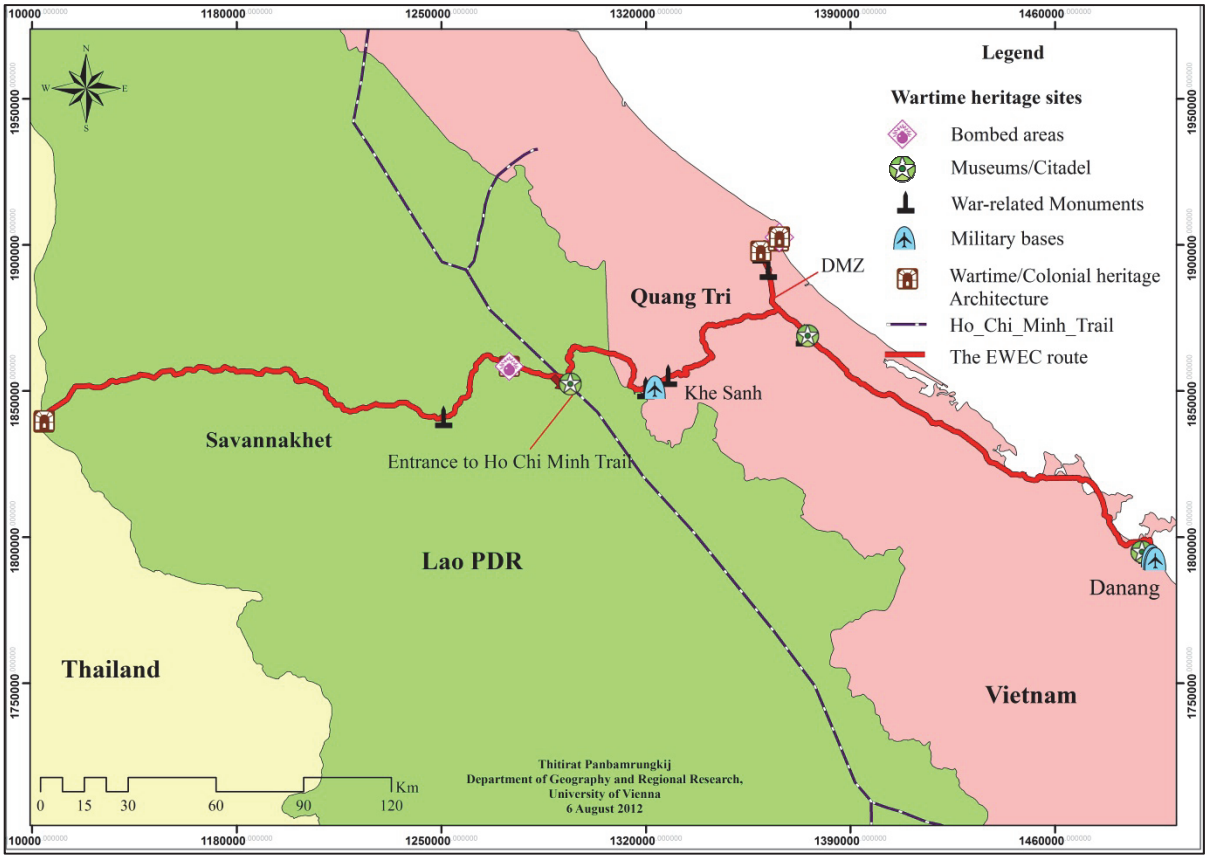
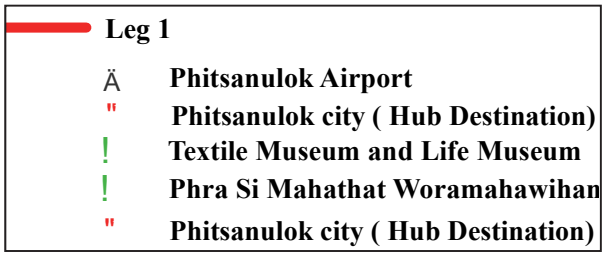


Figure 6.6 Map of wartime heritage tourist itinerary

6.3.2 Radius Destination

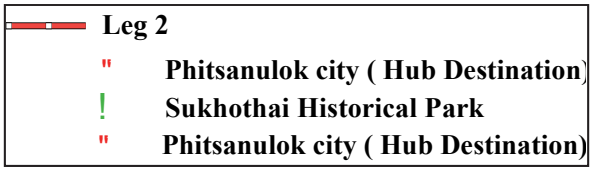
The Radius Destination scenario was applied on the western part of the EWEC to visit potential tourist attractions in north-central Thailand. The travelers are assumed to start their trip from the Phisnulok Airport and stay overnight at Phisanulok City as a major destination hub. This hub is a high potential city, which provides tourism facilities, including Phisanulok Airport, and is surrounded by lots of accommodations, car rental agencies, and public transportations. In this scenario, travelers divide their trips into multi-overland routes/legs, which begin from the city to visit many tourist sites along the tourist legs and return to the same accommodation in the city (see Figure 6.7). There are the following 4 tourist legs in this scenario:

Leg1: Phitsanulok Airport to Phisanulok City and visit tourist attractions in the city



The total distance of Leg 1 is 37,181.7 meters (about 37 kilometers) with a 37 minute driving time. The optimal route is displayed as map in Figure 6.7.

Leg2: Phitsnulok city to Sukhothai Historical Park



The total distance of Leg2 is 145,497.8 meters (about 145. 5 kilometers) with a 2 hour 25 minute driving time. The optimal route is displayed as a map in Figure 6.7.

Leg3: Phitsanulok City to the natural tour sites in the Phetchabun province

The total distance of Leg3 is 283,708.9 meters (about 284 kilometers) with a 4 hour 44 minute driving time. The optimal route is displayed as a map in Figure 6.7.

Leg4: Phitsanulok City to the Airport (a final trip)

This is the final travel when tourists leave the hub to the airport for transit flights to Bankok (Suvarnabhumi International Airport) and return to their origin/ home. The total distance of Leg3 is 5,772.6 meters (about 6 kilometers) with a 6 minute driving time. The optimal route is displayed as a map in Figure 6.7.

However, travelers can have sub-base camps at some attraction sites if the distance for a 1-day trip is too long and if there are surrounding tourist attractions nearby. So, they can spend a longer time at the attraction site and visit neighboring places. For an example of Leg3, travelers leave from Phisanulok City and travel to Khao Kho Wildlife Aquaculture Station and Conservation Research, Thung Salaeng Luang National Park and Khao Kho, which are situated in the Phetchabun province.

These sites require a half-day or more per site to visit. Therefore, tourists can stay overnight at a national park and visit many tourist sites before returning to the main hub in Phitsanulok.

The length of time spent in this scenario should be at least 3 nights. This suggestion is based on the idea that each leg should reserve one-overnight stop except the final leg.

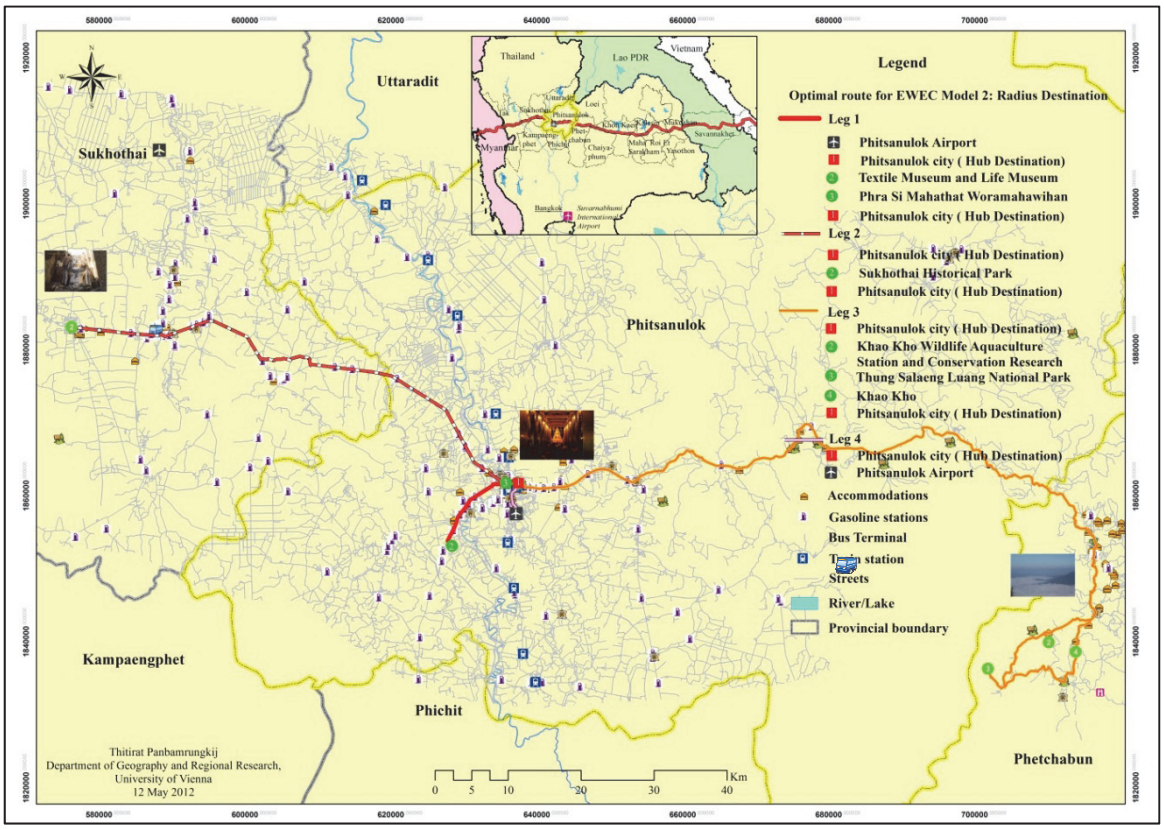


Figure 6.7 EWEC itinerary model 2: Radius Destination

6.3.3 Destination Area Loop

This scenario is formed in the Isan region and supports the regional touring route in the specific geographical characteristic of Khorat Plateau, Thailand. There are 8 tourist attractions provided in this scenario. Tourists are assumed to arrive to and depart from the Isan region in the Mukdahan province by bus (which is the existing public transportation for this province). Then, tourists continue their journeys from the bus terminal to visit exotic natural and cultural tourist sites around the Isan region as the following stops below:

Mukdahan bus terminal
(First destination: mukdahan city)
Kosamphi Forest Park and Marine Reserve
Lam Pao Dam
Lam Pao Wildlife Conservation Development and Promotion Station
Sirindhorn Museum and Phu Kum Khao Dinosaurs
Ban Phon Phrae Wa Silk Weaving Group
Pu Thai Culture Village (Ban Khok Kong)
Mukdahan National Park (Phu Pha Therb)
Ho Kaeo Mukdahan (Mukdahan Tower)
Mukdahan bus terminal
(First destination: mukdahan city)

The total travel distance is 525,465.6 meters (about 525 kilometers) with an 8 hour 45 minute driving time. The optimal route for this scenario is shows on the map (Figure 6.8).

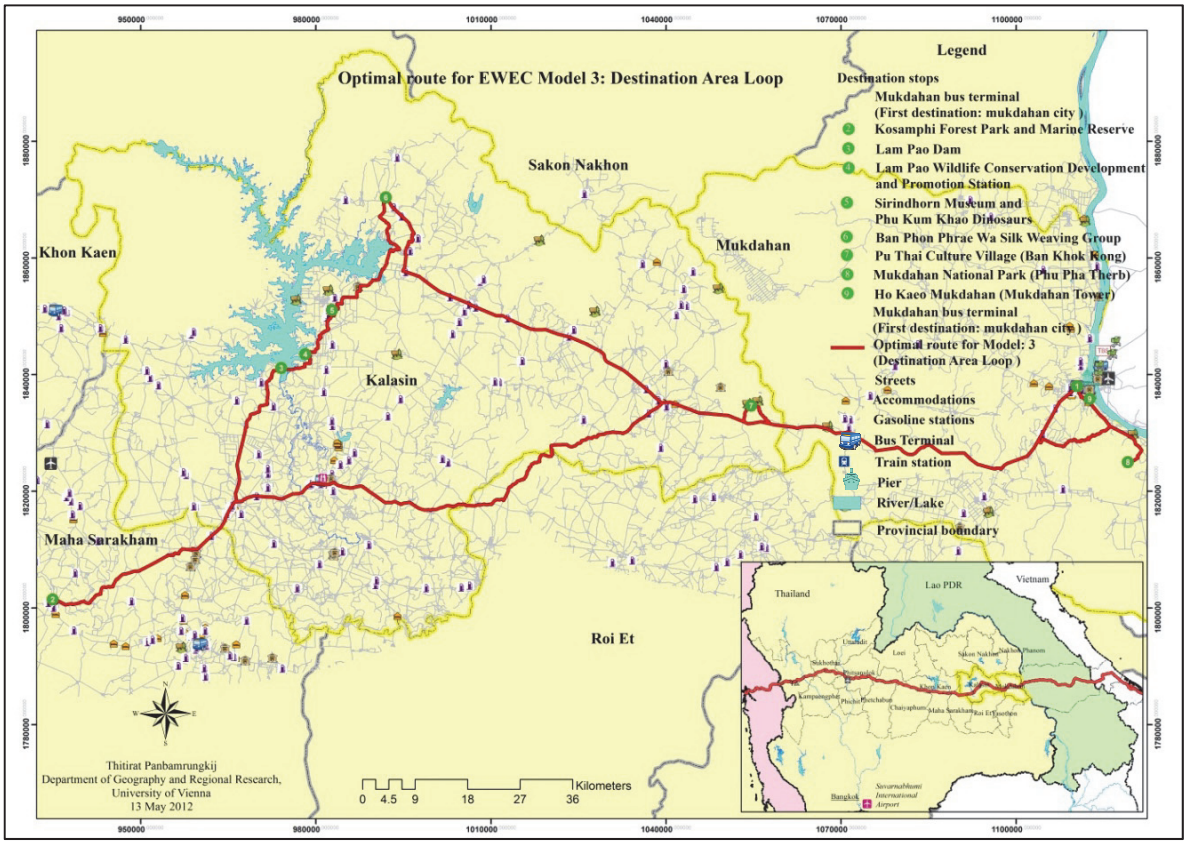


Figure 6.8 EWEC itinerary model 3: The Destination Area Loop scenario

6.3.4 Möbius Loop

This scenario operates in the central region of Thailand which has many potential tourist attractions. Travelers in this scenario are assumed to use Khon Kaen City as a primary destination hub before starting their journey on the left and right of this hub as a double loop. They finish their trip at this hub and use Khon Kaen Airport for arrival and departure. The optimal destination stops are arranged as follows:

Ä **Khon Kaen Airport**
" **Khon Kaen Hub Destination**
! **Phu Pha Man National Park**
! **Phu Kradueng National Park**
! **Nam Nao National Park**
! **Chulabhorn Dam**
! **Phu Khieo Wildlife Reserve**
! **Kosamphi Forest Park and Marine Reserve**
! **Pu Thai Culture Village (Ban khok Kong)**
! **Ban Phon Phrae Wa Silk Weaving Group**
! **Sirindhorn Museum and Phu Kum Khao Dinosaurs**
! **Lam Pao Wildlife Conservation Development and Promotion Station**
! **Lam Pao Dam**
" **Khon Kaen Hub Destination**
Ä **Khon Kaen Airport**

The total travel distance is 909,134.6 meters (about 909 kilometers) with a 15 hour 9 minute travel time. The optimal route for this scenario is shown on the map (Figure 6.9). This itinerary scenario can be supported the special EWEC theme of Isan region exploration.

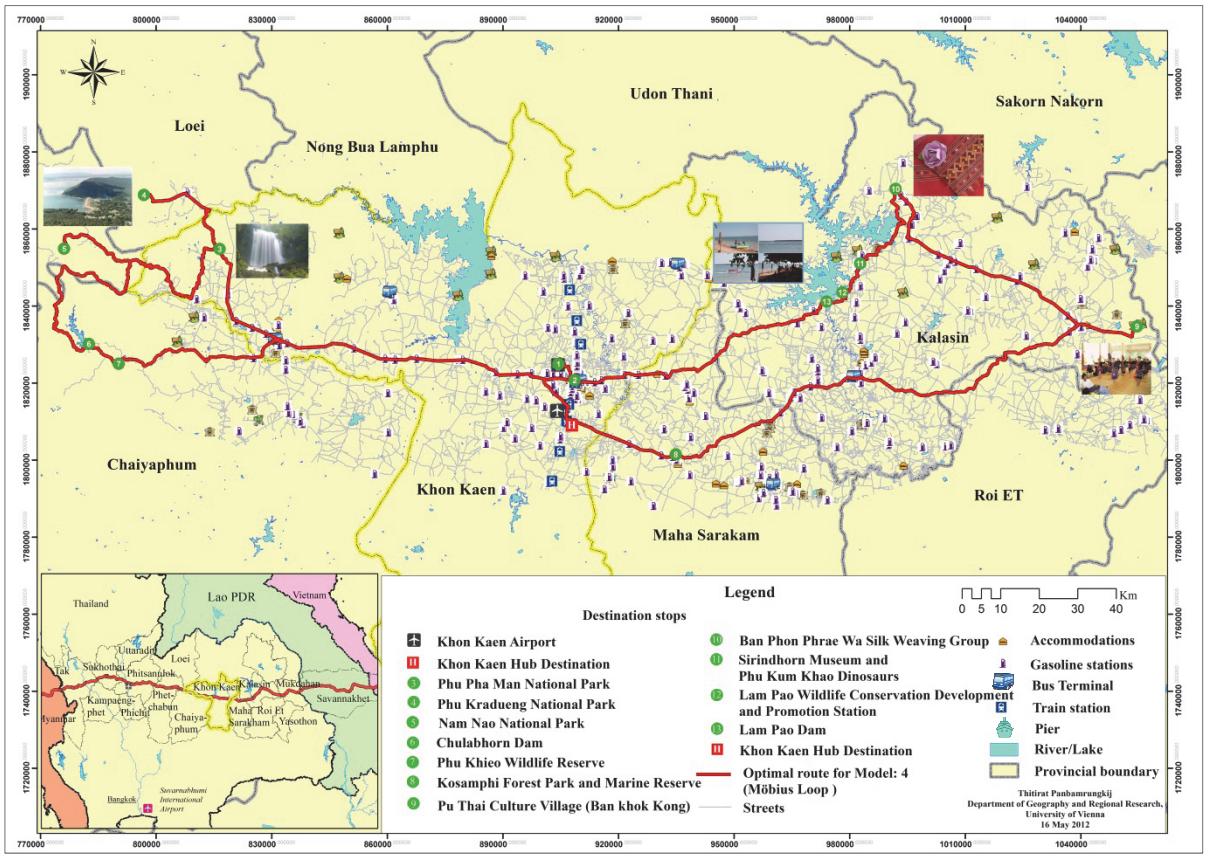


Figure 6.9 EWEC itinerary model 4: Möbius Loop

6.3.5 Open Jaw Loop

This scenario shows the touring route from the northeast of Thailand (called Isan) through Lao PDR and Vietnam. This route takes longer distances and times than previous scenarios, which serve only national touring routes. This tour scenario offers the spectacular experience of mixing urban and rural lifestyle and languages from the central part of the EWEC to western end. In addition, tourists do not repeat the route during their visits because the arrival and the departure are not necessarily the same. Therefore, tourists take stopovers along the route and depart from the public transportation stations at the terminal destination. The route starts from the Khon Kaen province bus station and travels around the exotic Isan region of Thailand, then continues into the rural lifestyle of Lao PDR gateway to Vietnamese culture in Quang Tri, Thua Thien Hue and Da Nang City. The departure gate is Da Nang International Airport. The optimal Open Jaw Loop scenario is shown in Figure 6.10. The order of stops is arranged below:

Khon kaen Bus Terminal (khon Kaen: First Destination stop)	Ho Kaeo Mukdahan (Mukdahan Tower)
Kosamphi Forest Park and Marine Reserve	Vinh Moc Tunnels
Lam Pao Dam	7 Colors Bridge
Lam Pao Wildlife Conservation Development and Promotion Station	Dai Noi Imperial City
Sirindhorn Museum and Phu Kum Khao Dinosaurs	Da Nang Museum of Cham Sclpture
Ban Phon Phrae Wa Silk Weaving Group	Marble Mountain and Tam Thai Temple
Pu Thai Culture Village (Ban khok Kong)	Hoi An Ancient City
Mukdahan National Park(Phu Pha Therb)	Da Nang International Airport

The total travel distance is 1,006,555 meters (about 1,007 kilometers) with a 16 hour 47 minute travel time. The optimal route for this scenario is shown on the map (Figure 6.10).

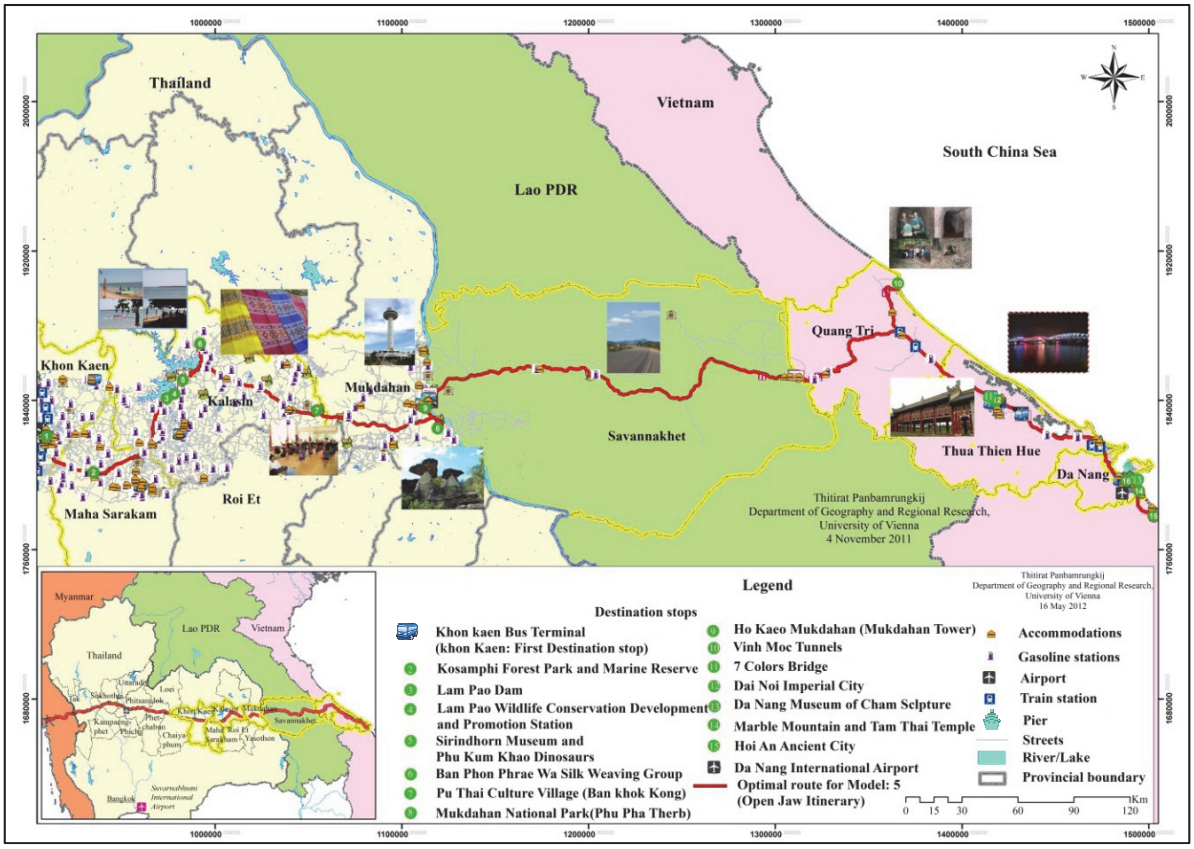


Figure 6.10 EWEC itinerary model 5: Open Jaw Loop

6.3.6 Complex Touring

This model is simulated to run the optimal tour itinerary route covering 26 EWEC high potential tourist attractions. This model is combined with the sub-itinerary model previously mentioned and travel across multiple countries. So it is suitable for a long-haul journey with at least a month to spend time in the EWEC region and gain more experience in various kinds of tourist attractions. This scenario is divided into 6 traveling legs or routes. The first leg starts from Phitsanulok Airport, and tourists are assumed to use Phitsanulok City as a first destination hub and travel to visit some attraction sites in the Phitsanulok and Sukhothai province as a radius model. The second leg is the route from the Phisanulok hub to visit attractions in the Phetchabun province, which offers tremendous natural scenery. Then, the third leg continues to explore the glorious nature and wildlife in the national parks in Chaiyaphum, Loei and Khon Kaen. The fourth leg looks like a destination area loop which has the Khon Kaen as the base hub, and then tourists travel around the Isan region. This leg of the trip is mainly based on cultural and historical attractions. The fifth leg starts from the Khon Kaen bus terminal to Mukdahan province, which is located at the national border between Thailand and Lao PDR. This leg brings tourists to the modern attractions at Ho Kaew Mukdahan - the provincial tower with a panoramic view of the Mekong River and then the spectacular geomorphology attractions at the Mukdahan National Park. The final destination route is the international itinerary which is across from the Thai border to Vietnam via Lao PDR. This route starts from the Thai-Laos ferry station and goes to the Savannakhet bus terminal in Savannakhet province, Lao PDR. Then, the route takes stopovers along the long continuous land route as a Fish Bone model from Lao PDR to Vietnam. The final destination is Hoi An City in Vietnam. Then, tourists depart from this region at the Da Nang International Airport. The complex touring scenario for all legs is shown in Figure 6.11.

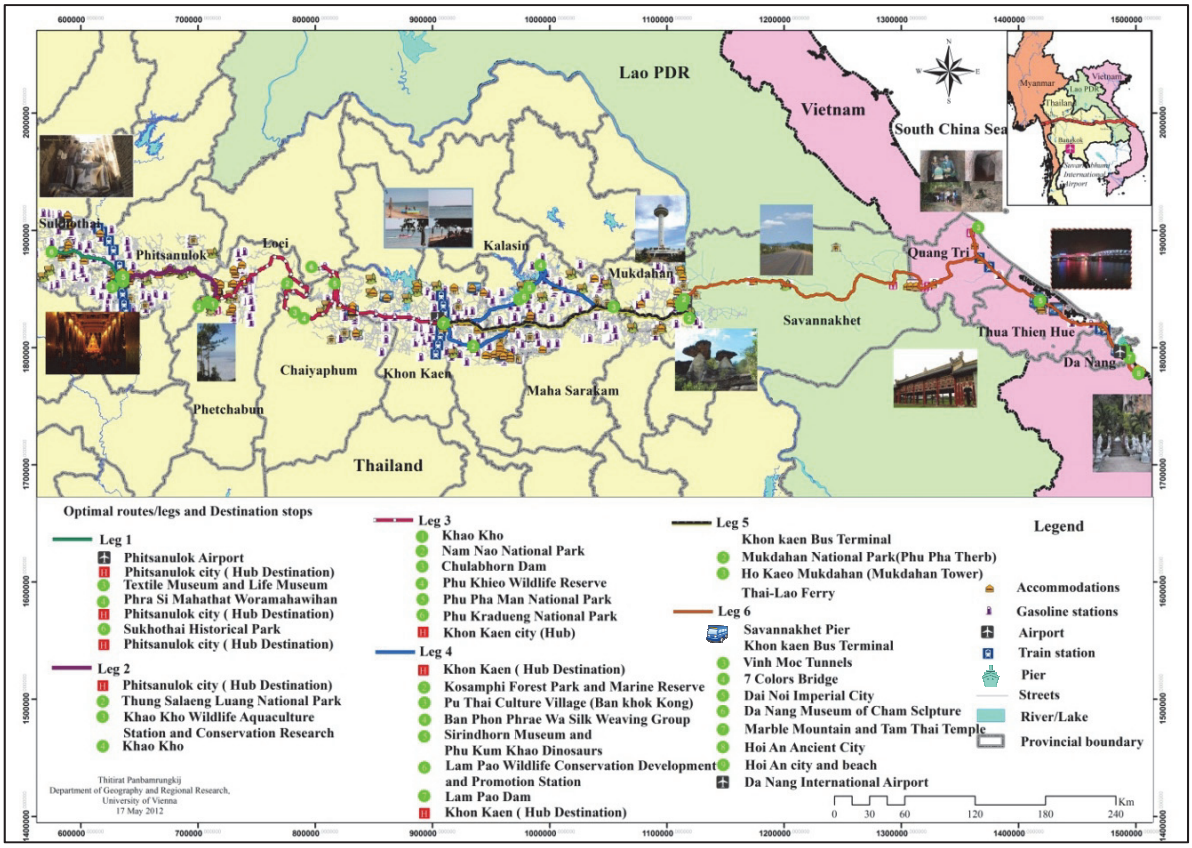
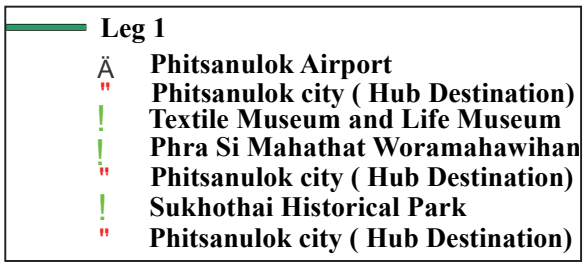


Figure 6.11 EWEC itinerary model 6: Complex Touring

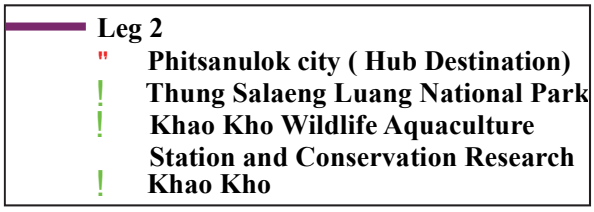
The total distance and time equal 2,137,202.1 meters (approximately 2,137 kilometers) and 36 hours. The destination stops for each leg are arranged to find the optimized touring leg in terms of time and distance savings. They are shown in detail below:

Leg1: Arrival Phitsanulok City (the first hub destination)



The total travel distance is 182,679.5 meters (about 182.7 kilometers) with a 3 hour and 3 minute travel time. Tourists can spend few days in the Phitsanulok and Sukhothai province.

Leg2: Sightseeing spectacular natural attractions: From Phitsanulok hub to Phetchabun province



The total travel distance is 165,839.1 meters (about 165.8 kilometers) with a 2 hour and 46 minute travel time. Tourists can stay overnight in National Park and Khao Kho.

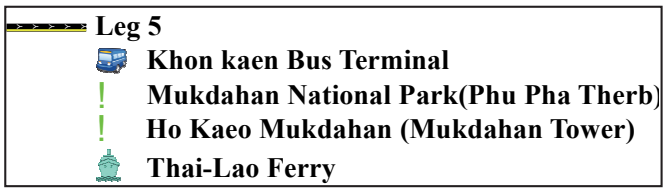
Leg3: Exploring nature and wildlife in Phetchabun, Chaiyaphum and Khon Kaen

The total travel distance is 464,948.9 meters (about 465 kilometers) with a 7 hour and 45 minute travel time. Various types of attractions are available for wide ranges of tourist interests.

Leg4: Historical and culture tour in the Isan region

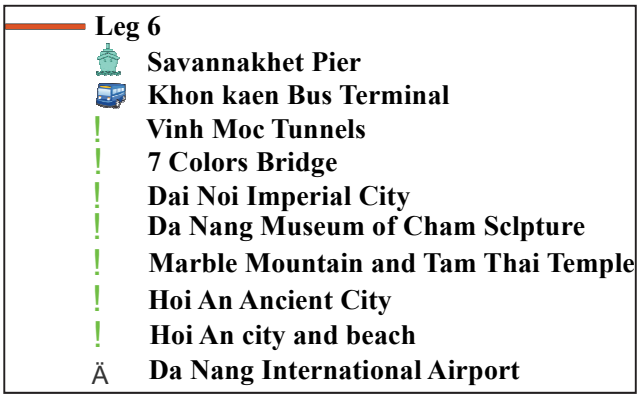
The total travel distance is 406,681.7 meters (about 406.7 kilometers) with a 6 hour and 47 minute travel time. Tourists can spend a week or more for gaining experience in Isan's exotic nature and culture.

Leg5: Panorama view of Mekong River at Thai-Lao border



The total travel distance is 266,324.4 meters (about 266.3 kilometers) with a 4 hour and 26 minute travel time. Tourists continue long traveling by air-condition bus to Mukdahan, the Thai-Lao provincial border and stay few days here.

Leg6: Final destination in Vietnam with Fish Bone model and stopover in Quang Tri, Hue and Da Nang City.



The total travel distance is 650,728.5 meters (about 650.7 kilometers) with a 10 hour and 51 minute travel time. Tourists have a chance to take a ferry to Lao PDR and visit marvelous tourist sites in Vietnam before departing to their origin/home by plane at Da Nang International Airport. This scenario can support the special interests of tourist groups who would like to explore Budhism/pilgrim tourism and World Heritage Tourist route.

6.4 Summary

This chapter provides the optimal tourist itinerary scenarios in six models. These support tourists' travel planning in the new route and provide basic tourism facilities information and road networks that appear in guide maps. Therefore, these can be sufficient planning tools for backpackers and rental car travelers. Although they cannot operate for individual tourists, they provide possible guidelines for tourists who share common interests and search for optimized traveling routes in similar ways.

Chapter 7

Investigation of weak points and offering guidelines for tourism investments and services

This chapter aims to investigate the weak factors that affect tourist attractions' potential based on the results from Chapter 5. Spatial statistic tools and Network Analyst extensions in ArcGIS were used to investigate specific problems in focused areas, which require further development in different aspects. These techniques and tourism planning-related information were combined to present possible guidelines for improving the potential of tourist attractions in particular areas. This chapter supports investors, tourism authorities and stakeholders with a deeper understanding of the current situation of tourist attractions in the EWEC region by indicating what tourism development strategies should be initially considered.

7.1 Investigation of the weaknesses

With respect to the results of tourist attractions' potential obtained from Chapter 5, the test of statistical significance of a correlation coefficient was used to observe the significant variables affecting the total potential scores of each tourist attraction. Initially, a scatterplot matrix was used to analyze the patterns of tourist site distribution corresponding to potential values of tourist attractions. This tool is capable of observing a two-dimensional correlation on a graph whose axes are the standard potential scores of each variable and the overall scores of potential values. In addition, the three groups were compared according to major aspects of potential-measurement factors (i.e. Physical aspect, Attraction, and Socio-Economic aspect). For example, the set of variables in the Attraction aspect was compared against the total scores of potential values (Total) obtained from Chapter 5 and its sub-criteria, which are Value/Uniqueness (VU), Popularity (P) and Tourism Activity (TA). The total comparisons of all groups are shown in Figure 7.1.

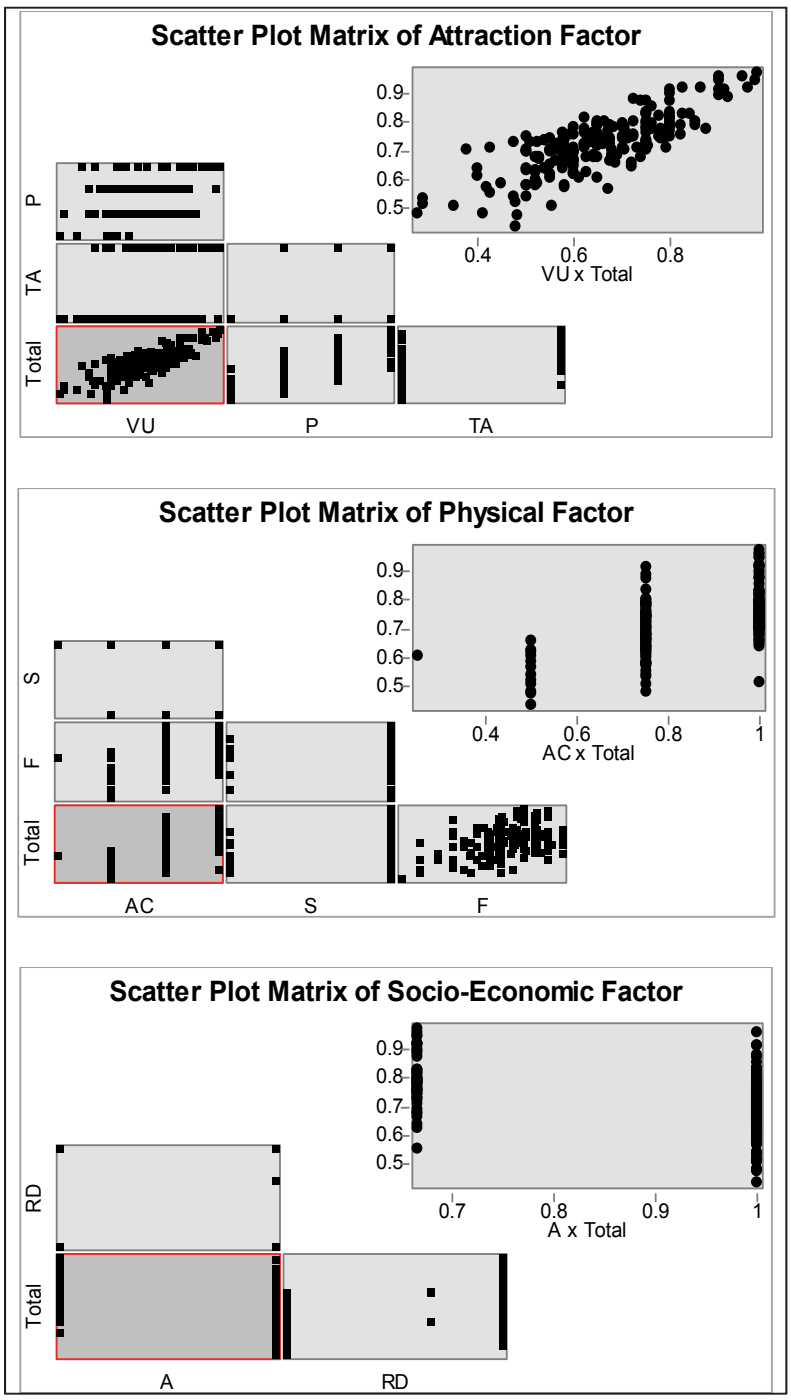


Figure 7.1 Scatterplot matrices of Attraction factor on Scatterplot Metric dialogue box

Then, each factor was tested by correlation statistics. Relationships between variables among major factors were determined from values pooled across different potential attraction sites. The spread of data was tested for normality using the Kolmogorov-Smirnov test. If data did not provide normal distribution, the correlation test was selected using the Spearman nonparametric correlation coefficient (Spearman's rho). This correlation coefficient method does not depend on the assumption of an underlying bivariate normal distribution. In this study, most scatterplots shown in Figure 7.1 are not non-linear associations and do not have usual distribution under the curves. Thus, a non-

parametric measure of Spearman's rho was performed to indicate relationships among couples of input variables. Results from all analyses are presented as a sample median and range. Statistical significance was considered at a P-value of 0.05. The test of correlations (r_s) classified by the groups of major factors are displayed as correlation matrices in Table 7.1.

Table 7.1 The matrix of Spearman Rank Correlation Coefficient (r_s)

Attraction Factor	P	VU	TA	Total
P	1.000			
VU	.359**	1.000		
TA	.324**	.301**	1.000	
Total	.669**	.774**	.473**	1.000
Physical Factor	**AC**	**S**	**F**	**Total**
AC	1.000			
S	.224**	1.000		
F	.503**	.159**	1.000	
Total	.521**	.191**	.365**	1.000
Socio-Economic Factor	**A**	**RD**	**Total**	
A	1.000			
RD	-.096	1.000		
Total	-.404**	.379**	1.000	

** Correlation is significant at $P < 0.01$ level (2-tailed) with n = 208

Sub-criteria of the Attraction factor positively correlated with each other (r_s= 0.301 to 0.359; $P < 0.01$) and they have a strong positive correlation with the Total score, in particular the VU (Value/Uniqueness; r_s = 0.774, $P < 0.01$). For the Physical Factor, all sub-criteria were also positively associated with each other (r_s = 0.159 to 0.503; $P < 0.01$). There was a high positive relationship between AC (Accessibility) and F (Facility) with r_s = 0.503, $P < 0.01$. In addition, a significant positive association was highest between AC and Total (r_s = 0.521, $P < 0.01$). In the Socio-Economic factor, there was no relationship between A (Admission) and RD (Risk of Endemic

Diseases). However, both A and RD are associated with the Total. The A had a negative correlation with the Total (r_s = -0.406, $P < 0.01$), whereas the RD was positively associated with the Total (r_s = 0.374, $P < 0.01$).

In order to emphasize tourist attractions' potential by using our investigated association, the correlation values (r_s) between the total and other criteria were highlighted. Assuming that the r_s criterion value correlated more with the Total, nearly 1 or -1, it associates more with the potential scores of tourist attractions. Value/Uniqueness had the highest association toward the total scores of potential values, followed by Popularity and Accessibility. However, Accessibility correlated more with Facility. Therefore, both Accessibility and Facility highly affected the potential of tourist attractions. Next, Admission had a negative influence on the potential of attractions; the Risk of Endemic Diseases had a slight positive association toward potential values in the Socio-Economic factor. In addition, because of the negative association of Admission with the total scores of potential values, it may be inferred that many high potential tourist attractions tend to charge admission fees higher than the lower potential attractions, which did not reduce the potential degree of these tourist sites.

To investigate the weakness of the lower potential tourist attractions, the most influential variables on potential were initially observed. Thus, the association among Value/Uniqueness, Popularity, Accessibility and Facility against the total scores of potential values were illustrated with the classification of the potential levels of tourist sites (Figure 7.2). According to this figure, most of the lowest potential levels of tourist attractions (black color) show low scores in these variables. There were only a few tourist sites that obtained high scores on Accessibility and Facility, but the total score of potential values was still low in this group. Moreover, no highest scores of the Value/Uniqueness and the Popularity were found in the lower potential tourist sites. This indicates their weak points - they are likely to show a lower attraction, a lack of valuable remarks to support visits from tourists, and also a lack of promotion to be better known by international tourists. In addition, it is necessary to improve the accessibility to tourism facilities in order to support the abilities of these tourist sites to develop into competitive destinations in the global tourist industry.

Obviously, the lower potential tourist attractions were mostly found in the area of Savannakhet province, Lao PDR. As this result has already been mentioned in the chapter 5, there is no high potential level of attraction found in this area. Therefore, it will be raised to improve as a specific case study of development in many ways.

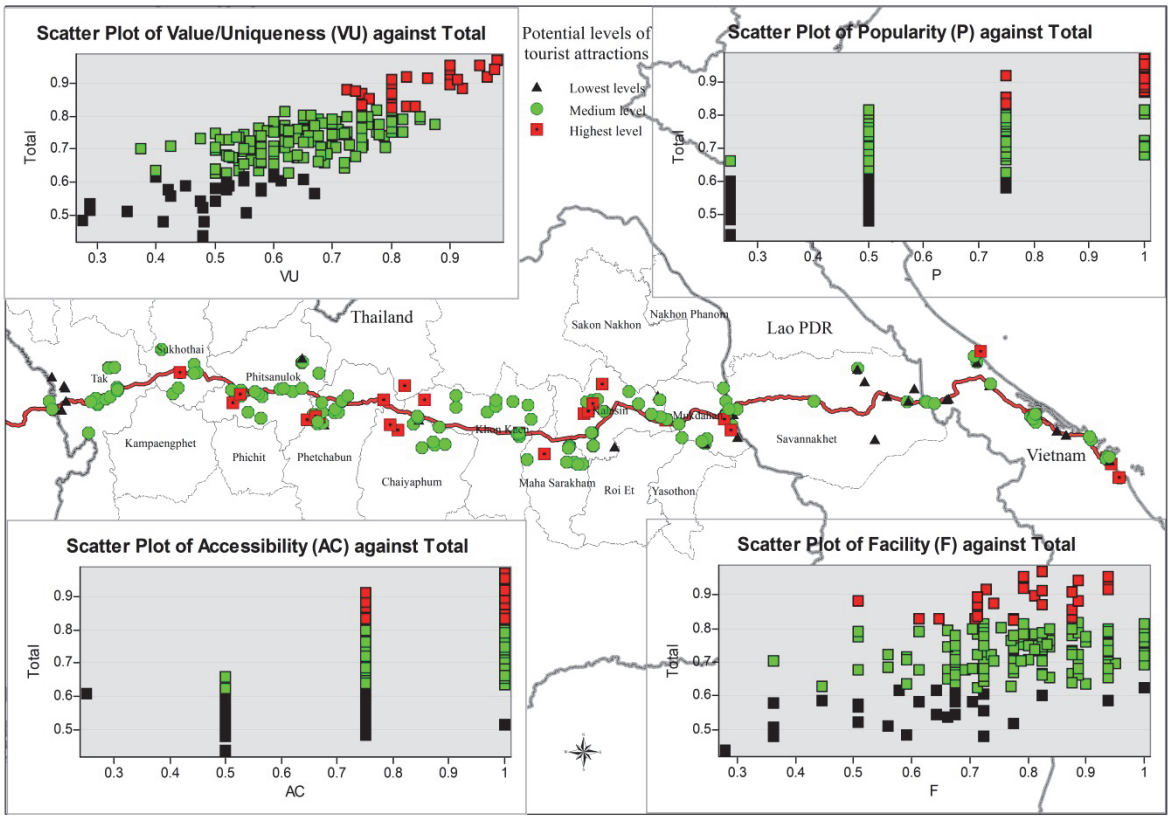


Figure 7.2 Graph of influential variables toward potentiality of tourist attractions

7.2 Guidelines for improving tourism potential

Corresponding to the development of the less potential tourist attractions along the EWEC, the significant variables (i.e. Value/Uniqueness, Popularity, Accessibility and Facility) should be initially supported. This should be divided into 2 parts. First, the Attraction factor should be developed, which includes Value/Uniqueness and Popularity, and then the Physical factor, which is Accessibility and Facility.

7.2.1 Support of the Attraction aspects

Tourism attractiveness concerns uniqueness, locality, and place-specific attraction, which reflects on the high spectacular sites. To transform the non-spectacular into having touristic meaning and value, the attraction site has to be special and extraordinary or represent something typical of an area or a nation in the eye of visitors (Leiper, 1990). This needs collaboration between public and private tourism stakeholders, from local to national governments. The current chapter aims to present multiple relevant methods for creating tourism place-making.

MacCannell (1976) offered a five-stage marking process of sight sacralisation that makes an attraction meaningful and attractive and differentiates it from other places:

1) Naming: this takes place when sight (i.e. features or characteristics of a place or attraction site) is differentiated from similar features and deserves to be preserved (Jacobsen, 1997). In addition, MacCannell (1976) defined that this sight or objects are "x-rayed, baked, photographed with special equipment and examined by experts. Reports are filed testifying to the object's aesthetic, historical, monetary, recreational and social values". Regarding this description of naming, it refers to the meaning of a place or memorial, as well as the values of the sites in this study.

2) Framing and Elevation: the elevation entails putting the features/objects or attractions on display or opening them up for visitation, while framing is the placing of an official boundary around the attraction. Framing can develop as either protecting or enhancing. For example, framing and elevation was done through building of monumental markers at the site of critical activity, which later became known as the Mont or Butte de Lion in Waterloo. This monument was built on a huge mound crowned by a bronze lion, which was a location where the Duke of Orange was wounded and where Wellington's army had been when the French attack began (Seaton, 1999). In the present study, monuments and landscapes served as social memorials of wartime events mainly battlefields, cemeteries and bomb craters can be protected on specific buildings or at outstanding spaces and highlighted by spotlights.

3) Enshrinement: this stage usually follows the framing and elevation process to enshrine and enrich the site. This can involve work of arts, relics and architectural works. It is the process of decorating and elaborating to increase the value and importance of an attraction.

4) Mechanical Reproduction: it is an important process to intensify and elevate tourism destinations and attractions. It includes the promoting, campaigning and giving public announcements, as well as creating technological innovations and presentations. The role of printing increases the distribution of books, press releases, brochures, images and maps that have been visualized to present the attractive objects or events at the attraction sites. These contribute to promoting the tourist sites to a wider range of visitors. In addition, film and media production about the historical memory have provided more experiences and gained attention, particularly in museums and at historical places. For instance, battlefields are capable of attracting visitors to participate in remembrance and to rehearse the war events in the past with sound and light effects (Winter, 2009). Light (1996) also suggested that special events and exhibitions on particular historical re-enactments encouraged visitors' enthusiasm and to stay longer.

5) Social Reproduction: this stage takes place after the areas or places have begun to name themselves as attractions and the attraction's influence can continue into the future. It refers to the process of representing cultural objects in everyday practice because the place or attraction serves as an identity icon for local people and becomes part of their everyday lives (MacCannell, 1976:p 45). For instance, a famous battlefield tourist place called Waterloo was used as a symbolic sign and its

name has been used in various appearances such as the hotels, roads, products, exhibitions of artifacts and restaurants (Seaton, 1999)

Regarding MacCannell's sight sacralization model, it has been widely applied to many kinds of attractions for examining the process of tourism-attraction creation, such as coastal tourism in the Arctic Ocean at North Cape (Jacobsen, 1997), and thanatourism or warfare tourism at Waterloo (Seaton, 1999). However, touristic sites differ in features, characteristics, history and geographical landscapes. The model can be switched from the order of different stages or added by other significant methods to enhance the attractions' appeal in specific areas.

To establish an appropriate suggestion in this study, several places and vestiges related to war were found along the EWEC and are capable of developing into special tourism products (niche tourism). Particularly, the area of Lao PDR and Vietnam has many war-related attractions with the potential to be developed with touristic marking. Furthermore, local residents and tourism authorities play a great role in exploring tourism place-marking, including motivating and interpreting their local culture and promoting the history of tourism heritage places. Then, tourism planners and authorities should be ready to design practical plans of tourism development and professionally offer the service of tourism facilities and provide reliable information about tourist sites to national and international tourists.

Recently, Hultman and Hall (2011) suggested destination developments for tourism place-making in 4 projects: Ecoregion, Litourism, Goodlife and Ecoexperience. In addition, these developments can be integrated with a model of creative tourism development presented by Richards and Wilson (2006) that has 3 components: creative spectacle, creative space and creative tourism through the creative form of tourism (Figure 7.3). Both models aimed to extract and utilize the distinctiveness of the tour sites to become remarkable places and have a potential advantage in the global competitiveness. However, the development project by Hultman and Hall focused on the context of natural and ecotourism, whereas the latter model was developed in the context of arts and cultural tourism. Thus, our current study combined the context of both models based on the key components of Richards and Wilson's model, and utilized the Hultman and Hall place- making project as an empirical example. These represent flexible strategies, which can be applied in many alternatives of tourist attractions.

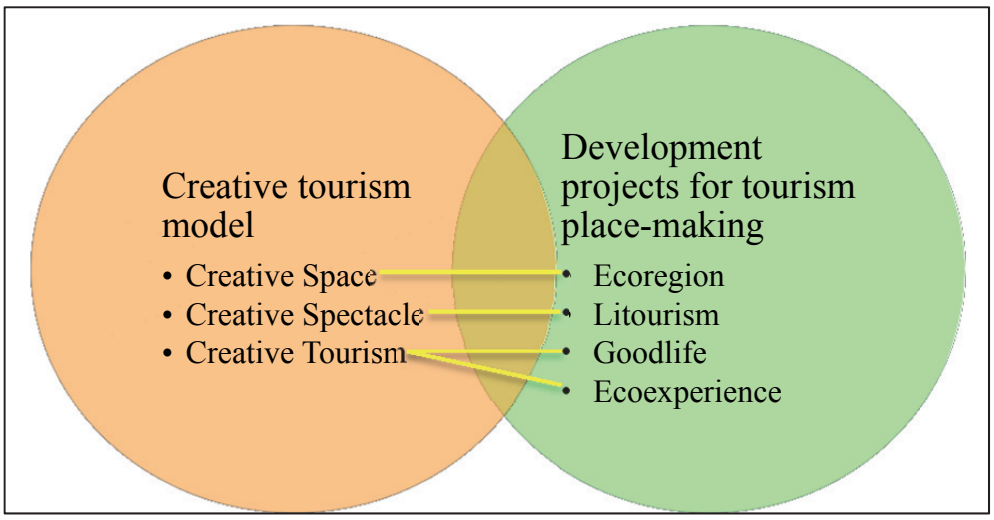


Figure 7.3 Integration of creative the tourism model and development projects for tourist place-making

Regarding Figure 7.3, the integrated concepts of both models are described in detail as follows:

1) Creative Space: this concept aims to make an area distinctive or specific. The creative space can be formed by specific clusters of particular themes, such as young artist galleries, new fashion shops and cultural diversity in East London (Richards, 2011). With this concept, the **Ecoregion** of tourism place-making project can be applied in practice. The space/region will be formed as an eco-region by starting with an Ecoregion initiative, whereas a municipality or target political area brands its boundary as an ecotourism destination. Thus, this destination region has to be a place where ecological concerns become highly visible to tourists, such as greening transportation services, driving uses of ecotourism products and environmental friendly activities (Hultman and Hall, 2011).

2) Creative Spectacle: Richards (2011) suggested that distinctive events or festivals serve as a concentrators in terms of time and space. They provide the value of creative tourism products and experiences (Richards and Wilson, 2006). In this study, the **Litourism** concept can support a creative spectacle for the development of tourist attractions. With a bias for literary heritage, it attempts to seek local folklore and local history and translate them into an assemblage of nationally and internationally marketed product packages (Hultman and Hall, 2011). Therefore, the results from this project enhanced the touristic value and remarkable traditions of the attractions.

3) Creative Tourism: this refers to "travel directed toward an engaged and authentic experience, with participative learning in the arts, heritage, or special character of a place. It provides a connection with those who reside in this place and create this living culture"(UNESCO, 2006:p 3).

It is a very important part for extracting a unique combination of knowledge, skill, tradition, physical assets and atmosphere to create potential in a certain place and provide specific tourism activities. Furthermore, it represents the interaction between tourists and the local environment (Richards, 2011). The present study suggested that the practical concepts of **Goodlife** and **Ecoexperience** can respond to the production of creative tourism. For example, the **Goodlife** project supported the popularity of countryside tourism. The special reference to rural lifestyle was introduced to visitors, particularly food experiences framed by ecotourism and the good life in the countryside. In addition, rural resources related to farming, orchards and local planting can be transformed into commercial products, which is a specific motivation to visit (Hultman and Hall, 2011).

Ecoexperience focuses on the development of nature centers offering nature experience to tourists. This project attempts to present an attraction environment with local material, such as lime-tree boards, elm floors, hardwood beds and chairs, including the creation of nature exhibitions or restored barn housing. Tourists have interactive experiences with the place, local people, and culture where they stay. The diverse assets were used to educate tourists about their cultural traditions and dynamic natural environment, and the interplay between the two (Hultman and Hall, 2011).

The tourism destination-making projects mentioned above are also suitable to apply in particular areas which, many small natural sites are less developed than national parks such as Hui Kong and Phalong Waterfall in Savannakhet province, Lao PDR. In this study, this province was chosen as an example case of specific study to develop particular model of improvement for enhancing the attractiveness and potential.

In addition, the GMS tourism sector designed the implementation strategy to stimulate tourism along the EWEC zone and to promote specific tourist attractions and training for improving valuable pulling forces toward tourists, In 2010, ADB identified the following plans to develop the EWEC zone (Asian Development Bank, 2010):

1) Promote tourism centers in Lao PDR.
2) Need to develop tourism infrastructure.
3) Market tourism in the corridor within the overall GMS context
4) Train for basic skills for EWEC tourism staff and authorities.
5) Offer a program to promote overland EWEC tours.
6) Promote Buddhist pilgrimage tourism in the EWEC.
7) Facilitate cruise tourism at the coastal node of the EWEC.
8) Promote ecotourism in the EWEC.
9) Present agro-tourism.

Besides, some nations create their own plans for promoting tourism compatible with local conditions. In Thailand, the government's development plan designed in 1998 aimed at developing the Mae Sot (Tak) border town as a city of international trade and a center for tourism activities. In addition, the Tak Chamber of Commerce, the governor of Tak province, Tak Provincial administrative organizations and the private sectors jointly presented the Tak tourism campaign as Mae Sot Mountain Bike Cross Country 2008 and as a place for adventure and ecotourism (Yongvanit, 2011).

7.2.1.1 Case study: Savannakhet tourism destination-making models

1) Background and tourism situation

To support the guidelines of potential development in particular area, the understanding of existing provincial situations and basic tourism information was explored. In this context, we focused on the low potential tourist attractions found mostly in the Savannakhet province in Lao PDR according to the results from Chapter 5.

Savannakhet has diverse ethnic groups where Lao and Phouthai are accounted for 75% of population. The remaining groups belongs to the Mon-Khmer-speaking Bru, Katang, Souay, Mankhong, So and Trii (Savannakhet Provincial Tourism Department, 2012). Most people are in the agriculture sector. Although 68% of the total provincial land area represents an agriculture land area, a large percentage of this area has low fertility and turning to forested areas. Over 84,000 people or 14,286 households have been recently living below the poverty line. However the incidence of poverty in Savannakhet Province has been continuously decreased from about 20.8% in 2004 to about 10% in 2009 (Poverty-Environment Initiative of Lao PDR, 2011).

This province has plenty of national resources with 52% of forest covered around the province including three national parks- Phou Xang Hae National Protected Area, Don Phou Vieng National Protected Area, and Dong Natad Provincial Protected Area. In term of tourism potential,

Savannakhet composes of 55 tourist sites in total (Lao National Tourism Administration, 2009a). However, there are only 21 sites are found in the 30 km around the EWEC line (called route no.9 in Savannakhet boundary), with 8 for HC, 5 for NT, 4 for AS, 2 for REC and SP.

As the result of the completion of the second Friendship Bridge and the establishment of EWEC project in 2006, Savannakhet has benefited from the commercial, investment and arrival of visitors. The number of tourist arrivals has increased steadily since last decade (Figure 7.4), with an average annual growth of 18.01% between 2000-2008 (Thomas, 2009). Obviously, the number of tourists increased dramatically since 2007 (430,604) and largely attributed to overall growth of tourism throughout Lao PDR during that year (34% national growth).

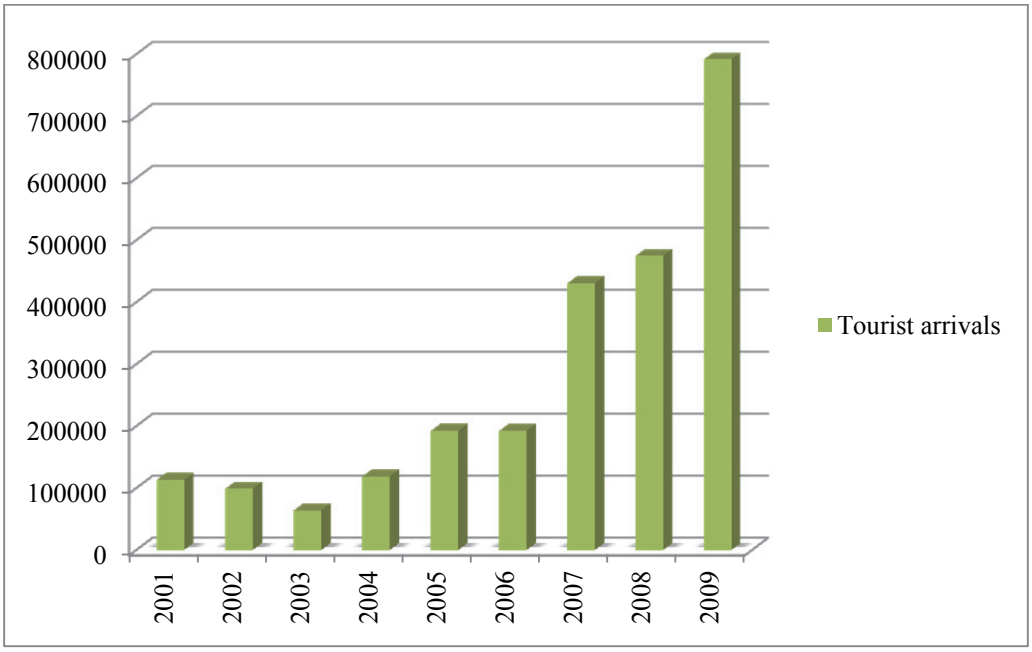


Figure 7.4 The number of tourist arrivals to Savannakhet during 2001-2009 (Lao National Tourism Administration, 2009a)

Regarding the Table 7.2, the top 10 international tourist arrivals to Savannakhet are shown. Neighbor tourists (mainly visitors from Thailand and Vietnam) clearly contributed to the most significant portion of arrivals. Thai visitors received the highest position as the main inbound market with 89.6% of visitors to Savannakhet via the second Friendship Bridge. In addition, the opening of casino (Savan Vegas) in 2009 has contributed to high proportions of intra-regional short haul visitors. An informal numbers of probable visitors at the casino reached an average of 40,000 per month.

Table 7.2 The Numbers of top 10 tourist arrivals by nationalities

NATIONALITY	Arrivals To Friendship Bridge II*	Arrival To Dan Savanh*
Thailand	217,005	56,419
Vietnam	24,180	95,964
USA	1,274	423
France	1,087	505
Japan	1,047	659
Australia	1,008	282
United Kingdom	848	407
Germany	585	326
Philippines	497	23
Canada	384	238

*Data source is available in 2008 from the Lao Tourism Administration (LNTA)

Furthermore, there are three modes of transportation for visitors who want to travel to Savannakhet, i.e., land, air and ship transport. The local buses (Song Teaws) are available in Savannakhet city (at Savanxay market) and bus station in district centers and larger towns. On the other hand, 2-3 flights per weeks are scheduled to depart from Bangkok (Thailand), Luang Prabang (Lao PDR) and Vientaine (Lao PDR) to Savannakhet. In addition, Ferryboats crossing the Mekong River between Mukdahan and Savannakhet piers are also provided every day. In order to extend tourism facilities for individual tourists and backpackers, bus accessibility to remote towns should be supported and services should be extended. Moreover, a bus stations along the EWEC route in each village should be added.

According to the Lao National Tourism Administration (2009a), Savannakhet provides total accommodations of 115 sites, with 2,302 rooms and 3,119 beds (Table7.3). However, it has only approximately 8% of the total country's bed capacity and less than 0.5% of its capacity can support tourists who stay overnight in this province. Therefore, this indicates that most proportions of visitors are short length of stay, transit visitors and day-trippers. In addition, there is a number of restaurants and entertainment activities which accounts for 8.3% and 42 % respectively of the total number in Lao PDR (Table 7.3).

Table 7.3 The number of Hotels, Guest houses/resorts, restaurants and entertainment sites of Savannakhet province in 2009

	Hotel			GH/Resort			Total Accommodation			Res-	Enter-
	No	Room	Bed	No	Room	Bed	No	Room	Bed	taurant	tainment
Savannakhet	17	799	1171	98	1503	1948	115	2302	3119	95	69
Total Lao PDR	357	11043	16299	1344	15515	21193	1701	26558	37492	1148	164
Savannakhet (%)	4.76	7.24	7.18	7.29	9.69	9.19	6.76	8.67	8.32	8.28	42.07
Beds' Capacity/			0.15			0.25			0.39		
tourists arrivals*											

*Tourist arrivals in 2009 (791,924)

In summary, concerning the Savannakhet tourism situation, key items of strength and weakness are described as follows:

- Strengths and opportunities

1) Many potential tourist attractions can be enhanced in their historical and culture value. For instance, ancient bombed sites, Ho Chi Minh trail, Phuthai village and Sepon gold mine in Virabouly district.
2) Some natural sites, i.e., Phou Xang Hae and, Don Phou Vieng National Protected Area have plenty of valuable species.
3) Opening various means of accessibility to the city by air and land (the practical link of EWEC route and the Second Friendship Bridge)
4) Savannakhet Eco-Guide Unit has established trekking tour programs from 1 day to 5 days in the city and national protected areas.
5) Community Based Tourism (CBT) was supported by Savannakhet Provincial Tourism Department.
6) Collaborations between local government and external institutes and organizations (e.g. JICA, ADB-GMS Sustainable Tourism Development Project, and SNV Lao Program)

- Weaknesses and Threats

1) Lack of tourism images or identity of tourist attractions
2) Lack of tourism activities and potential tourist attractions (particularly in the Virabouly district)
3) Lack of management in particular tourist site, i.e. Hui Kong and Phalong waterfall (Virabouly) and wartime heritages in Sepon.

4) Lack of service facilities in the tour sites such as toilets, signs of tour site direction, tourist information center along the EWEC route.
5) Not enough tourism services in public transportations and accommodations
6) Not enough quality food products and restaurants along the EWEC route
7) Most tourists passed through this province as a gateway to or from other destinations in Thailand and Vietnam without stop over for visiting in this region.
8) The low numbers of visitors who stay overnights
9) Lack of opportunities for tourists to spend their money on potential local product shops and services
10) No strategies of promotions, exhibition, and festivals for local and international tourists.
11) Lack of financial supports

Furthermore, this province still lacks variety in tourism packages and tour operators. There are only 6 travel agents in 2009 (Lao National Tourism Administration, 2009a). In 2009, the tourism market study of Savannakhet province indicated that most tour operators in this region did not have sufficient provincial information. They could not offer visitors with attractive tourist sites and competitive packages.(Thomas, 2009). Although many weak items were found in Savannakhet, some can be improved and developed in the coming future.

2) Savannakhet tourism destination-making models

This model aimed to support the tourist development plan for Savannakhet attractions to improve the meaningfulness and attractiveness of these regions by integrating tourism making processes with existing valuable natural and human resources. Regarding the investigation of the weakness in section 7.1, most of low potential tourist attractions were found in Virabouly district, for example, Hui Kong Waterfall and Phalong Waterfall, which is a part of Phu Xang Hae National Protected forest. In addition, these sites are located closed to the Sepon gold mine and Phuthai village, which has traditional cotton and silk hand woven products and Lao Silk-Cotton Center. Thus, this area has potential to be supported as an Ecoregion and a pilot destination development model.

In the present study, the process of tourism-attraction creation was modified from previously mentioned section (7.2.1) to implement in the Virabouly district (see Figure 7.5). All processes of this model were concerned about existing local tourism resources, possibility of implementation, real situation and local tourism stakeholders' opinions. This pilot model has been intensively discussed with local tourism authorities, community leaders, and other relevant groups. Responses to this model were presented as follows:

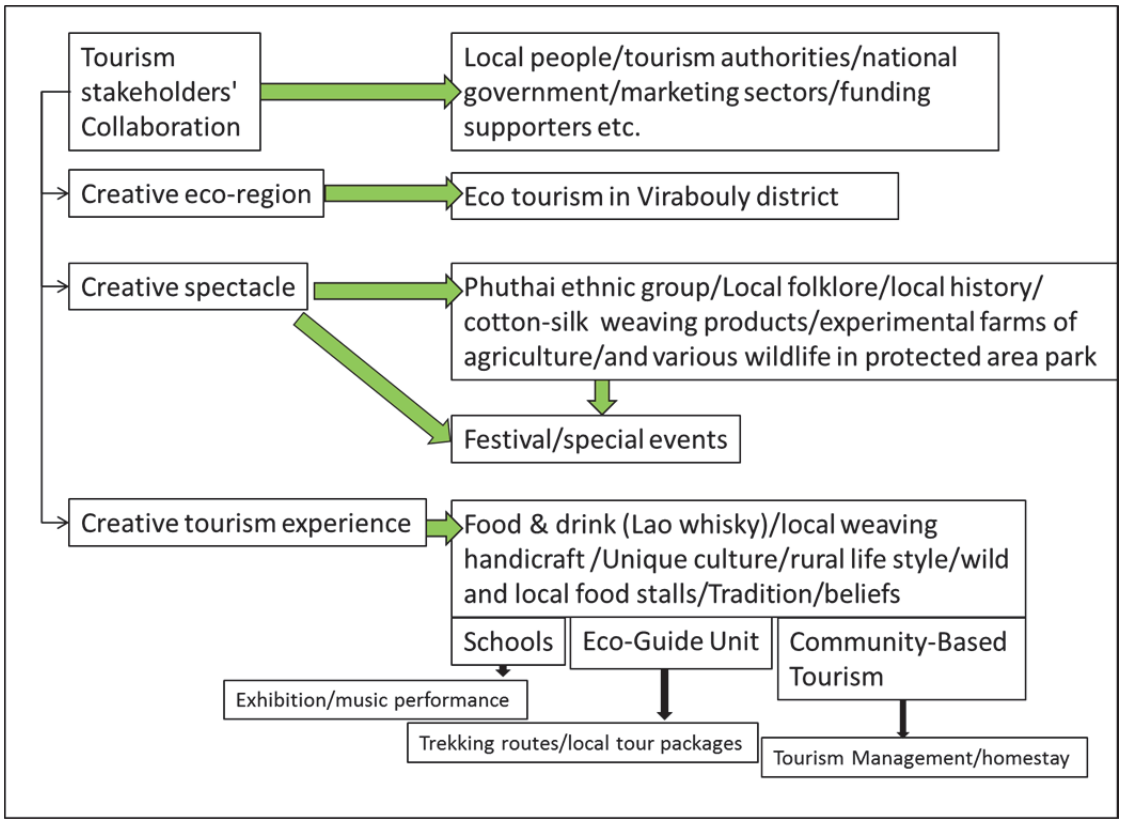


Figure 7.5 The Virabouly tourism-making process for development

Regarding the chart, this pilot model starts with the collaboration among tourism stakeholders. The government is suggested to support this area with tourism training projects, signs to access the tour sites, financial support, promotion, and so on. According to the JICA Project Team report (2012), one of the JICA-ASEAN LPP Tourism Component project is a Community-Based Tourism (CBT) in pilot provinces included Savannakhet which has been recently launched on 13 June 2012 to formulate a village tourism development plan for 9 villages. The project will invite local people from 9 pilot villages for taking a tourism training program which is focused on the analysis of tourism market and attraction sites for future vision of local communities. Furthermore, these pilot villages covered some villages in Virabouly district. Therefore, The CBT project can support Virabouly to be an eco-region and local communities can manage their own attraction sites for tourism-making process.

Then, tourism stakeholders should collaboratively seek to create a local dominant environment for creative tourism spectacles and markers/images in their region, based on primitive lifestyle and conservation tourism. It is suggested that the Lao silk-cotton weaving center and Phoutai Village can offer attractive traditional music instruments and Lao silk-cotton weaving products including its unique processes of silk-cotton hand-spin and natural dyeing. In the meantime, this region can increase visits by organizing special events or festivals of local tradition and beliefs such

as Laos (Phuthai) New Year festivals and Rice-barn annual opening ceremony. In addition, the Lao silk-cotton weaving center at Hui Kong villages is suggested to display or exhibit the process of obtaining silk-cotton from local raw materials and turning it into finished products. This valuable handicraft can be promoted as a special festival of Lao silk-cotton exhibition. Besides, local agriculture and livestock can create attractive markers for ago-tourism in this region. One of village agriculture trainers suggested about the development of agricultural crop and farm for visitation.

"*We established experimental farm of agriculture to improve and develop efficient methods of raising agricultural products in this district. Also we have fish and frog farming in the Hui Kong Lake. At present, we have trained villagers and other interested people to learn about optimized method of planting, kinds of suitable crops for this region including sustainable agriculture. Also tourists are welcomed to visit this experimental farm which is closed to the Hui Kong waterfall*". *(Mr KhamKheow: 28 July, 2012, telephone interview)* In the future, local agriculture crops can be processed to increase values and even direct sell to external people and tourists.

For natural attraction, there are two waterfalls and the national protected park (Phou Xang Hae) located in this region should improve for potential attractive sites. According to the author's fieldwork (February 2010), the Hui Kong and Phalong waterfall was unspoiled but they are difficult to access by road and lack of spectacular attractions.

Moreover, some local people commented that these sites were low potential because there was no water all year round and they are only known by local people. "*Hui Kong waterfall was lack of water in the dry season because most water was reserved to Hui Kong Lake for agriculture. This place has not been managed for promoting as a potential attraction and relaxation… no relaxing benches, no signs, and no tourism facilities to support camping and trekking"* (Ms Dausri Srisurat, 21 February 2010, direct interview). However, Phalong waterfall provides more water in the dry season than Hui Kong waterfall. It can be promoted for year-round attraction sites. In addition, both places should initially improve availability of basic tourism facilities such as toilets, rubbish bins, camping places, relaxing benches, trekking trail signs, food shops, telephone box and tourism information center. Then they should generate attractive markers besides waterfall scene, for example, exhibition of wildlife, waterfall formation, and village history including trekking trails to go sightseeing wildlife. This waterfall is the front gates to the Phou Xang Hae National Protected Area, which has tremendous fauna and flora and is surrounded with ethnic groups. Some rare species found in this area are Douc and Francois' Langurs, elephants, gibbons, tigers, bears, and Bar-bellied Pitta. The forest contains a mix of evergreen and deciduous forest including dipterocarp trees. It also has outstanding steep sandstone escarpment and attractive rock formation (Rosenbloom, 2010).

According to information from the Lao National Tourism Administration, this suggestion coincided with a project of Savannakhet Eco-Guide-Unit (EGU), which trained and supported ecotourism guides and two full-time staff who are responsible for administration and tourist facilitation, including promotion. The EGU offered 2 cycling tours and 3 trekking trails for environmentally friendly travelers, which included city sightseeing and 3 national parks including Phou Xang Hae National Protected Area, Don Phou Vieng National Protected Area, and Dong Natad Provincial Protected Area (Lao National Tourism Administration, 2009b). Since the formation of EGU in 2005, the EGU trekking has served about 400-500 tourists per year, mainly in national protected parks (Savannakhet Eco-Guide Unit, 2011). In addition, the vice president of Savannakhet Provincial Tourism Department and Tourist Information Centre stated that this ecotourism project in this area has attracted more interest by a number of international travelers.

"The EGU trekking trails are attracting a number of tourists. They want to see the elephant parade and wildlife, including learning about rural Lao lifestyle. In 2011, the number of tourists intending to visit Savannakhet as the leading destination increased. In addition, casino tourists, a majority of tourists in this province, tend to spend more time visiting historical and natural attraction sites in Savannaket besides the casino" (Mr Syha Pannavong: 12 May, 2012, telephone interview).

However, this number is still low compared to the total numbers of Savannakhet tourist arrivals, which accounted for 0.06%. The pilot Virabouly model therefore suggested the EGU to extend other eco-culture trails based mainly on the Virabouly eco-region to attract diverse groups of visitors. This eco-region project will aid to distribute incomes to communities in remote village and to conserve nature at same time. Regarding the statement of Eco-Unit Guide officer, he said "*the EGU trekking programs have currently served tourists only during the November to May every year. The tours could not operate in rainy season because of difficult access. So, there are only city and outskirt tours which can operate all year round…The monkey kingdom at Dong Muong village is currently popular visiting sites for tourists during this period. However, many tourists asked for the cultural tour packages which they want to see and learn more about real rural lifestyle. Some did not like to go to the forest and national park. They really need spend more time in the family homestays at unspoiled villages, Virabouly district in particular" (Mr Souliyong Lattana: 26 July, 2012, telephone interview).*

Furthermore, vice president of Savannakhet Provincial Tourism Department informed that they planned to survey new trekking routes after rainy season this year (informed by telephone: 18 July 2012). Therefore, the Virabouly eco-cultural tour is capable of being a potential alternative route to offer wider tourists with unique cultural style and real nature.

In the following step, the process of creative tourism experience should be implemented. The visitors are able to see, share and participate in local tradition, culture and routine during living in local homestays. They will have living experiences with local lifestyle and folk wisdom. Some forest products can be used for foods, herbs medicines, fuels, furniture, and other purposes. Also, Phouthai women brew a traditional Lao whisky drink (Lao rice alcohol) which can offer tourists to taste this local drink.

Besides, local schools should participate in this tourism development project. During the weekend, teachers and students can transform their classrooms and school libraries to public local folklore exhibitions and performances of traditional songs and music instruments. This benefits not only tourist admirations but also the local traditional conservatives. Simultaneously the process of creative experience support new income-generating activities such as local souvenirs, exhibition and performance fees, accommodation, foods, beverages and local tour guides. A Virabouly tourism coordinator stated that "*Some Phuthai villagers are professional music instrument makers. They can produce woodwind instruments such as bamboo flutes and reed mouth organs using in the villages" (Mr Baulee: 27 July 2012, telephone interview)*. These instruments and wickerwork can be supported as local souvenirs. However, they have not been produced yet for sell.

Regarding the statement of Virabouly tourism coordinator, he commented that "*Many local people are quite shy to communicate with overseas tourists, although they are very friendly and happy to share their traditional lifestyle. Therefore, the beginning step of this pilot model starting with CBT project will be necessary to train local people about tourism services and living with foreigners. In addition, tourists' rules should be constructed during their stay in this destination. Tourists should respect and understand the local beliefs, traditional culture and everyday life. They need to adapt themselves to get use to staying as usual as local people do" (Mr Baulee: 27 July 2012, telephone interview).*

Finally, this model will be proposed to Savannakhet Provincial Tourism Department after the publication of this dissertation. If this project is implemented successfully, it will encourage Savannakhet province with potential tourist attractions at Virabouly. However, to develop this pilot eco-region as potential destination, tourism government organizations, together with public and private stakeholders should support and promote this region to wider tourist groups through brochures, online communication, and campaigns. Moreover, this pilot tourism development project is on tourism authorities concerns. "*In fact, this project is quite useful for Savannakhet, but it needs financial support from the central government and/or external organizations. Although the profit can distribute much income to local people, it is not enough to implement it since the beginning steps". (Mr Syha Pannavong: 18 July, 2012, telephone interview).* Besides, the language is one of the threats for implementation. According to statement of a Virabouly tourism coordinator, "*There were few*

people in the village that can speak English. We have to hire external tour guides who have ability to communicate with tourists" (27 July 2012, telephone interview). Therefore, tourism authorities play a central role of coordinating and collaborating between local communities and other tourism-supported organizations for upgrading Virabouly tourist attractions into leading destination.

7.2.2 Support of the physical factor

To get the effective physical aspects, the accessibility and facility factors should be improved. Accessibility involves the characteristics of access roads directly toward the tour site and entrance system. The improvements can be made through local government or municipality construction plans. For the facility factor, service areas of tourism facilities are measured by the ability of tourists to access facilities from the tour sites or vice versa within a specific distance or period of time. The present study focused on the possible solutions toward the problem of inadequate facility services. The lack of efficient accessibility related to the lack of ability to access facility services. Therefore, the extensions of facility services were essential to support the improvement of accessibility for the physical factor. The guidelines of tourism facility extensions for investment and services can be implemented in two parts: 1) examining the gap areas of facility service and 2) presenting the optimal tourism facility areas for new investments and services in the following detail.

7.2.2.1 Examining the gaps of facility service areas

This part examines service areas of all tourism facilities used in the current study and focuses on the areas which were evaluated as having a disparity in service areas of facilities, although they were potential areas to promote as tourism resource sites. Obviously, low potential attractions were located on these disparities of facility services. The service areas for four types of tourism facilities were evaluated:

1) Investigation of public transport station service areas (Figure 7.6)

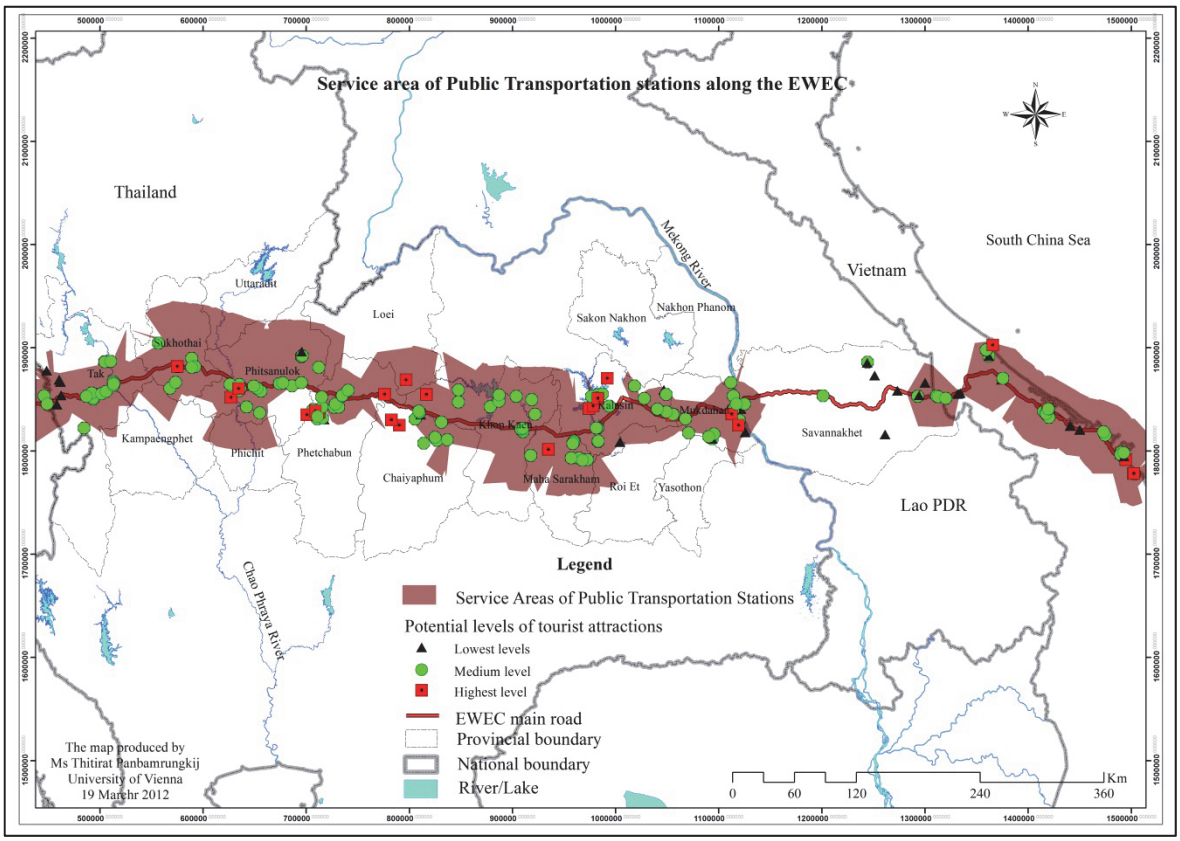


Figure 7.6 Public transportation station service areas

A big disparity in the public transportation service area was in Savannakhet, Lao PDR. There were 6 weak potential tourist sites that were situated in this area. They are 1) Dinosaur footprint and Pot hole on the cataract, 2) Lao silk-cotton weaving center, 3) Hui Kong Waterfall, 4) Phalong Waterfall (Phu Xang Hae National Protected area), 5) Ancient Sepon city, and 6) Tad Hai Bridge (war-related heritage).

2) Investigation of accommodation service areas (Figure 7.7)

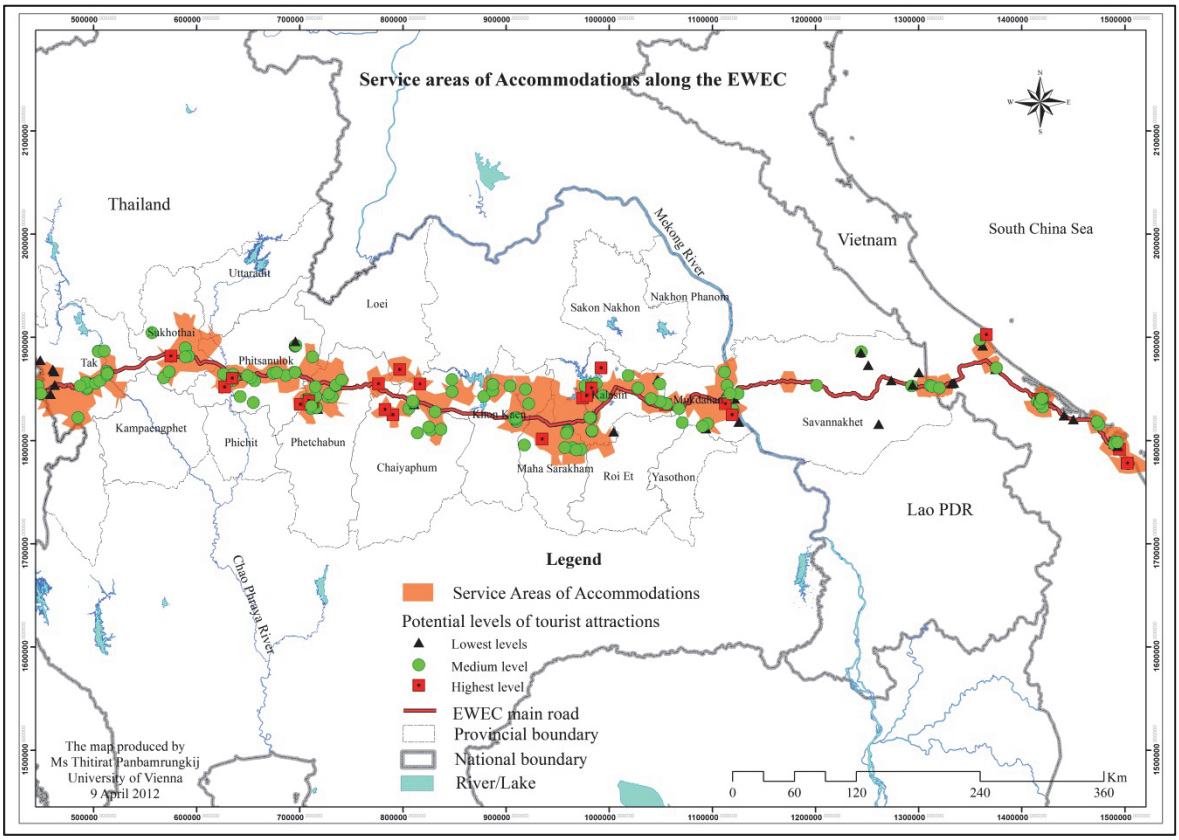


Figure 7.7 Accommodation service areas

It is noted that the largest disparities of this service area were also in Savannakhet province in Lao PDR, even though there was a small area found in Quang Tri, Vietnam. 13 weak potential tourist sites were outside the existing service areas of accommodations. Most of them were in the Savannakhet, Lao PDR and the rest of them were in Quang Tri, Vietnam.

3) Investigation of healthcare service center service areas (Figure 7.8).

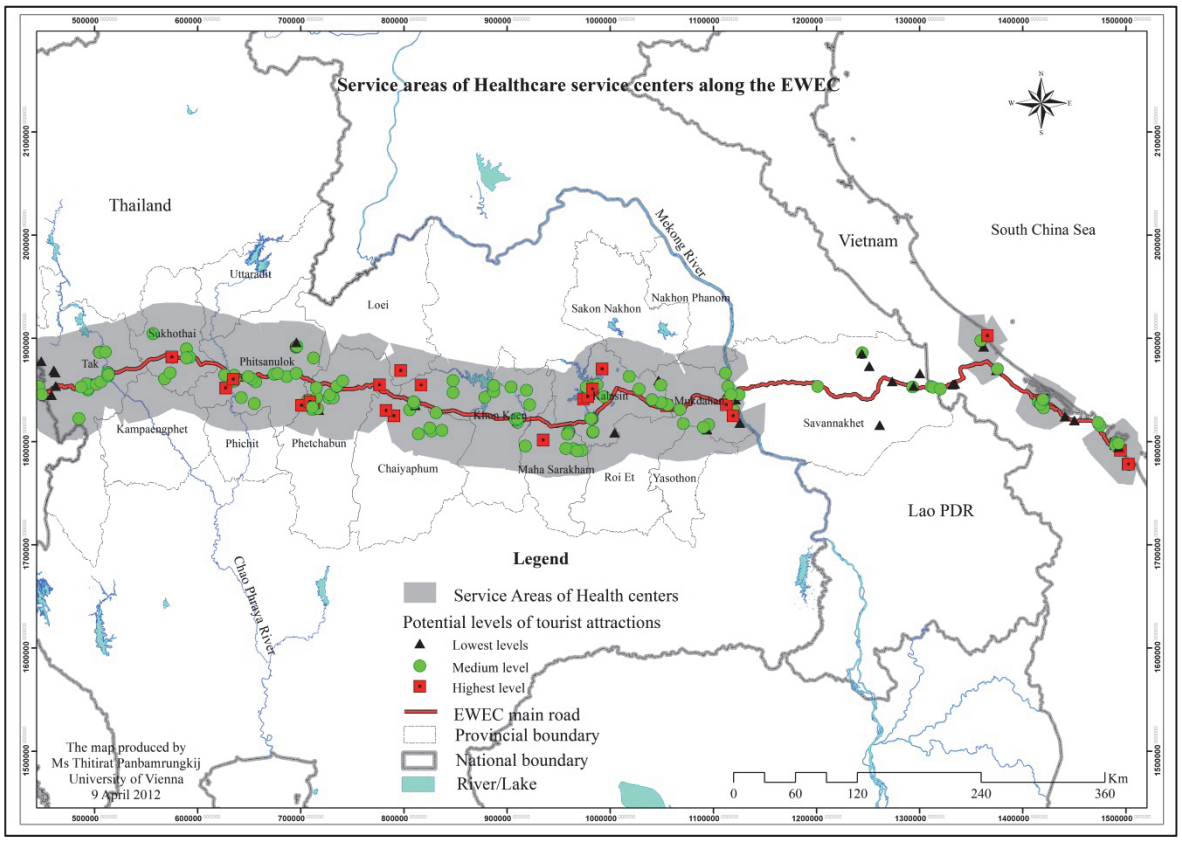


Figure 7.8 Healthcare service areas

It was noted that the biggest gap was also found from Savannakhet in Lao PDR to the Dong Ha district in Quang Tri province, Vietnam. 14 weak potential tourist sites were outside the existing service areas of healthcare service centers. Most of them were in Savannakhet, Lao PDR and the rest of them were in Quang Tri, Vietnam.

4) Investigation of petrol station service areas (Figure 7.9)

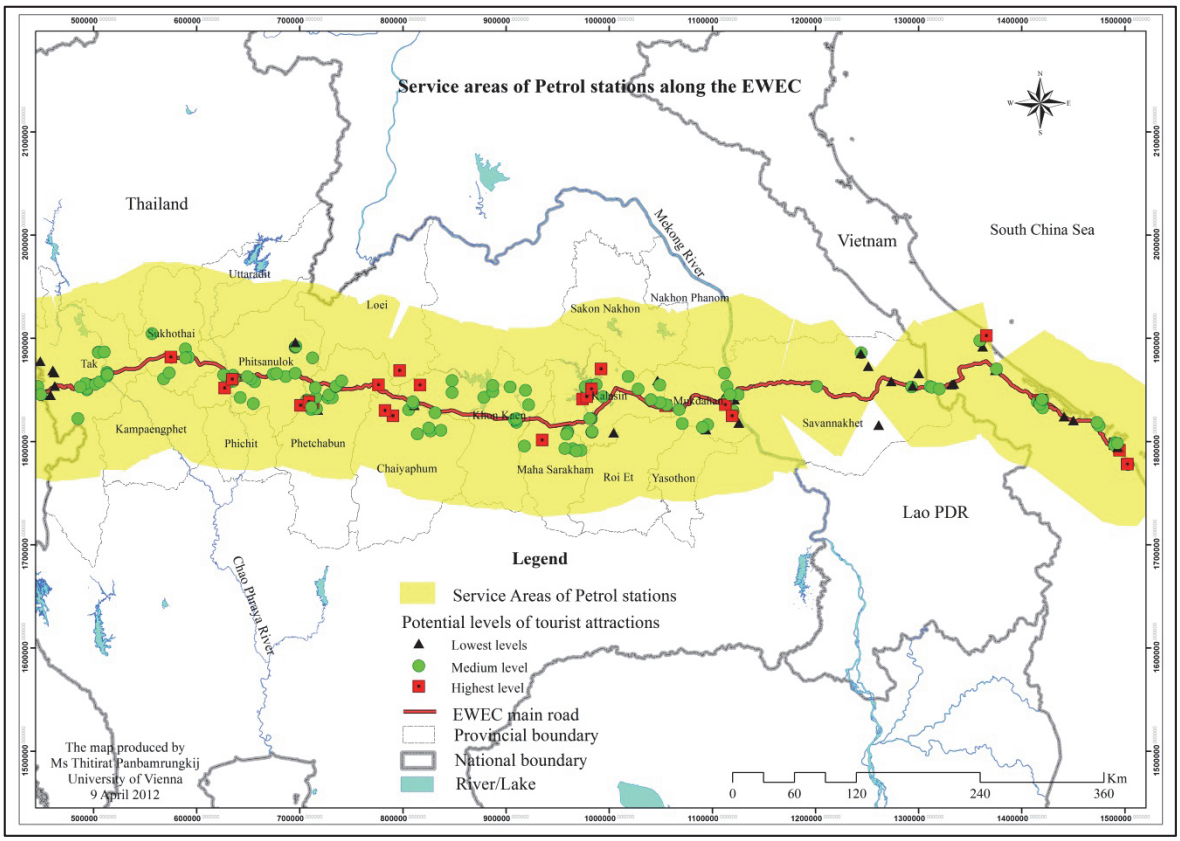


Figure 7.9 Petrol station service areas

The petrol service area in this area almost covers the entire region, so there is no urgent lack of this facility service that affects the potential of tourist attractions in the EWEC region.

Regarding the examination of these disparities, most of them dominantly appear in the Savannakhet province, Lao PDR particularly the Phalanxay, Phine and Sepon districts, while some of them are found in Lao Bao, Khe Sanh, and Gio Linhand districts in Quang Tri, Vietnam. Thus, the second step focused on these two areas for improvement.

7.2.2.2 Finding the optimal locations in the disparities of facility service areas

The GIS-base Location-Allocation analysis is one optional solution to assist facility planning and to improve potential placement of facility sites in specific disparities of facility services (Murray and Gerrard, 1997). However, this technique requires the locations of existing facility alternatives or new possible sites to assign optimal locations in weak areas and service demand effectively. For expanding new facility services, this study needed to offer possible locations to be analyzed, but it was limited in accessing data about the building area map or building unit, including the land use map. Therefore, the initial findings of possible alternative locations of new facility services was

implemented by using the Spatial Statistic tools (i.e., Mean Center, and Median Center) in the particular areas (i.e. Savannakhet province, Lao PDR). Then, the optimal alternatives for each facility were chosen by the Location-Allocation analysis. The results of these two major phases are shown in the following details:

1) Analysis of the Mean and Median Center: These tools worked as initial solutions to represent the central locations, which accounted for the lowest total distance from all surrounding low potential tourist attractions. These locations were identified as possible alternatives of new tourist facility locations. The required parameters are Input Feature Class (tourist sites required new tourism facilities) and Output Feature Class (points of locations representing the mean and median center of the Input feature class). In addition, there were optional parameters used to specify the demands of the Median Center work for this study: 1) Weight (i.e., potential ranks of attractions), and 2) Case Field used to calculate Mean/Median center separately in multiple specific areas. In this study, the Case Field was the districts or provinces with low potential tourist attractions.

2) Location-Allocation analysis was then used to find the optimal facility locations from a set of alternative locations, which were created from previous analysis (i.e., Mean Center, Median Center). These optimal facility locations have to locate in the area that can be access the road network and intend to serve tourists' demands in the low potential tourist sites that are out of existing facility service areas. In this study, the Maximize Coverage model was operated for Location-Allocation analysis to obtain the best new locations of facilities, which are able to serve the maximum demands of tourist sites within the maximum threshold distance or time on the real road network dataset. To operate this model, the current analysis was based on the assumption that tourists tend to select facility services more at nearby facility sites than at those farther away.

In this study, there were 3 tourism facilities (i.e. Public transportation station, Accommodation, and Healthcare service center) that required new sites for extending the services in the disparity of defined facility service areas. The results of these alternative locations and optimal sites for each facility are shown in the following maps.

Public transportation station

There are 6 alternative locations obtained from Mean Center and Median Center analysis for new public transportation stations in the Virabouly and Phine districts in Savannakhet province, Lao PDR. However, some of them are located in the forest area, so it was adjusted less than 5 kilometers away from that area and closed to the road. Then the Location-Allocation solver was used to calculate and find the optimal sites. Regarding the results displayed in Figure 7.10, two optimal sites (pink square checked box) were chosen and represent new public transportation stations in the Virabouly district and Phine districts, Lao PDR. Both locations can service 5 tourist sites from 6 total tourist attractions that are outside the current service areas. This is the maximum number of surrounding tourist sites within a 30 km threshold of service areas. Only one site requires up to 60 km travel distance to reach the closest facility.

Regarding the information given by the Vice President of Savannakhet Tourism Department, there will be 2 new locations of car resting stations which can be used for public transportation stations in Phalanxay and Phine. One of them (Phine district) is close to the optimal location presented in this study. This station will officially open next month (Syha Pannavong, 11 May 2012, telephone interview).

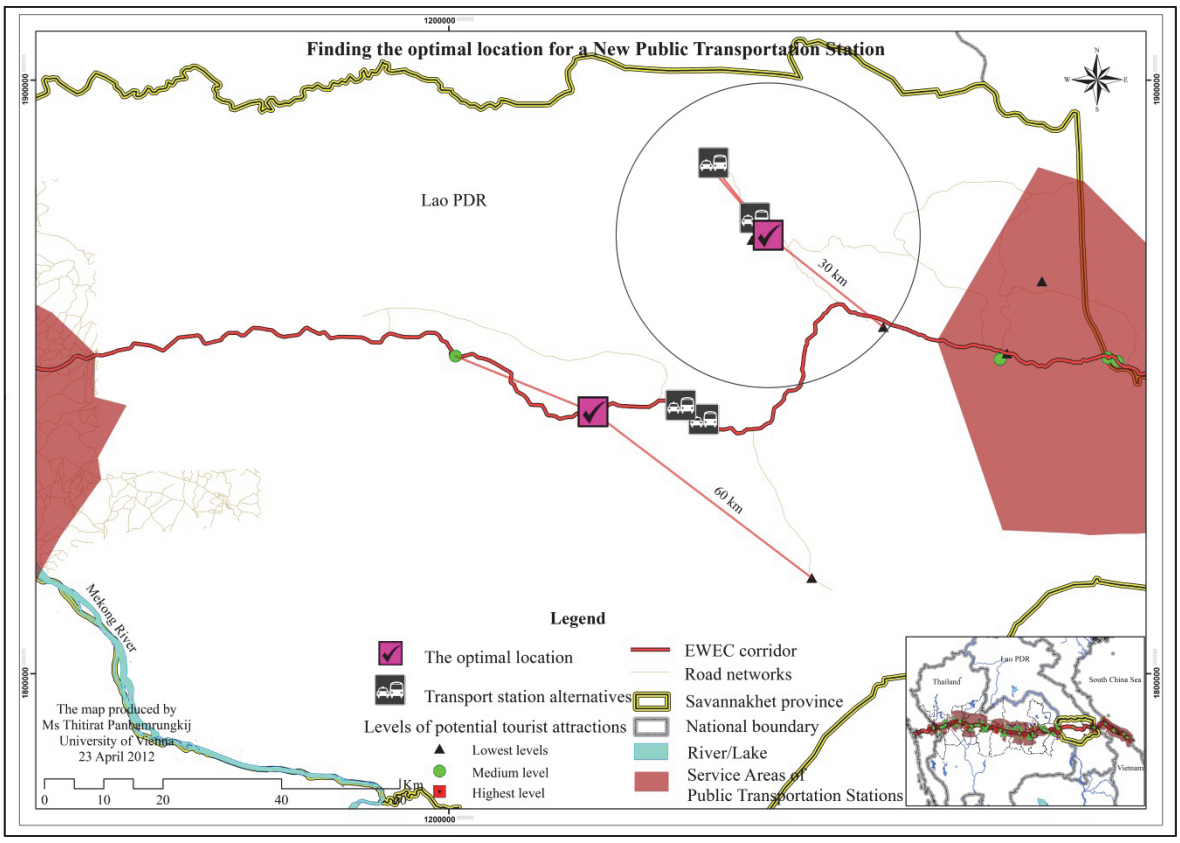


Figure 7.10 The optimal location for a new public transportation station

Accommodation

For accommodation, there were 8 alternative locations presented by Mean and Median Center for 3 districts (Phalanxay, Virabouly, and Sepon) in Savannakhet and for 1 district (Gio Linh) in Quang Tri (Figure 7.10). The optimal locations of each district were then selected by the Maximize Coverage model of Location-Allocation analysis. Therefore, there are 4 newly optimized locations of accommodation (pink square checked box) presented in Figure 7.11. These locations provide the 10 km maximum service areas and can service 7 out of 11 sites with poor potential tourist attraction. The rest of the tourist sites required up to 28 km to reach the accommodation, such as Tad Salen waterfall and Tad Hai Bridge (Bomb-destroyed bridge lying on the riverbed). The new optimal accommodation in Virabouly is suggested in the area of the Lao Silk-Cotton Weaving Center. This site may offer homestay possibilities enabling tourists to stay and learn Lao rural lifestyle and traditional weaving while in the natural setting of Hui Kong waterfall. In Sepon, the optimal location is closed to the main EWEC corridor and can service 2 attraction sites, Ho Chi Minh Trial and War Museum. For Phalanxay, this optimal location is required to service only one site, which is the Dinosaur Footprint on the cataract. Besides, the new optimized accommodation located in the Trung Hai commune in the Gio Linh district, Vietnam is shown on the south of the Ben Hai River bank next to Hien Luong Bridge, known as 17th parallel bridge or Peace or Vietnam DMZ Bridge. This area is a DMZ (Demilitarized Zone (DMZ) between North and South Vietnam with an approximately 8.05 km-wide buffer zone which straddles the 17th parallel (Page and Pimlott, 1988).

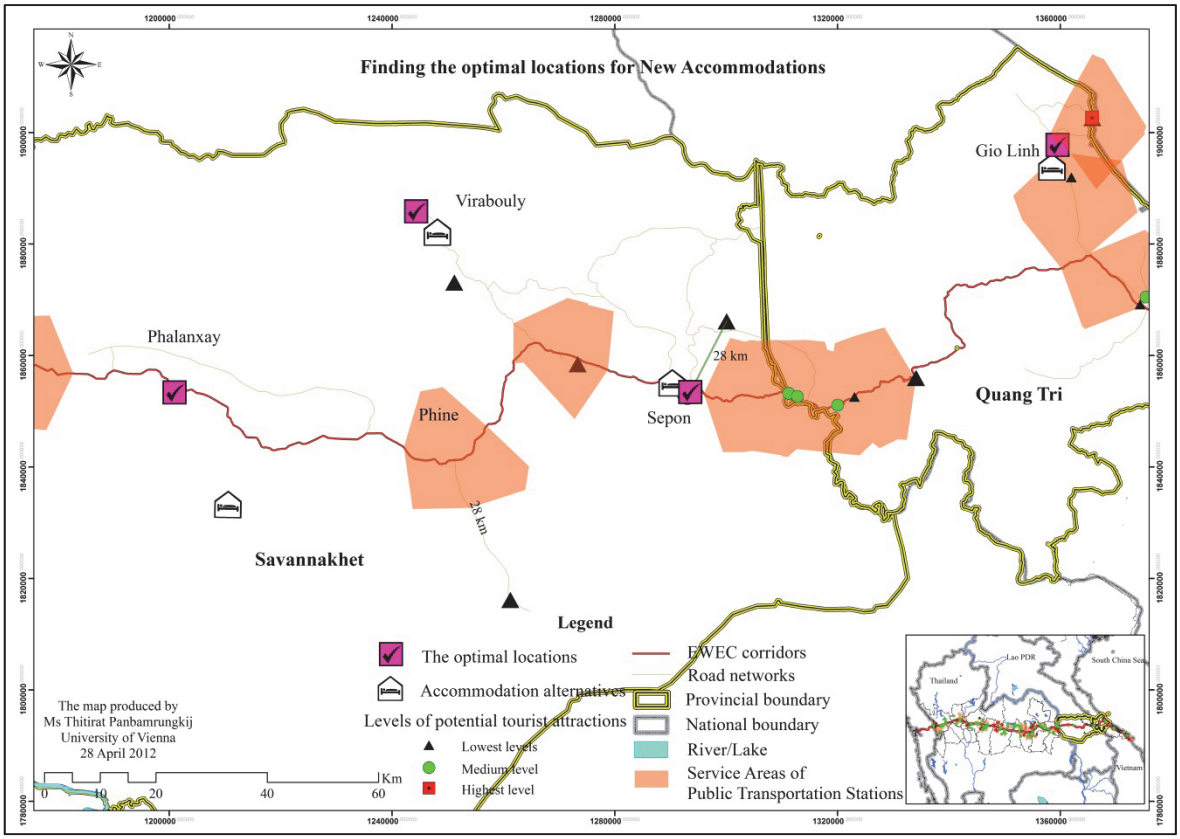


Figure 7.11 The optimal locations for new accommodations

Healthcare service center

Ten alternative locations were identified as candidates for new healthcare service centers in the Phalanxay, Virabouly, Sepon districts, Lao PDR, and from Lao Bao to Dong Ha in Vietnam. These alternatives were then solved to find the optimal locations for five sites (pink square checked box) (Figure 7.12) by the Location-Allocation analysis. The optimal sites should service tourist attractions around them, up to 11 out of 14 sites within 19 minutes. The rest of them required up to 28 km (i.e. Tad Hai Bridge, War museum and Tad Salen waterfall). In Lao PDR, the optimal sites were nearly the same as the optimal sites of accommodations. There are two more sites needed at the Lao Bao/Dan Savanh checkpoint and in the area between Lao Bao and Khe Sanh.

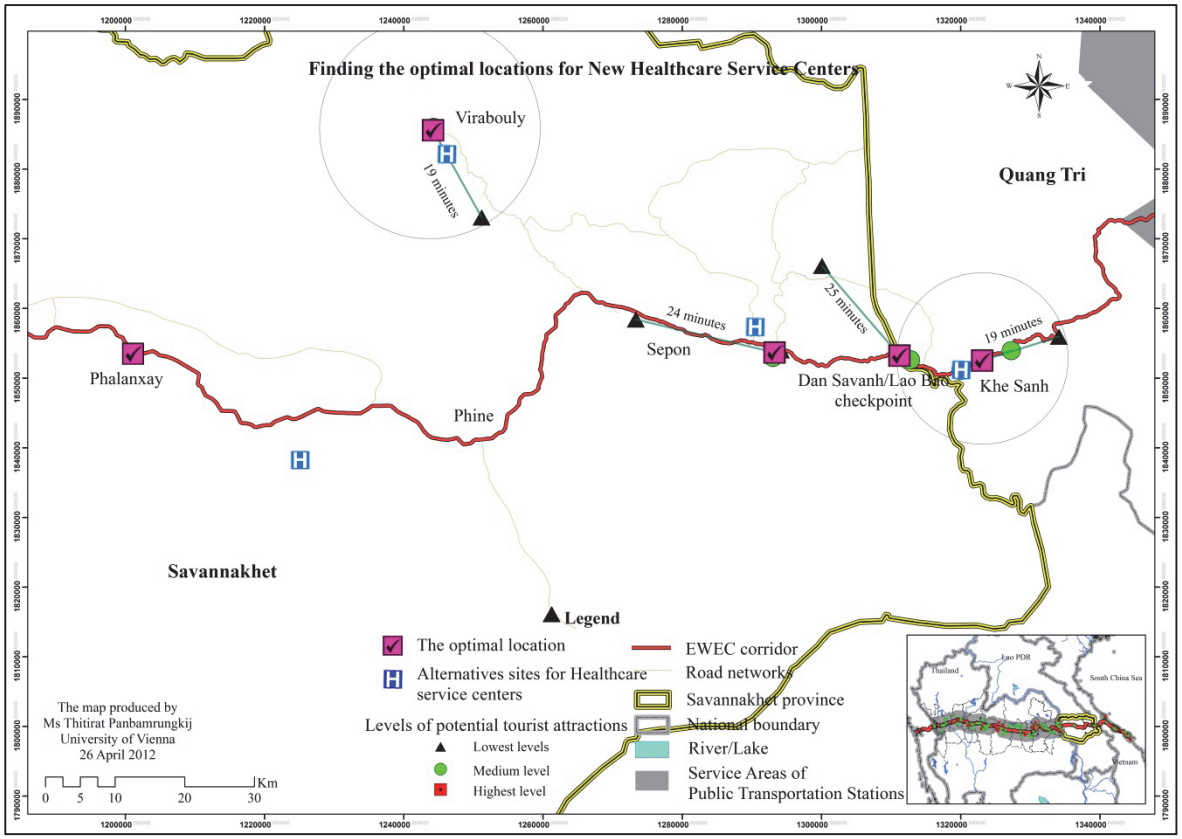


Figure 7.12 The optimal locations for new healthcare service centers

Regarding all the newly identified locations for each facility, the results of the suggested locations were mostly selected by the Median Center method. The highlighted principle of this function was related to the basic Location-Allocation Analysis method, based on minimizing the sum of distances from itself to other points of spatial distribution in Euclidean space and a network dataset. In addition, the results showed that newly optimal locations presented by the Maximize Coverage solver of the Location-Allocation analysis can serve a maximum number of tourist attractions within the standard response time of each facility, more than 64% (i.e. 83% for public transportation station, 64% for accommodation, and 79% for healthcare service centers). However, this analysis was based on fixed numbers of facility locations depending on the number of districts in this project's study area because this area is mostly rural. Therefore, it has fewer opportunities to extend many locations of facilities than urban areas. However, some facilities can be expanded to more than one site of facilities in the same district, particularly accommodation. In addition, the Lao Bao (Vietnam) and Savannakhet province (Lao PDR) are supported by the national government to construct facility services and infrastructure in these areas along the EWEC for tourism development, mostly accommodation and petrol stations (Office of Quang Tri Province, 2012). Therefore, new optimal facility sites presented in this study will serve as a practical guideline for national planners and investors for tourism planning across this region.

7.3 Summary

This chapter applied the correlation statistics to investigate the results of evaluating the tourist attractions in Chapter 5. The results emphasized that Attractive and Physical factors had the highest influence on determining the potential of tourist attractions. Therefore, low potential tourist attractions should be prioritized and boosted by improving these two factors. The marking process of MacCannell (1976) and place-making projects introduced by Hultman and Hall (2011) were adapted to increase Value/Uniqueness and Popularity of the destination developments for the Virabouly district in particular. The physical factor was stimulated by using the spatial statistics functions and Location-Allocation analysis to extend the service areas of tourism facilities from new establishments of services.

Chapter 8

Conclusion and Discussion

8.1 General conclusion and discussion

In recent years, many countries have struggled to recover their national economy from the global economic recession. One of key driving strategies is the development of the tourism sector. Tourism, recognized as the world's largest industry, is involved with many businesses, investments, labors, people, infrastructure and environment (Hall and Page, 2006 p.1). In addition, tourism development strategies become much more significant attention in scope of international collaborations. Specifically, ASEAN develops intensively tourism plans to improve facilitations of tourist movements by supporting an implementation of ASEAN single visa, transport constructions and cross border tourism among its member nations.

The EWEC is a new outstanding continuous land route collaborated by the ADB and the GMS countries in the Southeast Asia. This route facilitates movements of trades, investments, incomes, and domestic and international tourists throughout the region. Many groups of researchers have attempted to find the strategies to develop the infrastructure, increases of EWEC usages in many contexts, and tourism stimulations through the training basic skills of tourism services for staff and local people. However, this route has not been known widely for international tourists and it still lacks a tourism attractions database as a whole region including practical plans of tourist itineraries. In addition, the evaluation of tourist attractions' potential to support the EWEC cross border tourism has not been implemented. Therefore, this present study aimed to apply GIS-based capacities to develop implementation strategies for the EWEC tourism development. This outcome is planned to benefit not only the peripheral provinces, which the EWEC pass through, but also the support of regional links of tourism throughout the GMS.

We started this study with the establishment of creation of existing tourist attraction databases and then tourist attractions' potential evaluation was modeled corresponding to the AHP techniques. The result of this evaluation was further investigated for finding the weaknesses and influential factors to support potential of attraction sites along the EWEC. In addition, the possible guidelines for tourism investments and services were suggested in the particular problem areas. Finally, the study also generated the EWEC itinerary models and implemented these model on the real scenarios of current tourist attractions and facilities for finding optimal routes in terms of time and distance saving.

The study hypothesized that the outcomes derived from this study would support practical tourist development plans for tourism authorities and infrastructure planners in public and private sectors. For tourism itinerary models, they were optimized and made usable for tourists to explore potential tourist attractions in the EWEC region.

Our results thus provided information concerning the study objectives as follows:

Objective 1: **To establish the GIS database of tourism structures along the roads of EWEC.**

From our collections and surveys, all tourism attractions and infrastructure structures had been generated and documented for both spatial and attribute information in the GIS database by the process of data input and arrangement. This database is flexible for retrieving, updating, and preparing for further analysis. In addition, it will also provide useful information for other researchers to perform future studies in this particular region.

Objective 2: **To analyze the tourist attractions' potential in the EWEC and classifications.**

The result was classified into 3 categories- high, medium, and low potential groups of tourist attractions regarding the standard deviation method. The high potential groups had 26 sites out of 206 total attraction sites. They were mostly located in Thailand, which accounted for 13% of the total numbers of attractions in this countries. The outstanding province covering the most numbers of high potential attraction sites was Kalasin. In fact, this province is situated at a spectacular geographic characteristic of the Isan plateau region comprising Phu Phan Mountain and Lam Pao Dam. It is a land of unique traditional cultures particularly Phrae Wa cloth and Pong Lang music. Moreover, the Fa Daet Song Yang ancient city and the Sirindhorn Museum, one of the largest dinosaur fossil collections in Thailand, have also been located in this region. These benefit many tourist attractions in this province. In addition, it provides basic needs of tourist infrastructure and facilities covering tourist sites, which serve as a new leading destination in this region. Regarding the Northeastern Thailand Regional Plan in 2057, Kalasin is also a primary province to be served and promoted for ancient town development (Department of Public Works and Town & Country Planning, 2010).

However, the proportion of high potential tourist attractions held by Thailand is less than Vietnam which reaches up to 19% of the total numbers of attractions in its country. Most of these high potential attractions are in Da Nang City and Thua Thien Hue which provides particularly exotic architechture and culture to be attracted by a numbers of tourists. On the other hand, the result indicates that there were no high potential tourist attractions found in Lao PDR. This shows that the tourist sites in Lao PDR should be supported to improve the degrees of potential attractions, such as facility expansion and attractiveness.

Objective 3: **To develop itinerary models for tourist routes and implement the models for multiple destination routes along the EWEC by means of network analysis in ArcGIS package.**

Our study showed that the Oppermann itinerary model integrated with other relevant classic tourist travelling models could support the development of the EWEC itinerary models comprising six models- Fish Bone, Radius Destination, Destination Area Loop**,** Möbius Loop and Complex Touring. These demonstrated a pilot touring route project to support the plans of tourist movements in this region. Through the Best Route analysis being available in Network Analyst extension of ArcGIS 10 package, these EWEC models were verified to implement on the real data of potential tourist attractions obtained from the previous result including current elements of basic tourism facilities and road networks. These models successfully operated on the EWEC network dataset and they were implemented to find out the optimal touring routes in term of shortest time and distance on specific scenarios for each model. These scenarios were under the assumption that tourists started their journeys from the main public transportation stations available in the current situations. Tourists can choose to take modes of public transportations or rental car with drivers or self-drive hire cars from these stations. However, this assumption may not be applied for domestic tourists with private driving cars who start their trips from home. These groups of tourists can thus follow one of the EWEC itinerary patterns which are flexible for tourists to start from home or public transportation stations without destination stops arrangements analyzed by Best Route analysis on these scenarios.

Although these model scenarios cannot support individual trips, there are sufficient itinerary plans for international tourists who can share the same interests and find the optimized travelling patterns at the similar ways. Also, there is an initial support of travelling plans for tourists who are coming the first time in this region and there are no ideas how to manage their travelling routes in the unfamiliar region.

Objective 4: **To investigate main weaknesses of the lowest potential tourist attractions to be boosted for expanding tourism investments and services including offering alternatives solutions in particular area.**

The previous result of objective 2 was further investigated to find out the major factors affected to the tourist attractions' potential. The result revealed that the groups of Attraction (Uniqueness/Value and Popularity) and Physical factors (Accessibility and Facility) are the most important factors for improving potential of tourist attractions. This result also indicates that the low potential tourist attractions are mainly found in the area of Savannakhet, Lao PDR. These sites still lack of attractiveness and popularity. In addition, major reasons of tourists travelling to Savannakhet are casino and gateway to Thailand and Vietnam. Therefore, the groups of tourists, who are willing to visit this province as the final destination, are only small proportions and mostly domestic tourists.

Therefore the study introduced the creation of marking process proposed by MacCannell (1976), tourism place-making (Hultman and Hull, 2011), and the model of creative tourism (Richard and Wilson, 2006) to be adapted for developing Savannakhet destination-making model to improve attractiveness and popularity of tourist attractions in this area. This guideline was highlighted in Virabouly districts, Savannakhet province where Phuthai's lifestyle and traditional culture plays an important role to create uniqueness marker including handicrafts, traditional festivals and the eco-experience in remote area. These strategies can promote attraction sites in this area to be known wider in both domestic and international tourists. Also, they support groups of tourists who would like to stay and learn different traditional cultures and nature that are beyond their imagination. In addition, several places and vestiges related to war found in Savannakhet are capable of developing as special tourism products (niche tourism). The author did an extended research to investigate quality expectations of tourists toward the wartime heritage tourist attractions along the EWEC (Lao PDR and Vietnam) in 2010-2011.The results were presented in Tourism Imaginaries Conference (Berkeley, CA) entitled '*Wartime Heritage Tourist Attractions and Quality Expectation of Tourists*'. This finding suggested initial plans of tourism products to meet preferable destinations of travelers to visit the wartime heritage sites.

At present, the tourism related to war has become more popular and it has been paid attentions to by Lao Tourism authorities. Regarding the state of a Savannakhet Tourism Office's vice president, he informed that the new war museum was ready to open soon this year. This museum collects many evidence and images related to the Vietnam War including multimedia simulations of war through projectors to attract tourists' interest. Furthermore, the guidelines presented in this study, most of them were agreed by the Savannakhet tourism authorities and supported to some ongoing Savannakhet tourism development projects. However, the practices of guidelines are depending on the decisions of national government concerning the available financial budget and feedback of local people (a chairman of Savannakhet Province Tourism Department, 14 May 2012: telephone interviews).

Moreover, the study also indicates that this area and some particular areas (Khe Sanh and Gio Linh) of Quang Tri, Vietnam lack tourism facilities- accommodations, public transportation stations, and healthcare service centers. A possible strategy of tourism facility improvement is to expand facility service areas. The spatial analysis of Mean Center and Median Center demonstrated initially finding of the new alternative locations representing the centers surrounded by tourist attractions being outside existing service areas. However, some of these alternative locations were presented in the areas of national parks and no road access, which were impossible to construct the new facility services. Thus, the study applied the Location-Allocation analysis to overcome this problem. This method rechecked the alternative sites whether they were located on the network of road access. If

some alternatives were outside, those alternatives were removed from the potential alternatives. In addition, some alternatives located in the national parks were moved out less than 5 km to locate in the possible land. Then the rest of alternatives continued finding of the optimal alternative locations for new sites of each facility service. These optimal alternative locations could service the most numbers of poor attraction sites as much as possible.

However, the improvement of physical factors in accessibility and facility services require a large amount of budget to support the construction of new facility services. Regarding the Savannakhet tourism authorities' opinions, the construction of public transportation stations needs the budget allocated from the Lao PDR national government or external funding of organizations. However, they said that the projects of car resting stations financed by the Japan International Cooperation Agency (JICA) at the Phalanxay and Phine districts in Savannakhet could be used as the public transportation stations in this area. The new car resting station at the Phine distric was close to the optimal locations, which are presented in this study. This indicates that tourist attractions, which are surrounding this upcoming car resting station, were prioritized to access its service.

For healthcare service center, it is difficult to construct the new locations because of financial support and medical staff limitations. According to Lao PDR and Vietnam healthcare information, the provincial general hospitals are available in each province and small health center are serviced in districts with some places far from the tourist attractions. To expand the healthcare system for ensuring that all residents can access better quality of health services, the constructions of standard healthcare hospitals in provincial and commune levels are on the plan of Socio-Economic Development of Quang Tri province to 2020 in Vietnam. By 2015, every commune health stations will have doctors. Furthermore, the Quang Tri local government also plans to build the new provincial preventive medicine center which includes cosmetic-drug- pharmaceutical testing center, medical Quarantine center at Lao Bao, Center for Anti-HIV / AIDS, and Center for Anti-social diseases (Vietnam Industry and Trade Information Center, 2010).

Although, our finding for new healthcare service center are difficult to implement for covering only tourism purposes, this technique is an optimal alternative to support the government policies to expand healthcare service networks which are based mainly on population residential and requirement intensity. This technique can perform to cover all population within the specific times and distance services. However, we suggested that basic emergency medical set should be available for the first aid at the tourist sites being in the disparity of existing healthcare service.

For the accommodation expansion, the study revealed some optimal locations to service tourist attractions around them in Savannaket province, Lao PDR and the Gio Linh districts in Vietnam. Both areas are supported for trade and economic zones, the new accommodations are

therefore possible to be constructed. This will be the alternative guidelines for tourism investors and entrepreneurs to invest their businesses there.

In the conclusion, the results from our findings followed by the objectives 1 to 4 confirm our assumption that GIS-based multiple models and Network Analysis has the potential to be a novel model for tourism development in the EWEC region. Every models implemented the outcomes of this study are flexible to be updated by additional information and applied to other areas.

8.2 Limitations of the Present Study

Although the present study was carefully designed and conducted, there were some unavoidable weaknesses. First, hardware and software capacities were limited. Despite the fact that the ArcGIS 10 package can be potentially operated on individual desktops, it required large capacity of RAM/Memory (at least 2 GB) and CPU speed (2.2 GHz minimum). Although the author's computer has 4 GB with 2.26 GHz of CPU speed, the operation of a large amount of data was sometimes not completed at once for one factor. Particularly, the Service Area analysis procedure had to divide spatial data of each facility layers into sub-smaller groups and then operated this function separately. This resulted in a slightly differences of service area interpolation compared to whole data generation. In addition, there were some unexpected problems during processing a large database, for example, MaxFileLocks which did not allow extremely running of exceeding attribute table over 9500 records. This problem was time consuming and needed proper solutions to fix the system of software and hardware utilities, i.e. expansion of the advanced ArcMapSetting.exe to 2,000,000 records. Moreover, we struggled with the problem of fieldwork equipment, i.e., the GPS (Global Positioning System). Even though two sets of this device were prepared, neither of them performed properly such as an unavailable access of satellite signals and out-of-order tracking functions. Thus, the second fieldwork was performed with prompt spare devices in order to re-check geo-referencing positions of spatial data located in the study area.

The second limitation concerns on the content of the study models. Although the Location-Allocation model is a powerful tool to find the optimal locations under the planners' requirements, it cannot plot the new locations by itself. To identify the best locations for new facility services, the model requires locations of alternative sites or competitors from the building units map or cadastral map. In addition, these data are unavailable in the specific areas of development suggested in this thesis. Therefore, the Mean Center and Median Center analyses were initially applied to present the alternative locations combined in this model. However, some alternative locations presented were not possible to be located in the reality. To retain their accuracy and reliability, our results were therefore re-checked through land use map and satellite images together with local government policies and opinions of local tourism authorities.

Lastly, the proposed optimal tourist itineraries in this study aimed to display practical routes concerned initially on distance/cost saving which is one of the basic needs of all tourist groups in this era of the fuel crisis and the high cost of energy. These models could not support all specific interest of tourists, who may require a complex model which capable of processing self-designing factors. Further investigation of this cutting-edge model should be carried out in the future.

8.3 Directions for Future Investigation

The intention of this study was primary to present the existing tourism situations and potential tourist attractions along the EWEC, and then to apply the GIS capacities and Network Analysis to support practical tourism development across this region. The further finding of future investigations can be recommended as follows:

- For the new suggested itinerary model, it is of the highest interest to validate in the field. Regarding our novel EWEC itinerary models, which were implemented on the ArcGIS software scenario, further studies are required to test these preliminary models by specific tourists who are going to travel on these routes. The current research is a first step in the establishment of entire models to provide optimal routes based on a time and distance saving for many types of movements.

- A web application should be supported for further study to publish itinerary visualization and promotion.

- To support tourism services and investments, other factors should be concerned for each specific facility such as the geomorphology, environment, land parcel and resident opinions. In addition, all sectors should participate in tourism planning for the sustainable growth and development.

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Appendices

Appendix I: The detail of tourist sites along the EWEC members

Thailand

Province	Describe	Category
Chaiyaphum	Khit Cloth Weaving Center	AS
Chaiyaphum	Ban Khae Craft Wood Center	AS
Chaiyaphum	Phra That Nong Sam Muen	HC
Chaiyaphum	Centennial Arboretum (Phu Kum Khao)	HC
Chaiyaphum	Phu Khieo Wildlife Reserve	NT
Chaiyaphum	Nam Pud Tub Lao Arboretum	NT
Chaiyaphum	Nam Pud Na Wong Deun (Waterfall)	NT
Chaiyaphum	Nam Pud Na Lao (Waterfall)	NT
Chaiyaphum	Nam Phut Hin Lat Wanarom (Waterfall)	NT
Chaiyaphum	Chulabhorn Dam	REC
Kalasin	Culture & Tourism Promotion Center	AS
Kalasin	Sirindhorn Museum and Phu Kum Khao Dinosaurs (Kalasin)	AS
Kalasin	Lam Pao Wildlife Conservation Development and Promotion Station	AS
Kalasin	Ban Na Rieng Stupa	HC
Kalasin	Phu Khao Cave Reclinging Buddha	HC
Kalasin	Ban Kom Sema (stone boundary markers)Wat Pho Chai Semaram	HC
Kalasin	Phrathat Yakhu (Pagoda)	HC
Kalasin	Lak Mueang Kalasin and Kalasin Museum	HC
Kalasin	Wat Sim Na Ko (Pu Thai Local Museum)	HC
Kalasin	Wat Sakkawan	HC
Kalasin	Song Yang (Fa Daet Song Yang) Ancient town	HC
Kalasin	Phu Pha Phueng (Red Palm Cave)	HC
Kalasin	Pu Thai Cultural Village, Ban Khok Kong	HC
Kalasin	Ban Phon Phrae Wa Silk Weaving Group	HC
Kalasin	Phu Po Buddhistic Sigificance	NT
Kalasin	Phu Sing Buddhistic Significance	NT
Kalasin	Laem Non Wiset	NT
Kalasin	Saphan Hin (Phu Pha Wua Forest Park)	NT
Kalasin	Namtok Tat Thong (Waterfall)	NT
Kalasin	Tat Sung And Tat Yao Waterfall	NT
Kalasin	Pha Sawoei cliff and waterfall	NT
Kalasin	Namtok Pha Nang Khoi (Waterfall)	NT
Kalasin	Phu Faek Forest Park (Dinosaur Footprint)	NT
Kalasin	Lam Pao Dam	REC
Kalasin	Phraya Chai Sunthon Monument (Thao Somphamit)	VP
Khon Kaen	Khon Kaen National Museum	AS
Khon Kaen	Lak Mueang	HC
Khon Kaen	Non Mueang Ancient Town	HC
Khon Kaen	Kham Kaen Pagoda	HC

Province	Describe	Category
Khon Kaen	King Cobra Village (Jong Ang snake house)	HC
Khon Kaen	Nam Phong National Park	NT
Khon Kaen	Phu Kao-Phu Phan Kham National Park	NT
Khon Kaen	Phu Wieng National Park	NT
Khon Kaen	Phu Pha Man National Park	NT
Khon Kaen	Tat Fa waterfall	NT
Khon Kaen	Pattaya II	REC
Khon Kaen	Bang Saen II	REC
Khon Kaen	Bung Kaen Nakorn	REC
Khon Kaen	Si Than Swamp	REC
Loei	Phu Kradueng National Park	NT
Maha Sarakham	Phra Buddha Ming Muang	HC
Maha Sarakham	Mongkhon Standing Buddha (Phra Yuen Mongkhon)	HC
Maha Sarakham	Ku Mahathat Prang or Ku Ban Kwao	HC
Maha Sarakham	Ban Chiang Hian Museum and Ancient Town	HC
Maha Sarakham	Kanthraravichai Ancient Town	HC
Maha Sarakham	Pottery Village	HC
Maha Sarakham	Kaeng Loengchan	NT
Maha Sarakham	Kosamphi Forest Park (National Parks & Marine Reserves)	NT
Maha Sarakham	Hin Rong Park (Lan Hin Rong_Pot hole on sandstone)	NT
Mukdahan	Huay Kee Lek Reservoir	AGCO
Mukdahan	Ho Kaeo Mukdahan (Mukdahan tower) Hall	AS
Mukdahan	Wat Phu Dan Tae (Temple)	HC
Mukdahan	Phra Phuttha Sing Song	HC
Mukdahan	Lak Mueang Mukdahan	HC
Mukdahan	Chao Pho Chao Fa Mung Mueang (The Mung Muang Shrine)	HC
Mukdahan	Wat Sri Mongkhon Tai (Temple)	HC
Mukdahan	Chao Mae Song Nang Phi Nong Shrine	HC
Mukdahan	Wat Mano Phirom (temple)	HC
Mukdahan	Teen Daeng Cave (Red feet/palm cave)	HC
Mukdahan	Nam Tok Tad Ton (waterfall)	NT
Mukdahan	Phu Mu Forest Park	NT
Mukdahan	Mukdahan National Park or Phu Pha Therb	NT
Mukdahan	Kaeng Krabao Islet (Cataract)	NT
Mukdahan	Stone-Age Conch shell (Hoy Samai Hin)	NT
Mukdahan	Indochina Market	SP
Phetchabun	Tee Meed Baanmai Village (Ban Mai Man-made Knife village)	AS
Phetchabun	Khao Kho Wildlife Aquaculture Station and Conservation Research	AS
Phetchabun	Khao Kho Highland Agiculture station	AS
Phetchabun	Farming products view point	AS
Phetchabun	Phetchabun's City Pillar Shrine	HC
Phetchabun	Phra Borommathat Chedi Kanchanaphisek	HC
Phetchabun	Phra Tamnak Khao Kho (Royal palace)	HC
Phetchabun	Weapon Museum	HC
Phetchabun	Pho Khun Pha Muang Memorial	HC
Phetchabun	Thung Salaeng Luang National Park (Nong Mae Na)	NT
Phetchabun	Khao Kho	NT

Province	Describe	Category
Phetchabun	Namtok Than Thip Forest Park	NT
Phetchabun	Mueang Rat Arboretum	NT
Phetchabun	Nam Nao National Park	NT
Phetchabun	Nam Tok Sri Dit	NT
Phetchabun	Miracle hill Noen Mahatsachan	NT
Phetchabun	Tham Ruesi Sombat (Cave)	REC
Phetchabun	Rai B.N.	REC
Phitsanulok	Textile Museum and Life Museum	AS
Phitsanulok	Shrine of King Naresuan the Great	HC
Phitsanulok	Chula Mani Temple (Wat Chula Mani)	HC
Phitsanulok	Aranyik Temple	HC
Phitsanulok	Wat Wihan Thong (temple)	HC
Phitsanulok	Wat Klang Si Phut Tha Ram (temple)	HC
Phitsanulok	Wat Na Prathat (temple)	HC
Phitsanulok	Phra Si Mahathat Woramahawihan (Phra Budha Chinnarat)	HC
Phitsanulok	City Walls and Moats of Phitsanulok	HC
Phitsanulok	Chan Palace	HC
Phitsanulok	Khao samorkrang Historial Park	HC
Phitsanulok	Khao Chang Luang (Historical Mountain and (religious ritualsRitual)	HC
Phitsanulok	Sgt. Maj. Dr. Thavi Folkore Museum	HC
Phitsanulok	Ban Wat Tayom Ancient community	HC
Phitsanulok	Ban Wang San Ancient community	HC
Phitsanulok	Floating Housed Ancient community (Reun Pae)	HC
Phitsanulok	Ban Wang Thong Ancient community	HC
Phitsanulok	Ban Tao Hi Ancient community (Ban Ta Pa Khao Hai)	HC
Phitsanulok	Yommarat city Ancient community	HC
Phitsanulok	Nakorn Thai Ancient community	HC
Phitsanulok	Phu Hin Rong Kla National Park	NT
Phitsanulok	Lam Nam Khek Rafting	NT
Phitsanulok	Namtok Poi and Khao Krayang Forest Plantation	NT
Phitsanulok	Namtok Kaeng Sopha	NT
Phitsanulok	Namtok Wang Nok Aen (Sakunothayan Botanical Garden)	NT
Phitsanulok	Namtok Kaeng Song	NT
Roi Et	Pha Nam Yoi or Isan Buddhist Park	NT
Sukhothai	Ancient Fish Museum	AS
Sukhothai	Sukhothai Historical Park or Old Sukhothai City	HC
Sukhothai	Phra Ruang II road (Ancient road)	HC
Sukhothai	Ramkhamhaeng National Museum	HC
Sukhothai	Sangkhalok Museum	HC
Sukhothai	Ramkhamhaeng National Park (Khao Luang)	NT
Sukhothai	Nam Tok Sai Rung (Rainbow waterfall)	NT
Sukhothai	Tham Lom-Tham Wang Forest Park	NT
Tak	Museum of Indigenous Arts and Culture	AS
Tak	Doi Musur Hilltribe Development & Welfare Center	AS
Tak	Doi Muser Crops Research Station	AS
Tak	Phra That Hin Kiu Thi Doi Din Chi (Chedi Hin Phra In Khwaen)	HC
Tak	City Pillar Shrine of the Four Great Kings	HC

Province	Describe	Category
Tak	Shrine of King Taksin the Great	HC
Tak	Yutthahatthi Pagoda (The great King Naresuan elephant battlefield)	HC
Tak	Wat Mani Banphot Warawihan (temple)	HC
Tak	Wat Don Kaeo (temple)	HC
Tak	Wat Phra Boromthat (temple)and Ancient Tak City	HC
Tak	Trok Ban Chin	HC
Tak	Mae Ka Sa Thermal Bath	NBT
Tak	Petrified Forest Park	NT
Tak	Taksin Maharat National Park	NT
Tak	Lan Sang National Park	NT
Tak	Namtok Pha Charoen National Park	NT
Tak	Namtok Thara Rak (chedi Kho)	NT
Tak	Namtok Mae Kasa	NT
Tak	Mysterious Hill	NT
Tak	Thai-Myanmar Friedship Bridge	REC
Tak	Talat Rim Moei	SP
Tak	Local Product Market From MuSer Hilltribe	SP

Lao PDR

Province	Describe	Category
Den Savanh	Casino and Dutyfree (Opposite side)	REC
Phin	Tad Hai Bridge	HC
Phin	Laung Cataract (Kaeng) Pot holes and Dinosaur footprints	NT
Savannakhet	Dinosaur museum	AS
Savannakhet	OTOP centre	AS
Savannakhet	Lao Silk centre	AS
Savannakhet	Chaiyaphume temple(The ancient temple)	HC
Savannakhet	Phathat Inghang Stupa	HC
Savannakhet	Old Frech Colonial Architecture	HC
Savannakhet	Old Frech House	HC
Savannakhet	Va swamp near Phathat	NT
Savannakhet	Savan Vegas Casino	REC
Savannakhet	Savanxay market (Singapore market)	SP
Savannakhet	Viewpoint at Mekong river	VP
Savannakhet	The Lao Silk-Cotton Weaving Centre	AS
Savannakhet	Hui Kong Waterfall	NT
Savannakhet	Phalong Waterfall (National Protected forest)	NT
Sepon	Lam Son 719 War Museum	HC
Sepon	Ancient Sepon city (French old bank) & Bombing areas	HC
Sepon	Ho Chi Minh Trail and Suspended Bridge (Lao-VIet Bridge)	HC
Sepon	Tad Salen Waterfall	NT

Vietnam

Province	Describe	Category
Danang	Da Nang Museum of Cham Sculpture	AS
Danang	Marble Mountain Entrance and Tam Thai Temple	AS
Danang	American Aircraft Shelter	HC
Danang	Soldier Museum (Bao Tang Khu)	HC
Danang	China beach_My Khe Village	NT
Danang	Lang Co Beach	NT
Danang	Crowne International Casino	REC
Danang	Beach Viewpoint	VP
Danang	Hai Van Pass (Hai Van Tunnel: the longest tunnel in SE-Asia)	VP
Danang (Hoi An)	Hoi An Ancient City	HC
Danang (Hoi An)	Hoi An Beach/ Restaurant	REC
Danang (Hoi An)	Hoi An city	REC
Hue	Thuy Tien lake eco-tourist area	AGCO
Hue	Viet Vo Dao Matial Arts (Arts of fighting)	AS
Hue	Joss stick and Hat making village	AS
Hue	Tien Moo Pagoda Temple	HC
Hue	Thien An Hill Church	HC
Hue	Khai Dinh Tomb	HC
Hue	Di Tich Tomb	HC
Hue	Dai Noi (Imperial City or Old Citadel)	HC
Hue	King Silajaluek	HC
Hue	Big Lake (along the road)	NT
Hue	Perfume River Cruise	REC
Hue	Dongba Market	SP
Hue	7 colors bridge (New bridge)	VP
Hue	Soldier Monument and Viewpoint	VP
Quang Tri	Vinh Moc Tunnels	HC
Quang Tri	Quang Tri Citadel_wartime heritage tour sites	HC
Quang Tri	Division bridge for North-South Vietnam	HC
Quang Tri	Khe Sanh Combat Base	HC
Quang Tri	Lao Bao lake	NT
Quang Tri	Soldier Monument	VP
Quang Tri	Mother and children waiting for father Monument	VP
Quang Tri	Blood Monument	VP
Quang Tri	Vinh Moc Bombing Area	VP
Quang Tri	The Tank monument	VP
Quang Tri	River Viewpoint(Cataract, Rock etc)	VP

Appendix II: Standard Assessment Manual for the Value and Uniqueness Factor

The standard assessments of tourist attraction used in this study were modified from the Manual of Quality Standard Assessment of Tourist Attractions produced by the Environmental Research Institute of Chulalongkorn University (2006). They are divided into 6 categories of tourist attractions: 1) Cultural attraction standard, 2) Historical attraction standard, 3) Arts and Sciences Educational Attraction Standard, 4) The Recreational Attraction standard, 5) Natural tourist attraction standard, and 6) Waterfall standard.

1. Cultural attraction standard

This assessment focuses on the quality/value of culture, arts, and traditional lifestyle. There are 6 groups of indicators used to evaluate the value scores of each cultural tourist sites as follows:

1.1 Uniqueness/Indigenous knowledge/Folk wisdom/Traditional lifestyle

Criteria	Score
Local uniqueness/ normal tradition	1
Provincial uniqueness	2
Regional uniqueness	3
National uniqueness	4
World uniqueness (Only one in the world)	5

1.2 Continuation of traditional and cultural inheritance (existing traditional or cultural activities)

Criteria	Score
There are an activities held only 1to 2 times	1
There are activities held every 2 to 3 years within 10 years	2
There are activities held every year within last 10 years	3
There are activities held every year for more than 10 years	4
There are activities held more than once per year for more than 10 years	5

1.3 Beauty of arts and culture/ impressiveness (indicated by local tourism authorities)

Criteria	Score
Very low	1
Low	2
Medium	3
High	4
Very high	5

1.4 The ability of indigenous knowledge or cultural inheritance/ The length of inheritance period/ The background of site that can be investigated.

Criteria	Score
Novel indigenous knowledge	1
Indigenous knowledge in the era of Ratanakosin (1782-present)	2
Indigenous knowledge in the era of Ayuthaya (1350-1782)	3
Indigenous knowledge in the era of Sukhothai (1238-1350)	4
Indigenous knowledge in the per-history era (pre-1238)	5

1.5 The involvement of local community

Criteria	Score
No involvement	1
Partial involvement	2
Intermediate involvement	3
High involvement (with annual activities and neighbour communities' participations)	4
Very high involvement (with annual activities and well-known in national level)	5

1.6 The strength of traditional conservative (level of conservative foundations)

Criteria	Score
Local society (small community)	1
One conservative community foundation	2
Two to three conservative community foundations	3
Two to three conservative community foundations which have connectivity among groups	4
Two to three conservative community foundations which have connectivity between internal groups and external foundations' supports	5

2. Historical attraction standard

2.1 Important levels of history

Criteria	Score
Local history	1
Provincial history	2
Regional history	3
National history	4
World history (Only one in the world)	5

2.2 Archaeological evidence

Criteria	Score
Very low completeness of historical and cultural elements	1
Low completeness of historical and cultural elements	2
Medium completeness of historical and cultural Elements	3
High completeness of historical and cultural elements	4
Very high completeness of historical and cultural elements	5

2.3 The uniqueness of historical era

Criteria	Score
Ordinary find in the nation	1
It represents historical era but it was found many places in the nation.	2
It represents historical era but it was found some places in the nation.	3
It represents historical era and it was rarely found in the nation.	4
It represents historical era and it was found only here in the nation.	5

2.4 The physical uniqueness of historical sites

Criteria	Score
Local uniqueness	1
Provincial uniqueness	2
Regional uniqueness	3
National uniqueness	4
World uniqueness (Only one in the world)	5

2.5 The completeness and beauty of architectural integrity

Criteria	Score
Very low	1
Low	2
Medium	3
High	4
Very high	5

2.6 The completeness and beauty of arts

Criteria	Score
Very low	1
Low	2
Medium	3
High	4
Very high	5

2.7 The levels of historical acceptance and reputation

Criteria	Score
Local acceptance and reputation	1
Provincial acceptance and reputation	2
Regional acceptance and reputation	3
National acceptance and reputation	4
World acceptance and reputation	5

3. Arts and Sciences Educational Attraction Standard

This attraction becomes well-know and more interested by various groups of tourists. It includes the modern knowledge attractions, theme museum, science, industry and technology attraction sites as well as the places used for meeting, incentives, conventions and exhibitions. The indicators, used to evaluate the quality and values of these attractions are:

3.1 Level of novel technology/Indigenous knowledge

Criteria	Score
ordinary creation/easier to find anywhere	1
Medium level of invention/can find somewhere	2
Medium level of invention/ rarely to find somewhere	3
High level of invention/rarely to find in the nation	4
Very high level of invention/ only one found in the nation	5

3.2 Creation of presentations/ exhibitions/incentives which are attracted by various groups of visitors.

Criteria	Score
Very less attractive and impressive	1
Medium attractive and impressive	2
Good attractive and impressive	3
High attractive and impressive	4
Very high attractive and impressive	5

3.3 Potential levels of tourism managements (including tourism activities/attractions) and services

Criteria	Score
Very less potential management & service	1
Medium potential management & service	2
Good potential management & service	3
High potential management & service	4
Very high potential management & service	5

3.4 The level of participation/attention of local community

Criteria	Score
Very low participations	1
Low participations	2
Medium participations	3
High participations	4
Very high participations	5

4. The Recreational Attraction standard

This type of attraction aims to support tourists in purposes of relaxation, healthy benefit, recreation, modernization, knowledge, entertainment, amusement park. This attraction was assessed by groups of indicators as follows:

4.1 Levels of technology of tourist attraction/ unique technology/ indigenous knowledge

Criteria	Score
Ordinary creation/easier to find anywhere	1
Medium level of invention/can find somewhere	2
Medium level of invention/ rarely to find somewhere	3
High level of invention/rarely to find in the nation	4
Very high level of invention/ only here in the nation	5

4.2 Creation of presentation or activities which make tourist impressions

Criteria	Score
Very less interesting	1
Less interesting	2
Medium interesting	3
High interesting	4
Very high interesting	5

4.3 Levels of tourism attraction management and services of tourist staff

Criteria	Score
Very less potential management & service	1
Medium potential management & service	2
Good potential management & service	3
High potential management & service	4
Very high potential management & service	5

4.4 The levels of relationship involved with local community

Criteria	Score
Very low relationships	1
Low relationships	2
Medium relationships	3
High relationships	4
Very high relationships	5

5. Natural tourist attraction standard

5.1 Biodiversity value

5.1.1 Biodiversity of natural ecosystems (e.g. evergreen forest, Mixed Deciduous Forest, beach forest, and Mangrove Swamp Forest)

Criteria	Score
An ecosystem	1
2 ecosystems	2
3 ecosystems	3
4 ecosystems	4
More than 4 ecosystems	5

5.1.2 The fertility of natural attraction/ levels of human disturbances

Criteria	Score
Entirely destroyed and replaced with man-made constructions.	0
Most areas were damaged but there are few fertile natural systems.	1
Most areas were damaged but there are some fertile natural systems.	2
Half of areas were damaged and there are some fertile natural systems.	3
Most natural systems are fertile.	4
Entirely fertility	5

5.1.3 The conformity of biodiversity (How many extinct/endangered species can be found in attraction sites)

Criteria	Score
Only ordinary species	1
One extinct/endangered species	2
Few extinct/endangered species	3
Many extinct/endangered species	4
Some extinct/endangered species found in this area.	5

5.1.4 The uniqueness of natural ecosystem (How often are those ecosystems found in the nation?) e.g., Melaleuca forest, Peat Swamp forest, and Teak Bearing Mixed Deciduous Forest.

Criteria	Score
Only one unique ecosystem	1
A few unique natural ecosystem found in some places of the nation	2
A few unique natural ecologies found in few places of the nation	3
A few dominant natural ecologies rarely found in the nation	4
A few dominant natural ecologies found only this site	5

5.2 Physical value

5.2.1 The amount of natural resources within attraction sites

Criteria	Score
1 natural resources	1
2 natural resources	2
3 natural resources	3
4 natural resources	4
More than 4 natural resources	5

5.2.2 The area of natural attraction sites

Criteria	Score
1-10 km^2	1
11-50 km^2	2
51-100 km^2	3
101-500 km^2	4
More than 500 km^2	5

5.2.3 The physical beauty and landscape (Consideration is based on the whole elements compounded for physical characteristic of attraction site).

Criteria	Score
Very low beauty	1
Low beauty	2
Medium beauty	3
High beauty	4
Very high beauty	5

5.2.4 The Physical uniqueness and dominance (How often physical uniqueness and dominant spatial characteristics can be found in the nation?)

Criteria	Score
Only ordinary natural things found in the nation	1
Special/Dominant characteristics found in some places of the nation	2
Special/Dominant spatial characteristics found in few places of the nation	3
Special/Dominant spatial characteristics found in this site	4
Very Special/dominant characteristics found only this site and rarely found in the world	5

5.3 Social value

5.3.1 The attraction site has been importance/ involved to local people's lifestyle

Criteria	Score
No relationship between natural system and local communities' lifestyle/No evidence of human settlement in the area natural attraction site.	0
No relationship between natural system and local communities' lifestyle but a part of attraction site has some evidence of ancient human settlement which people got benefit from this natural attraction site.	1
Low relationships between natural system and local communities' lifestyle	2
Medium relationship between natural system and local communities' lifestyle	3
high relationships between natural system and local communities' lifestyle	4
Very high relationships between natural system and local communities' lifestyle form the past to the present.	5

5.3.2 The natural attraction has been involved with history, tradition and culture

Criteria	Score
No historical and cultural importance between the site and the local community	0
The site has very low relationship related to local community's history and culture.	1
The site has low relationship related to local community's history and culture.	2
The site has medium relationship related to local community's history and culture.	3
The site has high relationship related to local community's history and culture.	4
The site has very high relationship related to local community's history and culture.	5

5.4 The risk levels of damages/disturbance

5.4.1 Risk levels of damages influenced by human activities

Criteria	Score
Community surrounded the site. High impact of human influences and no relevant organizations to take charge of it.	1
The site was not surrounded by community. Medium impact of human influences and no relevant organizations to take charge of it.	2
The site was not surrounded by community. Low impact of human influences and no relevant organizations to take charge of it.	3
The site was not surrounded by community. No impact of human influences. The local organization is in charge.	4
No impact of human influences. The site has been upgraded to a national protected area and controlled by government organization.	5

5.4.2 Risk levels of damages influenced by nature

Criteria	Score
Some natural hazards found in some season a year.	1
One to Two natural hazards found a year.	2
One to Two natural hazards found within three years.	3
One to Two natural hazards found within five years.	4
One to Two natural hazards found within ten years or more.	5

6. Waterfall standard

6.1 The volume of water and water supply for tourism

Criteria	Score
No water in the dry season	1
Little water left in the dry season	2
Sufficient water all year round	3
Large amount of water in the rain season but little in the dry season	4
Large amount of water all year-round	5

6.2 The height of the waterfall

Criteria	Score
Less than 2.5 m.	1
Between 2.5 and 5 m.	2
More than 5 to 10 m.	3
More than 10 to 20 m.	4
More than 20 m.	5

6.3 The width of the cliff which water fall down

Criteria	Score
Less than 5 m.	1
Between 5 and 10 m.	2
More than 10 to 20 m.	3
More than 20 to 30 m.	4
More than 30 m.	5

6.4 How many floors have the waterfall?

Criteria	Score
Only 1 floor	1
2 floors	2
3 floors	3
4 floors	4
From 5 floor to more	5

6.5 The quality of the waterfall

Criteria	Score
Turbid water in the rain season and polluted water normally found in the dry season	1
Turbid water with sediment and dead plants in the rain and dry season but no polluted water	2
Turbid water with sediment and dead plants in the rain and dry season but clear water in the dry season	3
Little turbid water in the rain season and clear water in the dry season	4
Clear water all year round	5

6.6 The characteristic of rocks/ stones around the waterfall

Criteria	Score
High volume of broken rocks and stone/ Debris	1
Low volume of broken rocks and stone/Debris	2
Hard and stable rocks with no waterfall layers	3
Hard and stable rocks with a few waterfall layers	4
Hard and stable rocks with many waterfall layers	5

6.7 Availability of plunge pools or waterfall lakes (for swimming)

Criteria	Score
Rare waterfall lakes	1
Few waterfall lakes and insufficient places for visitors in high season	2
Adequate waterfall lakes but they are crowded in the high season	3
Adequate waterfall lakes all year round	4
Adequate waterfall lakes all year round and high potential to support tourists in the future	5

6.8 The fertility of forest around waterfall

Criteria	Score
High damaged forest in the large area	1
Medium damaged forest in some parts of the site	2
Medium damaged forest but there is reforestation	3
High fertile forest resources but few area damaged	4
Entire fertile forest resources with no damages	5

6.9 How many kinds of plant are there in the forest?

Criteria	Score
Few plants/ ordinary plants	1
Medium numbers of plants/ ordinary plants	2
Large numbers of ordinary plants/ no extinct or endanger plants	3
Large numbers of ordinary plants with few extinct or endanger plants	4
Large numbers of ordinary with extinct or endanger plants	5

6.10 How many kinds of animals are there in the attraction area?

Criteria	Score
Only a kind of animals	1
2-3 kinds of animals	2
4-5 kinds of animals	3
6-10 kinds of animals	4
More than 10 kinds of animals	5

6.11 How does the scenic viewpoint look like?

Criteria	Score
No interesting viewpoint because it has only a small-low waterfall	1
Few ordinary viewpoints	2
Few scenic viewpoints but they are not impressive	3
Few scenic viewpoints but they are very impressive	4
Magnificent viewpoints with natural panorama scenes	5

6.12 How important of history are there in the attraction area?

Criteria	Score
No historical or traditional folklore involvement	1
Low historical and traditional folklore involvements and few groups of local communities are interested.	2
Medium historical and traditional folklore involvements and local communities are interested and believed.	3
High historical and traditional folklore involvements but no official historical record	4
High historical and traditional folklore involvements including royal memorandum with official historical records	5

Appendix III: Declaration

This thesis is submitted for the degree of Doktorin der Naturwissenschaften (Dr. rer. nat) at the University of Vienna. It is the result of my own research and does not contain the work or writing of another except where appropriately cited and referenced.

Thitirat Panbamrungkij

August 2012, Vienna

Appendix IV: Curriculum Vitae

Name: Thitirat Panbamrungkij

Place of work:

Department of Geography, Faculty of Arts,
Chulalongkorn University,
Phayathai Road, Pathumwan, Bangkok
Thailand.
E-mail address: Thitirat.Pa@Chula.ac.th
nongkay21@gmail.com

Date of birth: January 21, 1979

Education:

March 2009 – 2012: PhD program (Geography)
Department of Geography and Regional Research,
University of Vienna, Austria
Thesis title: An application of Geographic Information System for supporting Tourism development along the Southeast Asian East-West Economic Corridor

2001 – 2004: Master of Arts (Geography),
Department of Geography,
Faculty of Arts, Chulalongkorn University, Bangkok, Thailand.

- GPA 3.78.
- Thesis title: The Analysis of suitable areas for supporting the expansion of condominium in Pattaya city, Changwat Chon buri , Thailand

2001 – 2002: Graduate Diploma in Project Management and Evaluation,
Faculty of Management,
Rajabhat Institute Thepsatri , Changwat Lopburi, Thailand.

- GPA 3.50.

1997 – 2000: Bachelor of Arts,
Department of Geography,
Faculty of Arts, Chulalongkorn University, Bangkok, Thailand.

- GPA 3.63 (1st Class Honours).

Award and Scholarships:

- Honorary Gold Medal for excellent academic scores.
- Professor Paitun Pongsabhud's fund award in 2000 for GPA 3.63.
- Supas Juntrabos' fund award in 2000. for GPA only field of geography 3.94.
- Scholarships for HM. King Rama IX 72 nd Anniversary of Graduate School, Chulalongkorn University (2001-2003).

Employment and experience

June 2005 – present

: Position: *Instructor/Lecturer*

Department of Geography,
Faculty of Arts,
Chulalongkorn University, Bangkok, Thailand.

: Research interest

- Human geography and Geography of Settlement
- Geographic Information System
- Geography of Tourism and development
- Network analysis and Logistics

January 2003 – May 2005

: Position: *Geologist*

Department of Mineral resources,
Ministry of Natural Resources and Environment

: Experience

- Applying Geographic Information System; GIS and Remote Sensing to analyze the landslide and flood risk area in Thailand.
- Mapping landslide and flood risk area in Thailand
- Surveying flooded and landslide area and organizing local community's network for early warning in natural hazards.
- Participating in landslide seminar arrangement for explaining causes, prevention and natural hazard vulnerability.

January 2002 – January 2003

: Position: *Village volunteer of government for managing village fund*

Paitum village, Nongkhae district, Changwat Saraburi, Thailand

: Experience

- Assisting villager manage account by themselves.
- Advising villagers produce One Tambol One Product and plan marketing.
- Cooperating between villagers and local administrative officials about developing 1 million baht village's fund.

October 2001 – December 2001

:Position: *Trainee*

Department of Public Works and Town and Country Planning

Ministry of Interior, Bangkok, Thailand.

: Experience

- Practice about Production of maps from Arial Photographs by using Manual and Digital Photogrammetry.

  April 2008

- To participate in training special course in **Advanced Spatial Analysis** at Geo-informatics and Space Technology Development Agency (GISTDA).

Publications:

PANBAMRUNGKIJ, T. 2006. The analysis of suitable areas for supporting the expansion of condominiums in Pattaya city. *The Journal of Social research*. 29 (1): 148 -162.

PANBAMRUNGKIJ, T., MANIROCHANA, N., and KAINZ, W. 2010. Wartime Heritage Tourist Attractions and Quality Expectation of Tourists. (in the process of publication)

Research :

PANBAMRUNGKIJ, T., and JUNHOW, P. 2008. The study of the evolution of old world maps appearing Thailand or Siam on them between 1400 – 1900 c., Chulalongkorn University (in Thai).

International conference presentation:

PANBAMRUNGKIJ, T., MANIROCHANA, N., and KAINZ W., Wartime Heritage Tourist Attractions and Quality Expectation of Tourists. *International Conference: Tourism Imaginaries/ Imaginaires Touristiques,* 18th -20th February 2011 at UC Berkeley, CA.

PANBAMRUNGKIJ, T., and KAINZ, W., Visualization of Multi-Destination Touring Routes on the Southeast Asia East-West Economic Corridor. *Annual International Conference of the RGS-IBG*, 3rd -5th July 2012, University of Edinburgh. Scotland.