DEVELOPMENT OF TRADE AND TRANSPORT DATABASE AND SPATIAL INFORMATION SYSTEM FOR THE UPPER MEKONG RIPARIAN COUNTRIES

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Abstract The Upper Mekong riparian region is a promising area for integrated social and economic development. The development would be involved with joint political, social, and economic among economic states. Trade and Transport is the central to this international consideration. Being in the area bordering less-developed and developing countries, and on the path of the trade route of the fast-growing economies, Thailand and China, transport and trade require comprehensive tools for making understanding and better analysis of various matters, especially the collection and analysis of trade and transport crossing the countries. Thus, spatial information system is required as an important tool for decision-making process.

This paper reports the development of cross - border trade and transport data and data management system in the Upper Mekong riparian area. The data include the collection of data from 4 countries, namely China (Yunnan province), Laos, Myanmar, and Thailand. The data collection process is described to illustrate the state-of-practice and limitations of the acquired data. Then the paper describes the management of the data through the use of Spatial Information System. The system is developed for the management of data as well as the readiness for further consideration. The study demonstrates the overall activities in obtaining transport and trade data, developing the spatial information system, and important issues in dealing with the matters in this region.

Key Words GIS, Spatial Information System, Mekong, Trade, Transport

1. INTRODUCTION

The Mekong River Riparian Countries consist of Thailand, Myanmar, Laos, and Southern China (Yunnan province). These countries connect with each other by land and water transport, as they lie on Mekong River, a major international river in the region. The area is rich in historical and cultural relations, and collaborates in economic development.

However, the political and independence of each countries make the intangible obstacle factors to cooperation. China, Laos, and Myanmar constitute social states while Thailand holds democracy political system. Nevertheless, the globalization policies in each country allow the needs to economically collaborate with each other. This results in the inter-dependence among the economic states. Thailand seeks for raw materials and energy sources, while Myanmar (Shan State) needs more barter with neighbors. Laos aims at having more "open" economy despite being "land-lock" country. Laos would also like to be the center for (land) transportation in the upper riparian region. The mutual interest creates promising atmosphere to jointly create economic prosperity in the region.

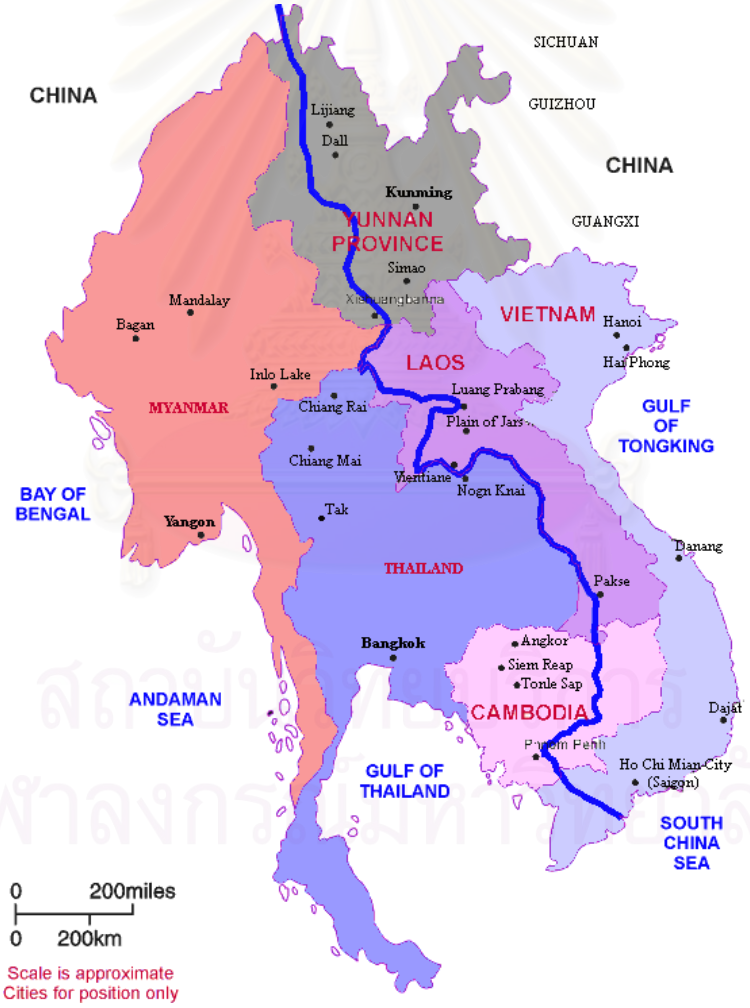

Figure 1 The Mekong Riparian Countries

During the past decades, the countries in the region encountered difficulty in poverty, especially in Myanmar and Laos. The social political system does not allow much opportunity to liberise the trade with other countries. After the new policy on international economic development, these countries are in need to establish more international trade.

The discernable advancement on international relations is the development of international transport infrastructure, especially the routes connecting neighboring countries. Several agreements are approved for developing transport facilities that enable international trade.

2. OBJECTIVES OF THE DEVELOPMENT OF DATABASE OF TRADE AND TRANSPORT

With the consent to new political and international relations among the countries, the economic activities in the Upper Mekong riparian are under special attention for boosting economic linkage and international relationship among the countries. With the growing interest and needs for trade and transport collaboration, knowledge on the basic data and statistics on trade and transport is very much needed. This information is fundamental for the planning, implementation, and monitoring of international policy. Transportation Institute at Chulalongkorn University has conducted the study and collection of basic statistics on trade and transport in the region since 1992. Primary and Secondary data have been collected from several sources. Primary data include the field survey on statistics and qualitative data obtainment through interview/assessment. Secondary data are gathered from related organizations both in Thailand and other countries.

To develop the database on trade and transport for a region, the Geographical Information system (GIS) is considered as a tool to implement. GIS is a proven tool that demonstrates the great effectiveness in manipulating trade and transport data with geographical references. The information system can contain data in various forms such as tables, descriptions, locations, and it provides analysis platforms for getting useful information in planning and making decision in international trade and transport policy. The database will serve as fundamental for further development in the terms of expanding the database extent to cover the Greater Mekong Sub – region.

3. DEVELOPMENT OF UPPER MEKONG TRADE AND TRANSPORT

3.1 Trade

Trade in the Upper Mekong riparian countries is characterized by the combination of border and “oversea” trade. The prominent feature is the high volume of cross-border trade. The barter takes place along the border lines connecting Thailand, Myanmar, and Laos. The trade utilizes the same channel to connect to Yunnan province in China. Thus, special consideration would be placed on local (area) factors rather than regional (country) factors.

Although the border trade does not generally account for large proportion of the total trade between two countries, the cross–border trade between Thailand and Myanmar holds approximately 80 percent of the total “sea” trade (Table 1). While the cross-border trade between Thailand and Laos is higher than 90 percent. These trade activities are vital for welfare of local areas and are the main activities of commerce along the border towns. The trade between Yunnan, China, and Thailand relies on transportation through either Myanmar or Laos, and has the biggest proportion in trade activities in the region. It is noted that

although Table 1 shows small proportion of the cross-border trade in the total international trade between Thailand and China, the majority of trade between Thailand and Yunnan province is done through cross-border trade.

Table 1 Thai – Upper Mekong Riparian Countries Trade

Value : Million Baht

Countries	2002	2003	2004	2005
Thai – Myanmar				
International Trade	52,858.80	55,411.30	76,586.90	100,298.00
Cross-border Trade	43,152.29	57,712.82	67,668.23	88,292.72
Ratio (%)	81.64	104.15	88.35	88.03
Thai - Lao P.D.R				
International Trade	21,104.30	23,212.50	27,989.30	40,106.99
Cross – border Trade	20,510.77	21,912.37	28,805.31	38,547.67
Ratio (%)	97.19	94.40	102.92	96.11
Thai – Yunnan				
International Trade	364,298.30	487,129.30	615,415.40	816,396.60
Cross-border Trade	3,209.08	4,218.54	3,352.63	5,268.67
Ratio (%)	0.88	0.87	0.54	0.65

Source: Information and Communication Technology Center, Department of Foreign Trade, Ministry of Commerce

Figure 2 Mekong River Ports

3.2 Transport

Major transportation networks in the upper Mekong Riparian comprise the water transport along the Mekong River and road transport. The Mekong River is a major international river, 4,880 km in total length, lying 33 ports. Eleven ports are situated in upper riparian area. Still the river has some physical limitations that prevent year–round (easy) operations. Transport data were not available from secondary source, thus, in this study the physical and transport situations were obtained from the river trips. Difficulties arose due to the prohibition to stop at ports. The access to ports by land was possible, but with amount of effort since the road connecting ports are unpaved and able to move very slowly. Thus, with this limitation of data collection, many ports physical and transportation situations were observed or implied from secondary data. It is noted that some ports are intentionally ignored from the survey due to security reasons, especially in Laos and Myanmar.

Figure 3 Road Network in the Upper Mekong Sub-region

With the limitation of Mekong River transport that could not furnish much of year–round and high–volume freight transport, coupled with the difficulty in accessing ports, road transport has played more leading role in transport in the region. In the past years, many links of highways are added, making the road network more complete and higher quality of riding. Thailand has upgraded her highway network standard, and now the condition is up to the cutting edge of the region. China has done very extensive highway construction in the Yunnan province. The major highway (4–lane) is built connecting the Southern border to major cities (Kunming). Another major promotion in international road transport development is pressed by international collaboration schemes, ASEAN highway and Greater Mekong Sub-region Cooperation (GMS). These international agreements let each country to put effort on road transport development and linking her highway network with each other. The collaboration not only focuses on the physical development but also the realization of trade and transport liberization through borders.

The major road network connecting the riparian countries lies between Thailand (Northern) to China (Yunnan, ended at Kunming city). There are two major routes: One starts at Mae Sai (Thailand), passing Kengton, Mong La, Xishuangbanna, Da Luo. The other route starts from Thailand passing Laos and ends at Yunnan. Three possible paths; 1) Chiang Khong to Houayxay, Bo Ten, and then to China border, and 2) from Nan province in Thailand to Pak Bang and China border, 3) Nong Kai (Thailand), Vientiane, Lunag Prabang, Natoey, and China border.

4. DATA COLLECTION

4.1 Trade Data

Trade data can be collected from responsible authorities in each country. The study attempted to contact all related organizations in the corresponding countries and found various degree of data availability and accuracy. Apart from the secondary data, the primary survey and interview with officials of the local authorities was conducted to verify and assess the accuracy of the secondary data, and to examine the possible refinement of database.

In Thailand, the secondary data was collected from Ministry of Commerce, and the primary data was gathered from local statistics by the Customs House at the border locations. Furthermore, the interview with Customs officers and Provincial Chamber of Commerce was carried out. It is observed that the volumes in the local and country statistics would constitute a portion of the actual trade, since a large volume of trade is done informally. The informal barter does not necessarily imply illegal trade, but trade is done in form of public barter which people in both countries commute and barter with less formal/control by authorities, as consequences, these volumes of trade are not recorded in the official statistics.

The study also attempted to collect statistics from all other countries. However, several problems on the raw data were quickly found. Most countries do not have the trade database, or channels to disseminate the trade data in usable forms. Especially Myanmar, the collection of data is a serious political issue. Along the border to Thailand lie minority groups which have disputed power against the central government. The official trade activities including the data gathering are under security control. Many of import–export data are confidential and trade is controlled by government and constitutional laws. For example, some items of merchandises are listed as exports from Thailand cannot be found in the official import statistics in Myanmar due to restrictions.

Trade data collection between Thailand and Laos are mainly conducted at Nong Kai border. Complete statistics can be collected from Royal Thai Customs (local and national). However, no statistics is available from Laos officials.

Yunnan's data collection included the interview of related officials and secondary data gathering. Similar problems of data collection were encountered, the data was provided in only local language. Moreover, translation is somewhat difficult as definitions and names are sometimes different. During the interview, the level of comprehension is not great as communication must be done through translators.

After field data collection and obtainment of the secondary data, it is decided to follow the statistics of the most reliable source in one country (Thailand). The field data verified several points that must be aware, but in general the final data could provide much information with dependable accuracy. The trade data includes:

1) General information on the areas bordering two countries
2) Customs Checkpoints
3) Cross–border trade and Transport statistics
4) Problems and obstacles of in cross – border trade and transport in each border
5) Pictures illustrating the present situation of the border

Table 2 Example of Cross – border Trade Value at Chiangrai Province : Fiscal Year 2005 – 2006

Value : Million Baht

	Import		**Export**		**Total**		**Trade Balance**	
Month	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**	**2005**	**2006**
Oct	285.62	184.26	561.96	1,005.58	847.58	1,189.84	276.34	821.32
Nov	310.39	240.89	626.55	842.73	936.94	1,083.62	316.16	601.84
Dec	266.14	187.51	666.63	934.03	932.77	1,121.54	400.49	746.52
Jan	166.86	148.02	619.24	369.47	786.10	517.49	452.38	221.45
Feb	91.89	126.29	449.96	416.37	541.85	542.66	358.07	290.08
Mar	144.54	120.04	918.51	320.53	1063.05	440.57	773.97	200.49
Apr	100.01	116.82	492.36	295.28	592.37	412.10	392.35	178.46
May	118.73	129.54	650.71	374.95	769.44	504.49	531.98	245.41
June	173.22	182.21	476.39	329.91	649.61	512.12	303.17	147.70
July	105.75	90.66	636.18	368.88	741.93	459.54	530.43	278.22
Aug	158.37	140.23	1,041.76	566.04	1200.13	706.27	883.39	425.81
Sep	197.82	202.01	866.75	363.05	1064.57	565.06	668.93	161.04
Total	**2,119.34**	**1,868.48**	**8,007.00**	**6,186.82**	**10,126.34**	**8,055.30**	**5,887.66**	**4,318.34**

Source : Mae Sai, Chiangsan and Chiangkhong Customs House.

a) Mae Sod Border, Tak Province

b) Handling of Some Prohibited Exports to Myanmar

c) Mae Sai Border, Chiang Rai Province

d) Hundreds of Small Shops in Mae Sai and Ta Chi Lek

e) Nong Khai Border,

f) Chiang San Port in Chiang Rai

Figure 4 Examples of Graphic Illustration of Trade and Transport Condition Contained in the Database

4.2 Transport Data

Physical data for transportation network were collected through road trip field survey. Moreover, interview with transport officials both local and national level, provided insight information to the secondary data. It is noted that there sometimes is discrepancy in information from several sources (countries). For example, the importance of the route. China places high attention on Bo Han–Chiang Khong route, since it is considered a major route connecting two capital cities in Thailand (Bangkok) and China (Kunming in Yunnan province). China believed that this route would be the major route connecting Southern China to sea (and oversea). Laos puts priority to Vientiane route, since this route passes two biggest cities in Laos and the country could get benefits on this major route (e.g. tourism in Luang Prabang). Thailand is more interested in the Ma Sai-Chiang Tung–La route, since it is the shortest path connecting Thailand and China.

Table 3 Examples of Data on Roads Connecting Thailand-Mynmar-Yunnan, China

	Distance (km)	**Road Class**
Chiangrai – Mae Chan	32	4 – lane Highway, Excellent surface condition
Mae Chan – Mae Sai	30	4 – lane Highway, Excellent surface condition
Mae Sai – Tachelek	1	River Crossing Bridge
Tachelek – Ta Dua	48	2-lane Highway, asphalt paving
Tha Dua – Mong Phayak	35	n.a.
Mong Phayak – Loimwe	81	n.a.
Loimwe – Kengton	31	n.a.
Kengton – Mong La	85	- 2 – lane Highway on mountaineous area, no shoulder - Three check points: 2 at Mong La and 1 at Kengton, 1 Toll booth at Kengton - Approximate Drive time of 6 hours
Mong La – Da Luo	1	Road Section bordering Mynmar and Yunnan, China
Da Luo – Menghai	76	Class – 4 Highway, 2-lane, no shoulder
Menghai – Jinghong	55	Class – 2 Highway
Jinghong – Mengyang	31	Class-2 Highway, in the process of upgrade to Class-1 Highway
Mengyang – Simao	128	Class-1 Highway
Simao – Mohei	67	Class-2 Highway, in the process of upgrade to Class-1 Highway
Mohei – Yanjiang	141	Class – 1 Highway
Yuanjiang – Yuxi	94	Class – 1 Highway
Yuxi – Kungming	121	Class – 1 Highway

In conclusion, the data on transport includes mainly physical description of road network, traffic volume (if available) and roadway conditions. Moreover, the data on surrounding land use area are collected, mainly the data describing the city characteristics that the route is on.

a) Road Condition in China (Menghai – Da Luo)

b) Road Condition in Mynmar (Tachilek – Kengton – Mong La)

c) Illustration of Toll Plaza of Upper Class Highway in Mynmar (Kengton –Ta Dua)

Figure 5 Examples of Graphic Illustration of Transport Facility in the Database

5. DEVELOPMENT OF SPATIAL INFORMATION SYSTEM

In accordance with the project objectives, a spatial database has been developed to support viewing, querying, and planning. The database consists of the following data sets or layers as summarized in table 4 below.

Table 4 Theme and Layers of the developed spatial database

Theme	Layers	Structure
Political/Administration Boundary	National Border	Line
	1st Level Administrative Boundary	Line
Human Settlement	Populated Places	Polygon
	Settlements	Point
Transportation	Road	Line
	Railway	Line
	Facilities (Bridges, Stations etc)	Point
	Sea Ports	Point
	Air Ports	Point
	Border Crossing	Point
Topography/Natural Features	Contour Line	Line
	Spot Height	Point
	River	Line
	Inland Water Body	Polygon

Each layer is associated with an attribute table containing identification numbers and/or names of features. The identification numbers serve as primary key to link layer attribute table to other data which exist in table form. For example, the IDs in the attribute table of border-crossing layer can link to cross-border trade volume statistics. The system, therefore, can generate a variety of thematic maps and enable planners as well as decision-maker to visualize statistics as graphics in map space. Further, non-alphanumeric information such as photograph or satellite/aerial imagery can also be linked through identification number to the database and so more flexibility for the database to serve text and the equally-important non-text information to the users.

Digital chart of the world (DCW) is the main source to develop the spatial database. DCW is a product originally developed for the US Defense Mapping Agency (DMA) at 1:1,000,000 scale. The DCW in this project is available form Environmental System Research Institute Inc. (ESRI) and consists of 2094 workspaces. Each workspace is bounded by 5-by-5 degree in latitude and longitude. Since the study area covers more than 20 workspaces, this means that editing particularly edge matching is required in order to obtain a continuous database of the study area. Most layers of the Thailand coverages have been created and edited during the previous research (Trisirisatayawong et al, 1997) as well as Laos coverages (Trisirisatayawong et al, 2001). The editing process of layers in the first three themes of table 2 is accomplished manually. Figure 6 shows an example of maps generated from the database.

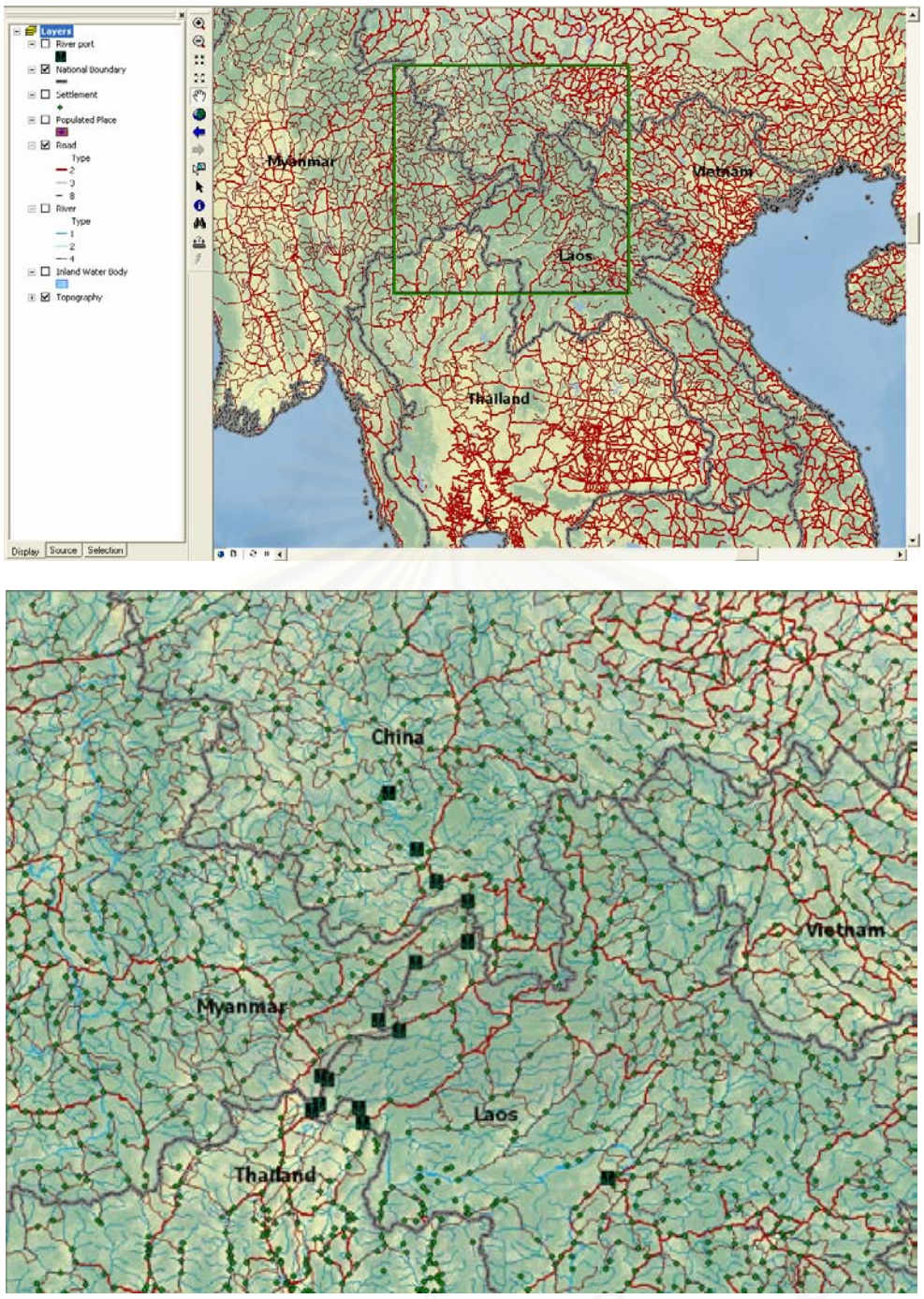

Figure 6 Maps created from the developed GIS database at 1:7,500,000 scale (above) and the enlarged version with the added layers of river, settlement (shown in green dots) and river ports (below).

Apart form the DCW, some layers in the database were developed from other sources. The layer of sea ports was developed in previous study project (Sukdanon et al, 2005) while the layer of border crossing is developed from a variety of sources including GPS surveying in the field for those situated along Thai borders (Sukdanon, 2004).

6. CONCLUSION

This paper addresses the obtainment of international transport and trade data and the development of spatial information system for the Upper Mekong Riparian countries. The characteristics of the neighboring states and the relationships among them, notably the political system, level of country's economic development, and historical background create the specific trade and transport activities. In the research, secondary data were obtained from various sources and creditability was verified from in-depth interview and field visit. Trade is characterized by cross-border trade, although these volumes are not accurate in the official report. Cross-border trade has the major proportion in the country's commerce. Transport relies on existing routes, water and road. A large volume is also the trans-border between Thailand and Yunnan province, China. The trade database contains variables describing the local areas' characteristics, cross-border trade statistics, while transport database contains physical description of road and river ways, traffic volumes on both channels.

A Spatial Information System is developed based on the characteristics of the input trade and transport data and the requirement of applications. The main features of the information system are the use of viewing and query capability in the program to manage/analyze the data for later planning applications. Trade and transport database are then divided into layers and linked each other on the Digital Chart of the World (DCW) platform. This allows the end-users to generate many thematic maps that facilitate their work.

7. ACKNOWLEDGEMENT

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