ANGIS

The Asian Network for
GIS-based Historical Studies

and

CRMA

The Cultural Relationship Study of
Mainland Southeast Asia Project

Bangkok Meeting

2015

Proceedings

Date: 5-6 January, 2015

Venue: SAC: Princess Maha Chakri

Sirindhorn Anthropology

Centre, Bangkok, Thailand

東京大学
THE UNIVERSITY OF TOKYO

JSPS

Contents

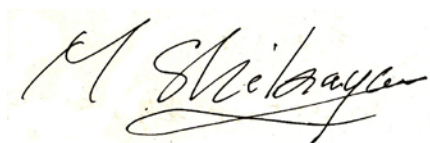# Message from Chairperson of the ANGIS and CRMA Bangkok Meeting 2015

It is a great pleasure to extend warm welcome to all participants for the third International Symposium on Asian Network for GIS-based Historical Studies (ANGIS) jointed with the Cultural Relationship Study of Mainland Southeast Asia Project (CRMA) which is held in 5th-6th, January, 2015 at the Her Royal Highness Princess Maha Chakri Sirindhorn Anthropology Centre, Bangkok, Thailand.

The symposium on the ANGIS and CRMA Bangkok Meeting 2015 is held as one of major activities of the ANGIS. ANGIS aims to promote all academics interested in GIS-based historical studies on Asia. The ANGIS and CRMA Bangkok Meeting 2015 will not only provide participants an unique opportunity to deliberate news areas of research but also offer a vibrant forum for exchanging mutual experiences and exploring new collaborations in applying GIS and remote sensing for historical studies.

I hope that the ANGIS and CRMA Bangkok Meeting 2015 will enrich you with new knowledge, foster collaborative research, and strengthen academic and scientific ties in Asian countries. As one a Chair to the ANGIS and CRMA Bangkok Meeting 2015 International Symposium, it is my great pleasure to offer to our international colleagues a platform for information sharing and opportunity for actively pursuing joint R&D in the field of GIS-based historical studies. I hope that the ANGIS and the CRMA project will continue to grow from strength to strength and continue with its activities on promoting GIS-based historical studies in Asia.

I would like to express my best appreciation to institutions and organizations for their strong and unstinted support and cooperation for the ANGIS and CRMA Bangkok Meeting 2015.

Finally, I hope all participants from interdisciplinary backgrounds will have fruitful deliberations and carry lasting memories of this conference.

Prof. Mamoru SHIBAYAMA
Chairperson
Asian Network for GIS-based Historical Studies
Director, Kyoto University ASEAN Center

Dated: 1st January 2015

Message from General Secretary of the ANGIS

Warmest welcome to the 3rd ANGIS Meeting in Bangkok!

Following two meetings in Tokyo and Kyoto in the past two years, this Bangkok meeting is the first one held outside Japan. This new development became possible by the courtesy of Dr. Surat Lertlum and his colleagues in Thailand. His enormous effort as well as extraordinary leadership has enabled us to gather here in such a wonderful venue. My special thanks also go to the Directors and Presidents of the institutions that strongly supported this meeting.

On behalf of the ANGIS organizing committee, I'd like briefly to introduce the past activities of the ANGIS.

The ANGIS or the Asian Network for GIS-based Historical Studies was founded in June 2012 as a pure voluntary association of academics who are engaged in GIS-based studies on Asia. With Prof. Mamoru Shibayama as President, it started with around sixty members to promote history-related studies based upon GIS. It aims among others to hold annual conference, to publish E-Journal annually, to build-up GIS infrastructure across Asia, and to organize various joint research projects in collaboration with Asian scholars in the same field.

With these objectives the ANGIS has conducted the following activities. Two E-journals have been published under the chief editorship of Prof. Hiroshi Kato, several seminars and symposiums were organized, and two annual conferences were held. The work of building GIS infrastructure over Asia has steadily progressed as well. It goes without saying, however, that the annual meeting plays by far the most important role among all the activities of the ANGIS. With this Bangkok meeting as a starting point, the ANGIS will hold meetings across Asia in coming years.

It is my sincere desire that this Bangkok meeting becomes a precious opportunity where everyone is greatly benefitted through discussions and warm friendship. Thank you.

Tsukasa MIZUSHIMA
ANGIS General Secretary
Professor
Graduate School of Humanities and Sociology
The University of Tokyo

Organizing committee

Chairperson:
   Prof. Mamoru Shibayama (Kyoto University ASEAN Center)

Vice-chair:
   Prof. Tsukasa Mizushima (The University of Tokyo)
   Dr. Surat Lertlum (Chulachomklao Royal Military Academy)

Members:
   H.E. Dr. Tej Bunnag (TRF: Thailand Research Fund)
   Dr. Silaporn Buasai (TRF: Thailand Research Fund)
   Maj. Gen. Vinut Intarasuwan (Chulachomklao Royal Military Academy)
   Mr. Pirapon Pisnupong (Fine Arts Department, Thailand)
   Dr. Panjai Tantasanawong (Silpakorn University)
   Prof. Hiroshi Kato (Hitotsubashi University)
   Prof. Ryuto Shimada (The University of Tokyo)
   Dr. Minori Yuda (The University of Tokyo)

Co-organizers:
   Thailand Research Fund
   Chulachomklao Royal Military Academy (CRMA)
   Silpakorn University
   Fine Arts Department, Thailand
   The Princess Maha Chakri Sirindhorn Anthropology Centre

In Corporation with:
   The Project on GIS-based Global History from Asian Perspectives at the University of Tokyo

Sponsored by:
   Japan Society for the Promotion of Science (JSPS) Topic-Setting Program to Advance Cutting-Edge Humanities and Social Sciences Research: Global Initiatives "GIS-based Global History from Asian Perspectives"

   Thailand Research Fund through Cultural Relationship Study of Mainland Southeast Asia (CRMA Project)

Conference Information

Venue:

SAC: Princess Maha Chakri Sirindhorn Anthropology Centre, Bangkok, Thailand
20 Baromaratchachonnani Rd, Taling Chan, Bangkok 10170, Thailand

Welcome, Keynote and Closing sessions: Conference hall (4th floor)
ANGIS sessions: Multimedia room (2nd floor)
CRMA sessions: Room 407 (4th floor)
Lunch, Breaks and Reception: Room 406 (4th floor)

Registration:

The registration desk will be located in 1st floor of SAC. Registration will be open during the following hours:

5th January 8:45 – 17:00
6th January 8:45 – 15:30

Conference Program

DAY1 (5th Jan 2015)

Time	Program	
9:00-10:00	**Welcome Session (Conference hall)** **Moderator : Dr. Surat Lertlum** 1. Welcome Address By Dr. Silaporn Buasai, Deputy Director, Thailand Research Fund 2. Welcome Address By Lt. Gen. Chanchai Yossundara, Superintendent of Chulachomklao Royal Military Academy, Thailand 3. Welcome Address By Mr. Bovornvet Rungrujee, Director General, Fine Arts Department, Thailand 4. Welcome Address By Prof. Chaicharn Thavaravej, President of Silpakorn University, Thailand 5. Welcome Address By ANGIS President, Prof. Mamoru Shibayama 6. Introduction to ANGIS and ANGIS-CRMA 2015 Bangkok Meeting By ANGIS General Secretariat, Prof. Tsukasa Mizushima	
10:00-10:30	Break (tea)	
10:30-12:00	**Keynote session** 1. Historical Study: Value, Approach, and Sequel By H.E. Dr. Tej Bunnag, Former Minister of Foreign Affair, Thailand 2. Impact of Cultural Study to Young Generation By H.E. Khuon Khun Neay, Deputy Director General, APSARA Authority, Cambodia 3. Future Historical GIS in Asia - Toward New Horizon - By Prof. Tsukasa Mizushima, University of Tokyo, Japan	
12:00- 13:00	Lunch	
13:00-14:30	**ANGIS Session 1: Infrastructure and Development** Ichiro Kakizaki (Yokohama City University) Development of Railway Network in Southeast Asia before World War II Rajnsh Kumar (Jawaharlal Nehru University) Railways and Economic Development in India: A Study from Historical GIS Perspective Hiroshi Kato (Hitotsubashi University)"Personality" of Socio-economic Development in modern Egypt Akira Ueda (The University of Tokyo) Ethno-demographic structure of Russian Turkistan: A historical GIS case study of Ferghana Province	**CRMA Session 1 : CRMA Project Overview** **Session Chair : Dr. Surat Lertlum** Surat Lertlum (CRMA, Thailand) and Im Sokrithy (APSARA, Cambodia): Overview of CRMA Project: From LARP to CRMA Pongdhan Sampaongern (FAD, Thailand) : Cultural Relationship in Southern and Central Thailand Through Archaeological Study Surapol Natapintu (SU, Thailand): Archaeometallurgy Information Implying Relationship of Ancient Cultures in Mainland Southeast Asia
14:30-15:00	Break (tea)	
15:30-17:00	**ANGIS Session 2: Economic and GIS** Milap Punia(Jawaharlal Nehru University) Merchant's Migration and Typologies of Development in India: A Historical Perspective from Shekhawati Region Marco Stefan B. Lagman, Ma. Simeona M. Martinez and Jonathan M. Villasper (University of the Philippines Diliman) Describing and Understanding the Occupational Characteristics and Environment of Selected Manila Arrabales through Census Data and G.I.S. Amaresh Dubey (Jawaharlal Nehru University)Spatial Variation and Temporal Change in Rural Wages and Poverty in India Michihiro Ogawa (The University of Tokyo) Mapping the Transition of the land revenue system in Western India from the pre-colonial to the early colonial period -with special reference to Indapur Pargana (1761-1836)-	**CRMA Session 2: Cultural Relationship at Regional Scale through Art History** **Session Chair : Dr. Nandana Chutiwongs** Nandana Chutiwongs (Thailand) and Tran Ky Phuong (Vietnam): Vimayapura, Yasodharapura and Vijaya - a joint presentation Nicolas Revire (TU, Thailand) : A Transregional Ritual Complex – Dvāravatī and Zhenla in the Seventh-Eighth Centuries Fifia Wardhani (National Museum, Jakata, Indonesia), Makara in Temples of Old Classical Era of Indonesia Kabilan Balasubrahmaniam (Dept. of Archaeology, Sri Lanka) A Research on the Forts during the Europeans Period especially in North Sri Lanka
18:00-19:30	Reception Hosted by Silpakorn University and CRMA project	

Venue:
  Welcome and Keynote Sessions: Conference hall (4F)
  ANGIS Sessions: Multimedia room (2F)
  CRMA Sessions: Room 407 (4F)
  Lunch, Beaks and Reception: Room 406 (4F)

DAY2 (6th Jan 2015)

Time	Program	
9:00-10:30	**ANGIS Session 3: Time and Space** J. Susetyo Edy Yuwono (Universitas Gadjah Mada) GIS application for Archeological Predictive Modeling: The case studies in fluvio-volcanic and karstic landscapes in Yogyakarta and surrounding area, Indonesia Sarah KLASSEN (Arizona State University) and Joyce WHITE (University of Pennsylvania): Preliminary Analysis using Middle Mekong Archaeological Project GIS data: A Model to Recommend Prehistoric Agrarian Sites in the Middle Mekong Basin for Excavation Andriyati Rahayu (Universitas Indonesia) Majapahit Short Inscriptions and the Relation with a Spatial Context Tatsuki Sekino (Research Institute for Humanity and Nature) Tools and basic data for temporal information analysis	**CRMA Session 3: Cultural Relationship at Regional Scale through Communication Networks and Geo-informatics Study** **Session Chair : Prof. Elizabeth Moore** Surat Lertlum (CRMA, Thailand) and Khien Chan (APSARA, Cambodia) : The Regional Communication Networks Tran Ky Phuong (Vietnam) and Rie Nakamura (Universiti Utara Malaysia): Eagle-wood and Jar: Reconstructing upland and lowland exchange network in Central Vietnam Mr. V. Manimaran (Dept. of Archaeology, Sri Lanka) A Research on Ancient Passengers Residences and (along with) Monuments. Elizabeth Moore (SOAS, UK): Ancient sites in Myanmar from the Williams-Hunt Collection
10:30-11:00	Break (tea)	
11:00-12:30	**ANGIS Session 4: Mapping Events** Kohei WAKIMURA and Kenji TANIGUCHI (Osaka City University) Cholera Pandemics and the 19th Century India: A Pilot Study of Spatial Analysis Bolorchuluun Chogsom and Munekh-Erdene Batsaikhan (National University of Mongolia) Some Historical Places of The "Secret History of The Mongols" Yoshikatsu Nagata (Osaka City University) Distribution and accuracy of place names in Thailand listed in a Japanese gazetteer during World War II Minori Yuda (The University of Tokyo) Visualization of Trade of the Dutch East India Company in 18th Century: with GIS and Historical Statistics	**CRMA Session 4: Cultural Relationship at Regional Scale through Archaeological Study** **Session Chair : Dr. Christophe POTTIER** Anulak Depimai (FAD, Thailand): Khao Khlang Nok Stupa: Construction Concepts and Comparative Study in Southeast Asia Thonglith Luangkhoth (Ministry of Culture, Lao PDR) : New archaeological finds in Southern Laos: Considering on the significant cultural interactions and overland trading route between the ancient kingdoms in Northeast Cambodia, Southern Laos and Central Vietnam Christophe POTTIER (EFEO, France) : Archaeology, scales and spaces: Recent developments in the cartography of Angkor
12:30-13:30	Lunch	
13:30-15:00	**ANGIS Session 5: Ethnicity and GIS** Michihisa Umekawa(Tokyo University of Foreign Studies) Theoretical and Fieldwork Analyses for the Population Density Distribution in Mainland Southeast Asia Ma. Simeona M. Martinez, Jonathan M. Villasper and Marco Stefan B. Lagman (University of the Philippines Diliman) Spatial Patterns of Migration in 19th Century Manila: an Exploratory Characterization of Migrants in the Pueblos of Dilao, Malate and Pandacan from 1881-1895 Ryuto Shimada (The University of Tokyo) Expansion of the Dutch Colonial City: Spatial Analysis of Ethnicity and Land-use of Batavia, 1619-1930 Toshiyuki Miyata (Tokyo University of Foreign Studies) Company, Industry and Network in "The Far East" in the 1930s: A Study of Directory Published in Hongkong	**CRMA Session 5: Cultural Relationship at Regional Scale through Underwater Archaeological Study** **Session Chair : Dr. Nguyen Giang Hai** Erbprem Vatcharangkul (FAD, Thailand): Overview of Underwater Archaeology in Thailand Preeyanuch Jumprom (FAD, Thailand): The 9th Century A.D. Shipwreck found in Samut Sakhon Province, Central Thailand. Bui Van Hieu (VASS, Vietnam) : Recent maritime archaeological research at Van Don
15:00-15:30	Break (tea)	
15:30-17:00	**ANGIS Session 6: Organized session: "Trade and Trade Centers in Asia during the "Long 19th Century": A Preliminary GIS Analysis of the Case Of China."** Tomoko Shiroyama (The University of Tokyo) Trade and Trade Centers in China during the "Long 19th Century":Working Hypothesis and Related Materials Sayako Kanda (Keio Univ.), Tomoki Shimanishi (Kagawa Univ.), Akiko Takahashi (Independent researcher) Visualizing Changes in the Routes and Scale of Trade in 19th-Century China Yoshinori Kigoshi (Osaka Sangyo Univ.) General Explanations for Chinese Trade Database in 19th Century Commentator: Kohei Wakimura (Osaka City Univ.)	**CRMA Session 6: Myanmar Session** **Session Chair : Prof. Elizabeth Moore and Prof. Mamoru Shibayama** H.E. U Than Swe (Deputy Minister of Culture, Myanmar) : 'Historical view on towns in Lower Myanmar' U San Win: (Myanmar) - The study on Mon State Shibayama Mamoru (Kyoto University, Japan) : EWCC between Myanmar and Thailand
17:00-17:30	**ANGIS-CRMA Jointly Closing Session**	

Venue:
ANGIS Sessions: Multimedia room (2F)
CRMA Sessions: Room 407 (4F)
Lunch and Beaks: Room 406 (4F)
Closing Session: Conference hall (4F)

Keynote Sessions

ANGIS and CRMA Bangkok Meeting 2015

Historical Study: Value, Approach, and Sequel

H.E. Dr. Tej Bunnag

Former Minister of Foreign Affair

Thailand

It is a great honour for me to be invited to attend this international conference and to give a speech as a keynote on the topic of "Historical Study: Value, Approach, and Sequel". History is the study of the past, the analysis of what happened in order to build a body of knowledge of the past, which would increase understanding of the present and prepare for possibly a better future.

Value : Historical study covers all fields of past human activities.There are many examples that we can study from the past as we face current and future situations. If we pay attention to the past, look at what had happened and learn from it, we may see the trend of the current situation and may be able to ameliorate the problems or make things better than what is happening.

Approach: By studying so much inscribed, written and printed records, historians are often regarded as "book worms", who are always sitting and reading in libraries and archives. This may be one of the points that make people from other disciplines think that historical study may not be correct due to the perception that records were written in the way the authors would like it to be. There is always the thought that history is the record of the winners, not what actually happened in the past. The question raised is how to enhance the way of studying in history. One idea is the "multi-disciplinary approach".

As the name implies, "multi-disciplinary approach" means using more than one method to accomplish the task. In order to use multiple methods to accomblish a given task, good plan and execution are required. Everything has to be synchronized in a harmonious way. Not all tasks can utilize the same methods or procedures, it depends on many factors. The main objective as well as the surrounding environment have impact on the result. Today, I would like to provide a practical example of research that utilizes the "multi-disciplinary approach".

The Khmer-Thai Collaboration research project named "Living Angkor Road Project" (LARP), supported by the Thailand Research Fund (TRF), is a good example of the "multi-disciplinary" approach to historical study. LARP is a cross-border multi-disciplinary research project aimed firstly at identifying all the remaining portions of ancient roads radiating from the Angkor capital to different provinces of the ancient Khmer Empire, taking into consideration an overall mapping of the network known to date; secondly, to identify and describe all the infrastructures existing along these roads: bridges, canals, temples, remains of rest-houses and hospitals as well as the life of the people along these royal roads from the past to present. Historical information as well as archaeological information together with geographic information are utilized for this study.

From very early on in the work, the core concept was enlarged. The project would target not only archaeological remains, but also present-day communities along these axes. The argument is simple and clear: from normal evolution, abrupt changes, and historical events, these communities are linked to the Angkor past. They still use and worship at the historical sites.

Therefore the team also conducts   ethnographic surveys in the two countries as well.

The first objective get of the project was the Angkor-Phimai road. Then, the continuation of the Angkor to Phimai road further away from the capital was also studied, namely the Angkor-Sdok Kok Thom road, called the West road, and the continuation of this road to the area currently in eastern Thailand; the Angkor-Vat Phu road, called the North-East road; and the Angkor-Vijaya, called the East road. For the study, the team benefited from the result of remote sensing surveys, which significantly help the systematic ground trusting conducted during several field-trips in Cambodia, Thailand as well as Laos. A number of sites were excavated, and the excavation was carried out according to modern method, using geo-informatics, geo-physics surveys, etc.

The steps that were taken in this study are as follow:

(1) Review previous studies about the royal road from Angkor to Phimai in order to identify a general view of science and technologies that can be utilized, and what should be the results from the proposed study;

(2) Preliminary analysis to utilize the result to develop GIS database for field survey planning;

(3) Conducting field surveys;

(4) Conducting geo-physics experiments;

(5) Conducting archaeological excavations.

(6) Developing GIS database from field surveys together with other related data for integrated analysis.

(7) Integrated analysis with all the information.

(8) Proof the assumptions from the results of the integrated analysis.

From this example, it can be seen that historical study can be integrated with other fields of studies to produce results that can be confirmed by physical evidence, not only information from documents as previously done. At the moment, the study is expanded to cover the area of Mainland Southeast Asia with the project named "Cultural Relationship Study of Mainland Southeast Asia" which   is one of the two components of this international conference today and tomorrow.

Sequel: From the Living Angkor Road project, the results of the study provide   broader picture of sharing and adaptation of culture in the past. The development of the transportation system and ancient industry have been revealed; this opens up new knowledge of cultural material as well as archaeological and historical evidence that had not been found   previously.

Historical study in the traditional manner cannot achieve this kind of results. Only integration of various fields of studies can accomplish this with proof which can substantiate the historical context. There are many other interesting studies that will be presented at this meeting that can suggest new ways of historical study. This meeting should bring new light to historical and archaeological studies in Southeast Asia as well as the rest of the world.

I am confident that in the future, thanks to the initiative of this international project, we will have more people join in the multi-disciplinary approach to historical and archaeological studies.

Thanks you very much for your kind attention.

IMPACT OF CULTURAL STUDY TO YOUNG GENERATION

Khun-Neay KHUON

Deputy Director-General of APSARA Authority, Cambodia

Advisor to the Living Angkor Roads Project (LARP)

Usually, archaeologists conduct research including field activities and publish the results of their works. The project is considered finished.

But the organizers and researchers of the Living Angkor Roads Project (LARP), a joint research between Thailand and Cambodia, act in different way. In fact the team uses the results of its works as tool to teach secondary school students of Cambodia and Thailand, to enable them to know their heritage and to conduct themselves some field works in their own communities.

LARP team trains the students how to conduct a socio-cultural survey, how to interview various people in the communities and how to do the research on their own. Equipment to help them learning quickly and more efficiently such as computer, recorder, camera and GPS are provided.

Since 2007, six heritage education sessions have been organized by the LARP team for the benefits of young Cambodian and Thai students, in the provinces where is situated the Angkor-Phimai road, in Cambodia and Thailand. Four sessions have been conducted in Thailand and two in Cambodia. The last one, the 6th edition of heritage education took place from 16 to 18 November 2014, in Banteay Chhmar, Cambodia, and Sdok Kak Thom, Thailand.

The project has successfully inculcated a love for heritage and cultural roots in the children. Our ancestors have created our heritage and it's our duty to train our children to protect and to preserve it. We aim to spread the idea of getting everybody in the community to participate in the conservation of heritage. Of course, we have the government, the ministries and departments to do this, but if the community contributes as well, then it will become more efficient.

But more than that, the project aims to engage youngsters in learning the history of both countries, in the hope that shared cultural roots will enhance ties between the two nations. They have similar folk games, traditional healing practices done through a medium, and rain-making prayers and rituals. They just call them by different names, for instance the praying-for-rain ritual in Thailand is called "Nang Maew Khor Fon", while in Khmer it is "Saut Trey Ros". Very little differences exist in these shared customs and rituals.

The experience between the youth in Thailand and Cambodia demonstrates that cultural study could be served as mean to strengthen relations between nations.

The main objective of the current project is to extend the study of the finished study.

Lastly, the LARP project team has decided to pursue the same spirit by extending the project to a new one called "The Cultural Relationship in Mainland Southeast Asia (CRMA)", comprising Vietnam, Laos, Cambodia, Thailand and Myanmar,

The project will focus on the impacts affecting cultural change in order to visualize the relationship of culture at regional scale in the past, to discover the relevance and coherence that impacted on society and culture as a whole and cultural development until the present. The results of

the research will be utilized in various ways, such as for the education of young people in the region, and for enhancing the relationship between the countries and promote Friendship and Peace in the whole Region.

Future Historical GIS in Asia: Towards New Horizon

Prof. Tsukasa Mizushima

The University of Tokyo

ANGIS or Asian Network for GIS-based Historical Studies was founded in 2012 to promote GIS-based historical and other related studies in Asia. As many of us notice, historical GIS started producing works in the international academic fields from the beginning of 2000s. The move was, however, not necessarily initiated by historians but often by those in the informatics or in urban engineering. Even the history-oriented books were often edited by non-historians. The slow pace of the diffusion of GIS-based history-related studies may be attributable to this cause.

Historical GIS may be defined as "An academic field of historical studies in which more spatial factors are taken into consideration". It is true that many of historical studies have paid attention to space where events, movements, or changes took place. Historical GIS, however, tries more to link historical evidences with specific geo-spaces and to analyze them by synthesizing information assembled from various fields in the past.

For developing Historical GIS, we have two critical matters to consider. First is to provide GIS facilities for historians and other academics in general. Free access to detailed base maps of different periods in the past is essential to persuade those who hesitate to work with GIS. The current situation in Asia is, however, far from satisfactory. In some cases original maps indispensable for preparing GIS-based studies are classified and not available even for academic studies. Even if maps are available, it still takes too time-consuming and costs too much for many of us before launching GIS-based studies. Secondly outstanding academic works with GIS application are vital to draw more students into the field. Historical GIS is yet to be recognized as one contributable for furthering academic research neither by historians nor scholars in other disciplines in humanities and social sciences. Apparently the outcome of historical GIS has been so far too poor to persuade others to be involved in it. Innovative products possible only through GIS would attract people greatly in future.

In my keynote speech I would describe the current stage of historical GIS facilities on Asia and discuss the potential of development in future.

ANGIS Sessions

The Asian Network for GIS-based Historical Studies
ANGIS and CRMA Bangkok Meeting 2015

Development of Railway Network in Southeast Asia before World War II

IchiroKAKIZAKI[1]

[1] Yokohama City University

Abstract: . This paper aims to reveal the pattern of railway network development in Southeast Asia before World War II. The first railway in Southeast Asia emerged in Java with the opening of the first section of the Semarang-Yogyakarta line in 1867. In 1877, British Burma was the second country to introduce rail travel. Then Vietnam, in French Indochina, opened its first railway in 1885, and British Malay saw its first railway in the same year. The fifth country was Spanish Philippines, where the first line was opened in 1891, followed by Thailand in 1893 and Cambodia in 1932. By 1940, the total length of railways in Southeast Asia exceeded 20,000 km.

Since railway construction was conducted mainly by colonial authority and the geographic feature of the archipelago, the number of railway networks increased until the 1910s before decreased to 13 networks in 1940. The pattern of railway expansion in each country was similar: either a suburban line from a large city or short inland line from a port city came first, then the construction of a longer inland line between an entrepôt and its hinterland followed, and the coastal line emerged last. The construction of this coastal line contributed to unify the isolated railway networks in each country into one system.

Keywords: Railway, Network, Development, Southeast Asia

1. Introduction

Railway construction in Southeast Asia started in the 1860s, and the first railway opened in Java in 1867. Then railways were introduced into almost all countries of the region, and the total length of all routes exceeded 20,000 km by World War II.

The history of railway development in several Southeast Asian countries has already been studied by scholars such as Doling (2012) in Vietnam, Kakizaki (2005) in Thailand, Maung (1964) in Burma, Kaur (1985) in Malaysia, and Corpuz (1999) in the Philippines. These studies show the detailed history of development in each country, but their scopes are limited to the specific country. As for the whole of Southeast Asia, Dick & Rimmer (2003) recounted a brief history of railway development in almost all systems, and Kakizaki (2012) compared railway development in Thailand with that of other Southeast Asian countries. However, comparison is not sufficient to describe the overall pattern of railway development in this region from a macro point of view.

Therefore, this author will attempt to analyze the overall pattern of railway development in Southeast Asia by making GIS maps that illustrate the process of expansion. The main data comprises the opening date of each line/section and the cumulative length of the railway routes in each country, which can be obtained from those previous studies, statistical year books, and some historical publications relating to railway development such as Reitsma (1928).

2. Construction of Railways in Southeast Asia

By the end of the 1880s, four countries in Southeast Asia started railway construction. Java and Burma were the center of railway construction. As shown in Figure 1, the country with the greatest overall length of newly-opened railways, at that time was Java, which was followed by Burma.
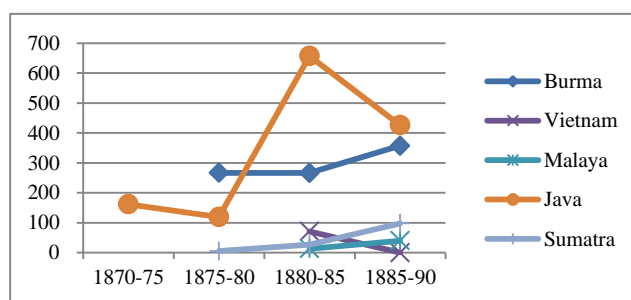
Figure 1 Length of Newly-opened Railways in Southeast Asian Countries （1870-1890） (km)

The first railway in Southeast Asia appeared in Java, in the Netherlands East Indies (Knaap 1989: 28). The first 25-km section of the railway from Semarang, a port town in central Java, to the southern former capital, Yogyakarta, opened in 1867 (see Fig. 2). After the first 4-km section of the Ache Tramway was opened in 1876, Burma opened the longest line at that time during the following year: the 258-km Irrawaddy Valley line running from Rangoon to Prome (Maung 1964: 41-42). The first railways in Vietnam and Malaya were also opened during this period. In Vietnam, the first railway construction started in Cochinchina, which France gained first. Its first railway, between Saigon and Mytho, was opened in 1885 (Lien Hiep Duong Sat Viet Nam 2001: 17). In the same year, the first railway in Malaya also opened: the 13-km short line between Port Weld and Taiping, on the western coast, followed by a second line, between Klang and Kuala Lumpur in 1886 (Kaur 1985: 14-19).

Railway construction in Southeast Asia accelerated once the 1890s began. As shown in Figure 3, the yearly length of newly-opened railways reached its peak of approximately 1,400 km in the latter half of the 1890s. During the first decade of the twentieth century, Vietnam expanded its railway networks the most. Then Thailand accelerated railway construction during

Figure 2 Railway Network Development in Southeast Asia (1864-1890)
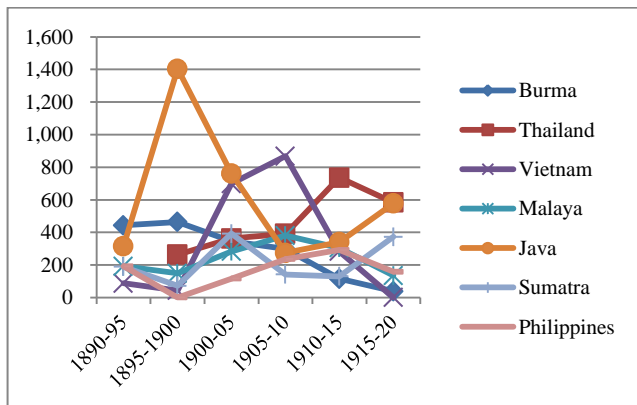
Figure 3 Length of Newly-opened Railways in Southeast Asian Countries (1890-1920)(km)

the next decade.

In Java, railway construction continued energetically. The railway link between Batavia and Surabaya was finally completed in 1897 (Reitsma 1928: 116, See Fig. 4). Apart from the completion of the trunk line, numerous feeder lines, mainly tramways, were constructed, especially in central and eastern Java. In Sumatra, the extension of the Ache Tramway continued during this period, connecting with the Deli Railway network, centered at Medan in northern Sumatra, in 1919 (Ibid.: 120).

Figure 4 Railway Network Development in Southeast Asia (1891-1920)

Railways also emerged in western and southern Sumatra during this period.

Both Malaya and Burma expanded their railway networks. In Malaya, the trunk line between Pray (opposite Penang) and Singapore was completed by 1909 (Kaur 1985: 56-57). Burma added many feeder lines radiating from its two trunk lines (Maung 1964: 44-46). Rapid railway development was also observed in French Indochina. Thailand and the Philippines introduced railways during this period, as well. The first railway in Thailand was the 21-km suburban railway between Bangkok and Paknam, followed by the trunk line between Bangkok and Khorat in the northeast (Kakizaki 2012: 12-23). The first railway in the Philippines, part of the Manila–Dagupan line, opened in 1891, and the whole line was completed in the following year (Corpuz 1999: 30-31).

Since motor transport became popular after World War I, the pace of railway construction slowed down beginning in the 1920s, and the competition between rail and motor transport became more severe because of the World Depression. Thus, some feeder railways were abandoned during the 1930s. Figure 5 clearly shows the decline of railway construction beginning in the 1920s. From then on, newly-opened railways were concentrated in mainland Southeast Asia.

In Vietnam, construction of the trans-Indochina line was finally completed in 1936 (Doling 2012: 69-71, See Fig. 6). The first railway in Cambodia emerged in 1932, but the railway to Laos was never materialized, despite the construction of a short spur line from the trans-Indochina line. Thailand also expanded its railway network eastward during this period (Kakizaki 2012: 41-43). However, there were rather few openings of new railways in island Southeast Asia.

Figure 5 Length of Newly-opened Railways in Southeast Asian Countries (1920-1940)(km)

Figure 7   Total Length of Railways in Southeast Asian Countries （1870-1940）(km)

3. Increase and Decrease in Railway Networks

During the 70-year period of railway construction in Southeast Asia, the number of railway networks has changed in each decade. Figure 8 shows changes in the number of railway networks in five-year intervals from 1870 to 1940 with the emergence and unification of each network. During the latter half of the nineteenth century, the number of networks increased to 17 in 1900. Then the number slightly decreased before reaching its peak in 1915, with 19. In 1940, the number fell to 13.

The increase in the number of railway networks attributed to the increase in the number of starting points of railway construction. As this figure shows, the number of networks was relatively large in island Southeast Asia. The total number of networks in Southeast Asia was 31, among which the Netherlands East Indies had the greatest number, with 12. The next countries were Malaya, with seven, and the Philippines and French Indochina with four each.

The number of railway networks was to be greater in island areas, since a separate network had to be constructed in each island, and it was virtually impossible to unify them. However, railway construction sometimes started at several points even on the same island or peninsula, as with the cases of Java, Sumatra, and Malaya. In such cases, railway construction was usually conducted by several organizations. However, the number of railway networks in mainland Southeast Asia was fewer.

Although the number of railway networks increased steadily in the early years, it gradually decreased after 1915. The reason for this decrease was mainly the unification of networks. The reduction of networks was most dramatic in Malaya; a total of seven networks were finally unified into one network by the 1920s. The unification of railway networks took the longest in Vietnam. The construction of the trans-Indochina line commenced in the late 1890s with three starting points: Hanoi,

Figure 6 Railway Network Development in Southeast Asia (1920-1940)

In the end, a total of approximately 20,000 km of railways were constructed in Southeast Asia. As shown in Figure 7, Java gained the greatest length of railways, with approximately 5,400 km, followed by Thailand and Burma, each of which had a 3,200-km network. This figure also shows that the overall growth of railway length slowed down after the 1920s, and some countries such as Java and the Philippines experienced a slight decrease in the 1930s because of the discontinuation of unprofitable lines.

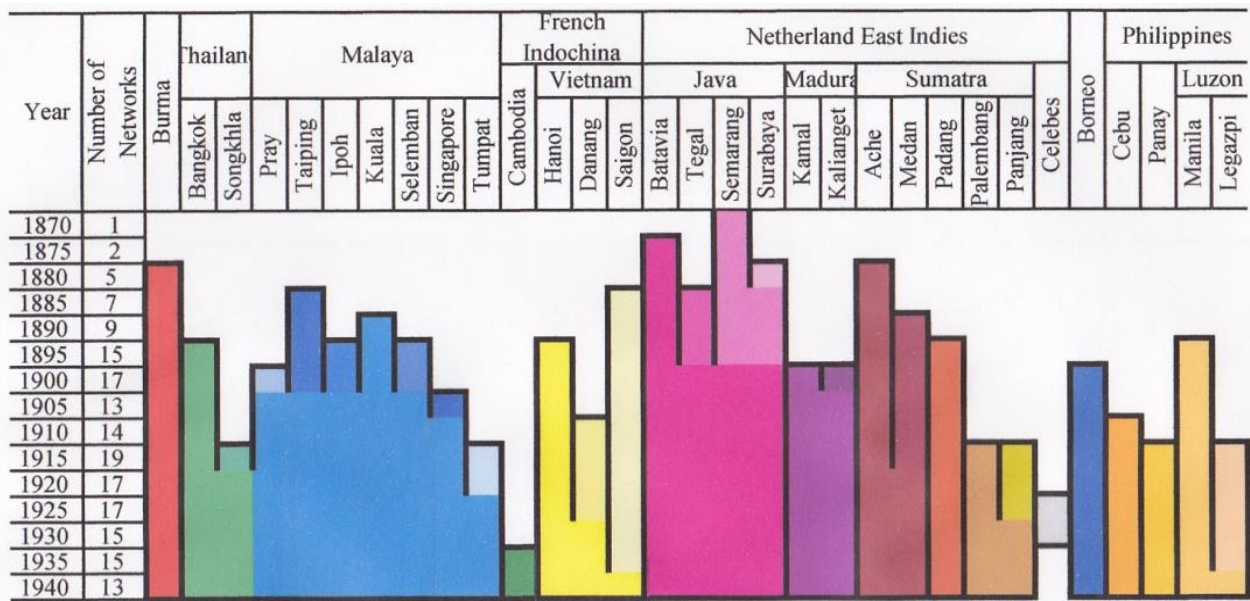| Year	Number of Networks	Burma	Thailand		Malaya							French Indochina				Netherland East Indies														Philippines			
													Vietnam			Java				Madura		Sumatra									Luzon		
			Bangkok	Songkhla	Pray	Taiping	Ipoh	Kuala	Selemban	Singapore	Tumpat	Cambodia	Hanoi	Danang	Saigon	Batavia	Tegal	Semarang	Surabaya	Kamal	Kalianget	Ache	Medan	Padang	Palembang	Panjang	Celebes	Borneo	Cebu	Panay	Manila	Legazpi
1870	1																																
1875	2																																
1880	5																																
1885	7																																
1890	9																																
1895	15																																
1900	17																																
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1915	19																																
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1925	17																																
1930	15																																
1935	15																																
1940	13																																

Figure 8　Change in Railway Networks in Southeast Asian Countries　（1870-1940）

Danang, and Saigon, but it took almost 40 years before the three networks were successfully unified into one (Doling 2012: 50-52, 69-71).

　　After the unification in each country and each island was promoted, the number of networks was finally reduced to 13 in 1940: four mainland and nine island networks. In mainland Southeast Asia, Burma and Thailand had single networks, while French Indochina possessed two: one in Vietnam and the other in Cambodia. As for island Southeast Asia, since there were nine railway networks on seven islands, the unification of railway networks on each island had progressed considerably.

　　One character of railway networks in Southeast Asia was that there were few international railways. There were only three international lines in Southeast Asia: one between China and Vietnam (French Indochina) and two between Thailand and Malaya. In fact, efforts were made to construct several international railways in mainland Southeast Asia to materialize one railway network. The most developed one was the construction of the international railway between Thailand and Cambodia. A railway between Thailand and Vietnam via Laos was also planned, and France constructed the first section of the Thai-Vietnam line in the 1930s. However, construction was suspended both in Thailand and in French Indochina (Kakizaki 2012: 56-57). As for Burma, there were several plans to construct railways toward India and Thailand, but these were never started before World War II.

4. Patterns of Railway Development

When considering the pattern of railway development in Southeast Asia, it can be summarized that the construction of a suburban line or a short inland line came first, followed by the construction of a long inland line and a coastal line.

　　In most countries, the suburban line or short inland line was the first railway. From the point of technology, it was quite normal that a port city became the starting point of railway construction, since most of material for railway construction and operation had to be imported from abroad. However, the destination of each first railway might have differed according to the geographic location and the purpose of railway. In terms of passenger transport, a short suburban line between a port city and its suburban area might be the most profitable route. However, short inland lines from a port city to an inland city along a river, or sometimes across a mountain, would benefit freight transport.

　　After the first suburban or short inland lines were constructed at the first stage, long inland lines were constructed to improve transport conditions in inland areas. The typical examples were Thailand and Vietnam. In Thailand, the government selected the Bangkok–Khorat line as the first state railway. This line aimed to improve transport conditions between Bangkok and Khorat, the gate city of the Northeast. Since the Northeast is located in the middle Mekong basin, a mountain range had to be crossed when traveling from Bangkok to the Northeast. In Vietnam, the Vietnam–Yunnan line gained priority over the trans-Indochina line.

　　Compared to inland lines, construction of the coastal lines along the coast was rather delayed. In many countries, coastal lines were the last to be constructed after the construction of the main inland lines was finished. Since coastal lines were mainly constructed between two separate networks, they played an important role in filling up missing gaps and contributing to the unification of networks. In mainland Southeast Asia, the delayed construction of the trans-Indochina line was the typical example. The same pattern is also found in island Southeast Asia. In Malaya, the west coast line was constructed by combining several short inland lines, which eventually became the trunk line connecting important cities in Malaya. The Philippines' Southern line between Manila and Legazpi also took 30 years to complete (Corpuz 1999: 50).

5. Conclusion

Two characteristics were found from the analysis of railway development process in Southeast Asia. The first one is the change in the number of railway networks in the region. In the first stage, the number of network steadily increased to as many as 19. Then, it decreased to 13 through unification. This increase and subsequent decrease in the number of networks corresponded to the pattern of railway construction, which was the second characteristic. In the first stage, short inland lines or suburban lines were mainly constructed from a port city, which resulted in an increase in the number of networks. Then, after the construction of a long inland line followed, a coastal line was finally constructed. Since such coastal lines played a role in the unification of networks, the number of networks usually decreased after their construction.

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Railways and Economic Development in India: A Study from Historical GIS Perspective

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Abstract: The history of Indian Railways starts from 1853, when the first wheels rolled on rails from Bombay to Thane. Indian Railways played a significant role in the process of early urbanisation and development major industrial regions of India. First four metros namely Calcutta, Bombay, Madras and Delhi registered rapid growth by increased railway connectivity. Presently, the Indian Railways with nearly 64,000 route kilometres fulfils the country's transport needs, particularly, in respect of long-distance passenger and goods traffic. It emerged as the main vehicle for socio-economic development of the country. The objective of the paper is to study history of development railways in India and its implications on economic development. It explores the possible nexus between rail density with urbanisation and industrialisation across the different regions over the time. The study will be in empirical in nature. It will be based on secondary literature and historical records of Railway Board and Ministry of Railways, Government of India. It will apply GIS technique to show spatio-temporal dimension of development of railways and its implication on Indian economy. It attempts to answer how the face of Indian Railways has changed during last 160 years? The paper will contribute historical GIS studies by making historical maps related to evolution and development of Railways in India. Besides, it will also compare levels of regional development with increasing railway network in India.

Keywords: Terrain, Train, Trade, Transport, Tourism, Migration, Urbanisation, Industrialisation

1. Introduction

A well–knit and coordinated system of transport plays an important role in the sustained economic growth of a country. The transport system in India comprises a number of distinct modes and services, notably railways, roads, ports, inland water transport, coastal shipping, airports, and airlines. Railways and roads are the dominant means of transport, carrying more than 95 per cent of total traffic generated in the country. Terrain and topography of the region defined early transport systems in India. Further, location, proximity to oceans and waterways had greatly impacted the development of urban settlements and transport networks. Railways were the most important infrastructure development since 1850, as railways construction was easy in plains than plateau and mountains. Politically, railways shaped the finances of the colonial government and the Princely States. In terms of the economy, railways played a major role in integrating markets and increasing trade. As the twentieth century progressed, railways became a force for independence and democracy when Gandhi travelled across the country to mobilise the masses for the freedom struggle.

In the light of the above stated argument it becomes important to understand if trade and transport always facilitate economic development of a region or merely remains a medium for exploitation of domestic and human resources for developing the better world? The story of development of railways in India shares the twin view of exploitation of local resources and facilitators of regional development. Introduction of Indian railways is associated with many functions of the unity of British Empire, welfare of the people and the steady flow of external trade across the country. One set of scholars described it as a wheel of economic and regional development; whereas others see it as a tool to exploit local resources and spreaders of the bubonic plague, famine, and general roguery.

Literature related to railways in terms of travel diary exists in large number. However, socio-economic impact of Indian railways has been studied by few scholars only. Though, data on railways has always been there in the government record, but studies on railways are limited in numbers. In the year 1906, Huddleston (a railways official) wrote, 'The History of the East Indian Railways' where the idea of connecting Calcutta and Delhi via railways has been elaborated. Hurd (1975) compared average prices and standard deviations of prices across railways and non-railways districts. In railway districts, prices were less dispersed and closer to the mean as compared to non-railway districts. A large body of research has examined the effects of railways on the price convergence. National Book Trust, India also published Indian Railways under India, Land and its People series. M A Rao (1975) has elaborated on the history of railways and its development, where railways has been termed as an empire in itself. Donaldson (2010) shows that inter-district price differences in salt are equal to trade costs because salt is produced in only one district and consumed in many other districts. He then empirically measured trade costs and found that the arrival of railways significantly reduced trade costs, as well as that railroads significantly increased the trade flows. Bagort and Choudhary (2012) focused on the development and organization of the network, the trends in railways performance, the effects of ownership and regulatory policies, and the impact of railways on the Indian economy.

The objective of the paper is to study the history of railway development in India and its implications for economic development, especially urbanisation and industrialisation of a country. It explores the possible nexus between rail density with urbanisation and industrialisation across different regions over a period of time. The study is empirical in nature. It is be based on secondary literature and historical records of Railway Board and Ministry of Railways, Government of India. It applies GIS technique to show spatio-temporal dimension of the development of railways and its implication for the Indian economy. It attempts to answer how the face of Indian Railways has changed during last 160 years? The paper contributes to the existing historical GIS studies by making historical maps related to evolution and development of Railways in India. Besides, it will also compare levels of regional development with increasing railways network in India. It will be also interesting to find out why Bihar remained backward in terms of industrialisation and urbanisation, in spite of good network of Indian railways whereas many other parts of the country experienced high economic growth?

The paper has been organised into six sections. First section starts with the introduction and rationale of the study where objectives and research methodology has been discussed in detail. Second section deals with the political economy of pre-railway era of British India. Emergence of railways and its spread across various regions has been discussed in section 3. Economic development and its linkages with railways is the central theme of section 4. A case study of Bihar in terms of less developed region in spite of high rail density has been dealt in section 5. Conclusion and research gaps comprises section 6.

2. Political Economy of pre-railway era

After the demise of Aurangzeb, Mughal Empire started losing its hold over the political economy of the country. The period between 1707 and 1761 witnessed a resurgence of regional identity that promoted both political and economic decentralization and emergence of colonial power. At the same time, intra-regional as well as inter-regional trade in local raw materials, artefacts, and grains created strong ties of economic interdependence, irrespective of political and military relations due to spread of industrial revolution. Bengal, Bihar, and Awadh in northern India were amongst the regions where such developments were most pronounced. These provinces saw a rise in revenues and also the emergence and increasing affluence of a number of towns served by a long-distanced trade routes. Though the society was predominantly agrarian with very low level of urbanisation, it was able to sustain larger urban settlements. Major concentration of towns with population more

than 50000 was there in the fertile plains of the Ganges. Inland water trade through navigable rivers facilitated trade in towns such as Lucknow, Patna, Cawnpur, Bareilly, Mirzapur, Benarus and Misrhsibad. These towns sustained its masses and integrated with regional and international trade.

It is clear from table 1 that water transport was instrumental in the majority of the towns with more than 0.75 million population. Remaining 15 towns with more than 50 thousand population concentrated in the Gangatic plains namely Allahabad, Farrukhabad, Jhansi, Rampur, Shajahanpur, Meerut, Muttra, Moradabad, and Bhagalpur. Rest of India had only six towns namely, Indore, Tricinapoly, Mysore, Poona, Gwalior, and Srinagar. For the country side trade, mode of land transport was mainly wooden cart or domesticated animals like horse, camel, elephant, bull and donkey. The quality of roads was certainly not that good. In comparison to land transport, water transport network was quite cheaper. However, its service was limited to towns or kasbas situated along navigable rivers or canals. Prior to the railroad age, trading in most parts of India took place on dirt roads. Bullock-powered road transport was costly, seasonal, unpredictable and often damaged goods in transit. Mode of production was mainly dependent on human and animal power. Rural artisans were playing significant role in the local household manufacturing.

Table 1: 20 Major Towns of India, 1850

| Population Size	Water Transport	Land Transport	Total
More than 0.2 million	Bombay, Calcutta, Madras, Lucknow and Patna		5
0.1 million to 0.19 million	Delhi, Cawnpur, Agra, Amritsar, Barielly, Baroda	Hyderabad, Bangalore, Jaipur	11
0.075 to 0.099 million	Surat, Ahmedabad, Murshidabad and Mirzapur		4

Source: Chandler, 1987

3. Emergence of railways and its spread

In 1832, Madras witnessed first proposal for building railways in India, which was not executed. The journey of railways in Indian sub-continent started modestly in 1853 with 34 kilometers. Iron wheels rolled on rails on 16th April, 1853 from Bombay to Thane.

Map 1: Early spread of Indian Railways

Indian Railways Map - 1870

Indian Railways Map - 1909
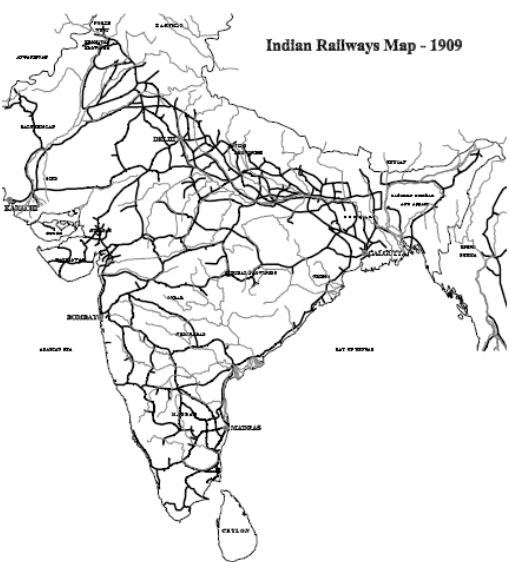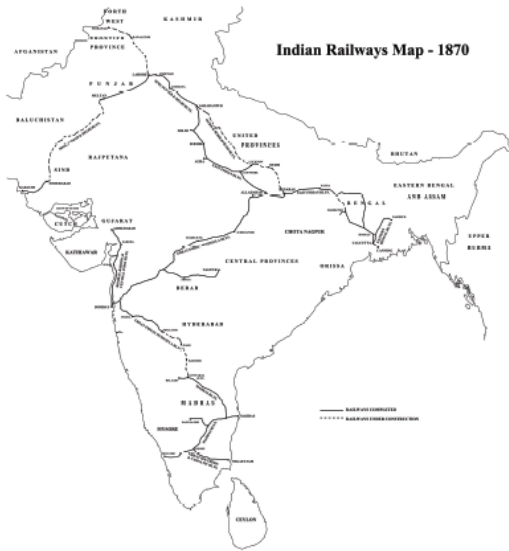
Source: Bogart and Chaudhary, 2012

The Government of India had a strong influence on railways from the beginning, but the government's role increased over time. The first stage of railway development in India was under the guarantee system. Afterwards this system was replaced by policy of State construction and ownership. During 1882 to 1924 third phase of railway development took place, in which state and quasi state agencies and private companies took part, and which was called as modified guarantee system. Railways were partially nationalised between 1880 and 1908 as the Government of India assumed a majority ownership stake in the former guaranteed railway companies. Afghan conflict and First World War along with frequent famine pushed Colonial ruler for rapid expansion of railways. It is clear from map 1 that all old guaranteed railway companies were able to connect four big cities of Calcutta, Bombay, Madras and Delhi by 1870. Building
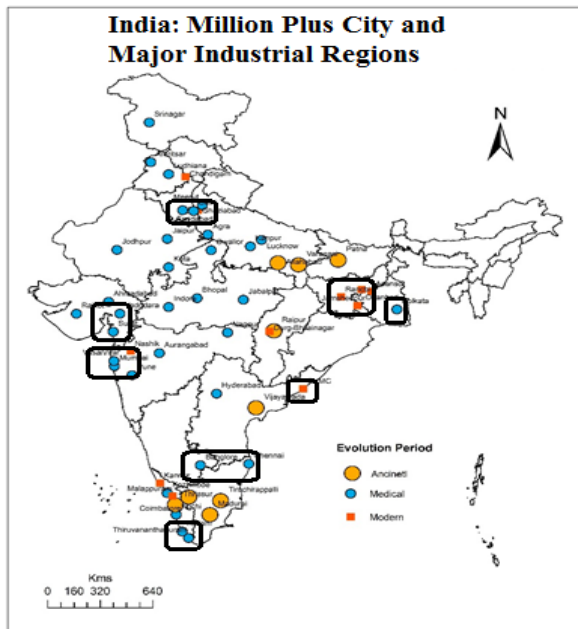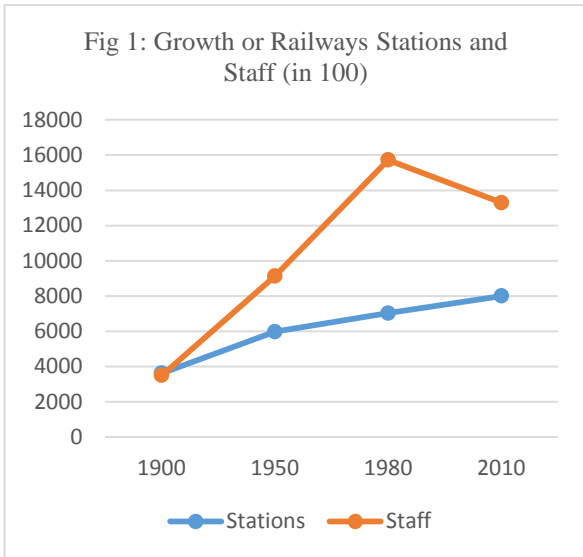
Railways Bridge and railways track construction in the difficult terrain of Chotanagpur and Deccan plateau delayed the expansion process. However, by 1909, railways tracks were constructed in every corner of the country, though rail density was quite high in the Indo-Gangatic and Gujarat Plains.

By 1950, India had a network of about 34,000 miles. In 1948, immediately after Independence, there were as many as 42 different railway systems. The major task for the Indian Railways (IR) was to integrate the above mentioned divided railway system of the sub-continent such as princely state railways, state owned railways and to bring them under one management. The Railway Board in 1950 decided to go for the regrouping of the Indian Railways into six zonal systems to become sixteen railway zones at present. Now Indian railways has made inroads in the hilly states of north-east and Jammu and Kashmir. Konkan Railways is another milestone for building railway track in difficult topography.

4. Railway and Economic Development

Economic impact of railways can be categorised into two broad categories of direct and indirect impact of railways on various sectors of the economy. Indian railways has remained as one of the biggest employers in the country. More than 1.3 million workers are running the huge management of railways. There are around 8 thousand railway stations in the country which serves as the engine of growth for its hinterland. Majority of the large urban settlements are connected with railways, where pace of industrial and other development is facilitated by it. Historians have long argued that national income would have been far smaller in most countries if railways had never been introduced. Hurd (1975) was the first to make a social savings calculation for Indian railways. As the railroad network penetrated into inland regions, it brought them out of near-autarky and connected them with the rest of India and the world (Dolandson, 2010). It appears that railways' primary impact on the Indian economy was to increase inter-regional and international trade. The Indian government paid a lot of attention to profits and freight rates were perhaps not set at the socially optimal level. Ultimately, it seems that railways could have done much better to aid Indian economic development.

Modernization of India's textile industry took place during the early 19th century; the first textile mill in the country was established at Fort Gloster near Calcutta in 1818. A few years later, the first cotton textile mill of Bombay was established in 1854 by a Parsi cotton merchant.

Fig 1: Growth or Railways Stations and Staff (in 100)

Likewise other industrial regions like Calcutta, Gujarat, Bombay, Madras, Southern Malabar and Vishakhapatam-Guntur flourished with integration of railways network. India has 13 minor industrial regions and majority of the Industrial districts like Kanpur, Hyderabad, Agra, Nagpur, Gwalior, Bhopal, Lucknow, Jalpaiguri, Cuttack, Gorakhpur, Aligarh, Kota, Purnia, Jabalpur and Bareilly emerged only because of good railway connectivity. Increased connectivity attracted rural masses in the city and integrated the city with raw materials and finished goods.

5. Railways, urbanisation and industrialisation in Bihar

The economy of Bihar was agrarian and it was part of the Bengal Presidency during early colonial rule. Early European traders entered in the region by using inland water ways through the Ganges. Patna was the major commercial centre whereas there were large of kasbas which were serving as a centre of exchange. Bihar has very low level of urbanisation and industrialisation at present. However, railways contributed a lot to connect agro-based factories. All the sugar mills of north Bihar plains were well connected with the railways. Sonpur is reported to be the largest platform of about 780 metre length, because railway was playing key role in Sonpur's animal fair. Similarly, Jamalpur emerged as the centre of railway engineering.

Map 2: Million Plus Cities and Industrial Regions of India

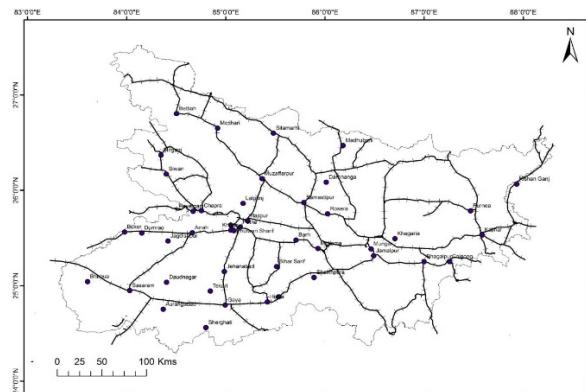Map 3: Railway network and urban growth of towns in Bihar after 1901

Clustering of industries at a particular site leads to the emergence of the major industrial regions, minor industrial regions and industrial districts. Interestingly, major industrial regions of India are situated in and around million plus cities. Delhi NCR Industrial region has four million plus cities namely Delhi, Meerut, Ghaziabad, and Faridabad. It is exception to the industrial location theory, that Indian railways played a significant role in the development of this region where there was absence of local raw material. Chotanagpur Industrial region is located in mineral resource base where million plus cities like Dhanbad, Ranchi, Jamsedpur and Asansole are located. Role of railways was instrumental for the rapid growth of the region in the beginning itself. Rajmahal coal belt was first amongst the initial railway tracks that came into existence.
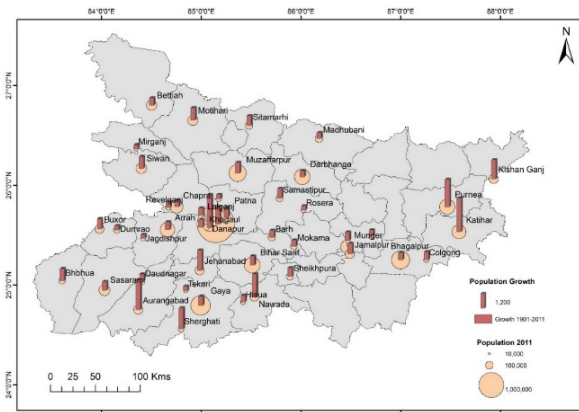
Railway network map of Bihar clearly depicts the presence of three important lines. In southern part, Gaya rail line connects all east going trains of Jharkhand, West Bengal and Orissa, whereas in the central part, Patna-Bhagalpur line is important. In northern Bihar, Barauni line connects north-eastern states. In other words, entire Bihar is well connected with railways. Here the question arises why level of urbanisation and industrialisation is so low in the state? Bihar has 199 towns with 11 percent urban population. Historically, the state has remained prosperous, but today it is categorised as state with chronic poverty and massive out-migration. Railways connect the rural masses with large cities which absorbs unskilled labours of Bihar.

6. Conclusion

Indian railway leaves its imprint on every walk of life, all sections of the society. It promotes entire economy with more focus on the sectors like trade, transport and tourism. It is referred to as lifeline and unites the diverse country by keeping together the social, economic, political and cultural structure. Indian railway played a significant role in the process of early urbanisation and development major industrial regions of India. First four metros namely Calcutta, Bombay, Madras and Delhi registered rapid growth by increased railway connectivity. Railway has no doubt succeeded in establishing inter-regional, inter-sectoral and rural-urban linkages and providing effective transportation support during wars and natural calamities even at short notice. An analysis of Indian railway during pre and post-independence period would reveal some interesting facts that regional disparity of India is also due to transfer of mineral and human resources to the better off regions. Mineral resource rich tribal belt of Central India could not witness balanced growth but it has always experienced in-migration in the cities. Similarly, all the mega cities are flourishing due to rural urban migration from the backward Hindi belt especially Bihar and Eastern Uttar Pradesh.

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"Personality" of Socio-economic Development in modern Egypt

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Abstract: The image of Egyptian society as a hydrologic society, which is characterized by centralized management of water, high land reclamation, intensive labor agriculture, systematic crop rotation and so on, is the image that was created after World War Ⅱ, when the transition of irrigation system from natural (basin) one to artificial one was achieved. However, it is a just image that turns our eyes away from the historical transformation and the variety of agrarian life in Egypt through history. In fact, today's "personality" of rural Egypt was formed in the process of modernization and colonization in modern times since the beginning of 19th century. This presentation aims to follow the formation of the Egyptian "personality" concerned, based on historical statistics and geographical information. GIS is useful to link the two kinds of data and information. Egypt is a suitable field for the research of historical and spatial analysis on this issue because of two reasons. The first is the uniqueness of Egyptian geographical and ecological features as a hydrologic society, on which many historical strata have been piled up. The second is the relative abundance of statistical data and geographical information. The main subject of the presentation is to show the social change of Egypt at the end of 19th and the beginning of 20th centuries by using population census database by smallest administrative unit (shiaykha, nahiya/qarya).on 1897, 1907, 1917, and GIS maps, which indicate the Egyptian social and economic situations in at that time, focusing on population change.

Keywords: Egypt, demographic trends, social change

1. Introduction

Today's agrarian society in Egypt is imaged as a hydrologic society, which is characterized by centralized management of water, high land reclamation, intensive labor agriculture, systematic crop rotation and so on. This is an image that was created after World War Ⅱ, when the transition of irrigation system from natural (basin) one to artificial one, which will be discussed below, was achieved.

However, it is a just image that turns our eyes away from the historical transformation and the variety of agrarian life in Egypt through history. In fact, today's "personality" of Egypt was formed in the process of modernization and colonization in modern times since the beginning of 19th century.

The term of "personality" is borrowed from Gamal Himdan's monumental book named *The Personality of Egypt.* Gamal Himdan was a famous Egyptian geographer, who had researched the characteristics of his home country, Egypt, through his life, whose research for a long time resulted in a marvelous book mentioned above.

In Himdan's opinion, the "personality" of the land is formed of two aspects, the *site* (*al-mawdi`*) and the *situation* (*al-mawqi`*). He says,

> The *site* means the circumstances that have in themselves the characteristics, the scale and the sources peculiar to the land, such as, for example, the circumstances of river flood and the forms of valley, while the *situation* is the relative characteristics that are regulated by the relationship between the region concerned and the distribution of land, population and product goods, and are conditioned by the inner and outer relations of the region concerned. ・・・In other words, The *site* is the tangible, inner and native peculiarity to the land, while the *situation* is the directly invisible and geometric thought.

This presentation tentatively aims at tracing the formation of the Egyptian "personality" at the end of 19th and the beginning of 20th centuries, focusing on the demographic trends and the social changes, and linking the statistical data with the geographical information through GIS.

2. Data and Subject to Be Discussed

2-1 Data

Main data and information are the following two. The first is the population census database at smallest administrative unit (shiaykha, nahiya/qarya) on 1897, 1907 and 1917. The second is the GIS maps, which indicate the social and economic situations in Egypt at that time. Egypt is a suitable field for the historical research using GIS, because of the relative abundance of statistical data and geographical information, especially after the British military occupation of Egypt in 1882, which was the starting point of systematic collection of statistical data and geographic information.

2-2 Subject to Be Discussed

Egypt has geographical and ecological features as a hydrologic society, on which many historical strata have been piled up. Therefore, a kind of the correlation between the environments, distribution of resources, and social changes can be observed in spite of the regional diversity.

3. Environmental Changes and Demographical Trends in Modern Egypt

3-1 Environmental Changes

The environmental circumstances were drastically transformed in modern Egypt by the change of exploitation of water resources as a result of the transition of irrigation system from natural (basin) one to artificial one, as shown in the following two maps. The banks that had previously surrounded the cultivated lands (basins) to protect them from floodwater were destroyed and these lands were subsequently converted into small units of land for cultivation.
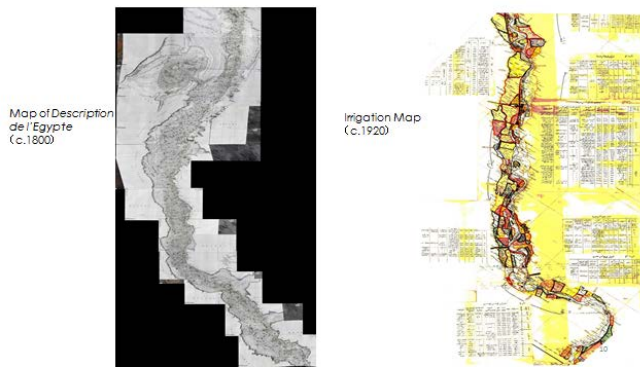
Figure 1 Irrigation system in Upper Egypt in c.1800 and c.1920

3-2 Demographical Trends and Distribution Maps of Settlements in Modern Egypt

The transition to an artificial system of irrigation in the 19th century resulted in a significant change in the layout of the Egyptian countryside. Before the 19th century, the geographical location of a settlement in Egypt was determined by one simple condition: it required an elevated location (hill) that remained above water when the Nile flooded, which occurred regularly once a year.

But, after the transition of irrigation system, hamlets began to be constructed on the cultivated lands since these were no longer flooded by the Nile. In addition, hamlets appeared especially on the lands that were reclaimed after the 19th century in the area bordering the desert, where large farms for commercial crops had developed. Thus, many new hamlets were born.

The number of hamlets increased rapidly with the demographic expansion, and rendered the landscape of the Egyptian countryside drastically different from that before the 19th century. The map shows the changes in the number of settlements and in their distribution patterns against the background of the transition from natural to artificial irrigation and the demographic trends.

Figure 2 Population and number of settlement in modern Egypt

Figure 3 Distribution of settlement in modern Egypt in the 1800s, 1900s and 2000s

4. Egypt and Cairo between 1897-1917

4-1 Indicators Available in the Population Census Database by Village

This section is based on the population census database by village in 1897, 1907 and 1917. The beginning of 20th century is the important period for the social and econnomic history in modern Egypt from the viewpoint of source materials, when many kinds of statistical data were collected all together.

Especially, 1907 is the year when many kinds of census and statistical survey were done along with the population census, so that it is a suitable one as a benchmark year for the time series analysis. The information available in three population censuses at the smallest administrative unit, that is village for rural areas and town (*nahiya/shiyakha*) for urban areas, are, for example, as follows.

1897
1. Population by sex
2. Occupied houses
3. Household size
4. Literacy by sex
5. Population by nationality
6. Population by religion
7. Number of villages
8. Number of camps

1907
1. Population by sex
2. Occupied houses
3. Household size
4. Literacy by sex
5. Population by nationality
6. Population by religion
7. Bedouins

1917
1. Population by sex
2. Occupied houses

3. Household size
4. Literacy by sex
5. Population by nationality
6. Population by religion
7. Marital status

In this presentation, we try to deduce some implications for the social changes of Delta region and Cairo at the beginning of 20th century, focusing on demographic issues, by combining the results of statistical analyses, based on these indicators, and digitalizing them in maps GIS.

The indicators mainly used in this presentation are the population growth (see Figure 4 and Figure 5), the population by sex, the literacy by sex, the population by religion, the bedouin proportion, and so on. The main aimes in it are to firstly examine the regional differences in Delta region and Cairo from the demographic point of view, and secondly point out some factors, which influenced the regional differences, especially the changes of residential patterns of some social categories.

beginning of 20th century?

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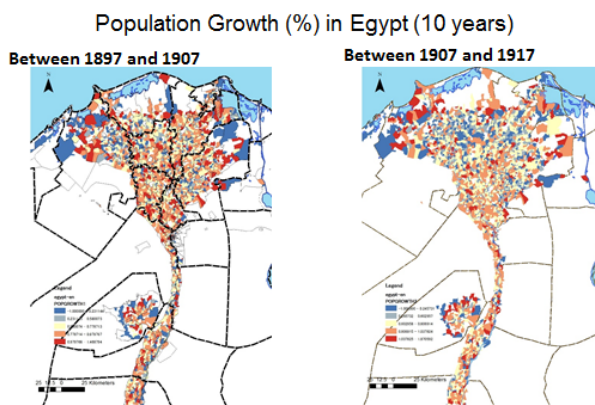
Figure 4 Population growth in Delta region every 10 years in 1897-1917
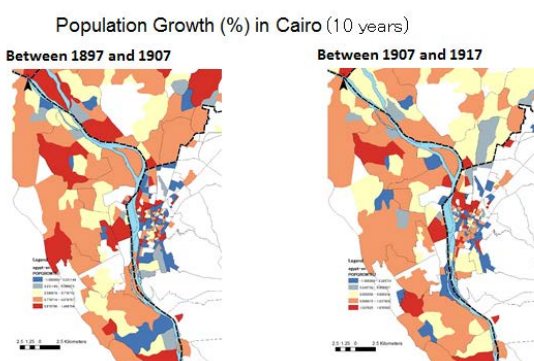

Figure 5 Population growth in Cairo every 10 years in 1897-1917

The points of discussion are the following two. As for Delta region, when the regional categories of the central and peripheral regions was formed? And as for Cairo, what are the factors which caused the residential segment in Cairo at the

Ethno-demographic structure of Russian Turkistan:
A historical GIS case study of Ferghana Province

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Abstract: This study tries to reconstruct the demographic and economic history of the Ferghana region from a new point of view using Historical GIS, based on statistical data collected by the Russian authorities and by the Soviet authorities. The Ferghana region became an intensive cotton-planting region and the economic center of Russian Turkestan after the destruction of the Kokand Khanate in 1876. The historical investigation of Central Asian household composition is important not only to historian but also to sociologist, economist, and ethnologist because the rapid population increase in Soviet Central Asia mainly after 1960s has been related to "large undivided patriarchal family." But such "large family" is not axiomatic character of Central Asian native society and the historical formation of demographic turn after WWII is necessary to investigated with historical sources. Thus this study tries to reconstruct the household composition and ethnic characteristics in the Ferghana region up to 1920s in order to suggest demographic dynamics before the full-scale Sovietization such as total collectivization in early 1930s.

Keywords: demographics, ethnicity, household, Central Asia, Ferghana

1. Introduction

This study tries to reconstruct the demographic and economic history of the Ferghana region from a new point of view using Historical GIS, based on statistical data collected by the Russian authorities and by the Soviet authorities. Historical GIS is an information technology allowing various pieces of information about one region to be integrated by location codes. It makes possible a more precise statistical analysis of a given historical subject.

The Ferghana region became an intensive cotton-planting region and the economic center of Russian Turkestan after the destruction of the Kokand Khanate in 1876. The Ferghana Valley was the most densely populated zone in Russian Turkestan. The Russian authorities made statistical investigations of the population and the economy of the Ferghana Valley just after the annexation. These statistical investigations are highly significant for a historical survey of the Central Asian socioeconomic situation.

The historical investigation of Central Asian household composition is important not only to historian but also to sociologist, economist, and ethnologist because the rapid population increase in Soviet Central Asia mainly after 1960s has been related to "large undivided patriarchal family." But such "large family" is not axiomatic character of Central Asia and the historical formation of demographic turn after WWII is necessary to investigated with historical sources. Thus this study tries to reconstruct the household composition and ethnic characteristics in the Ferghana region up to 1920s in order to suggest demographic dynamics before the full-scale Sovietization such as total collectivization in early 1930s.

2. Population change and household size in the Ferghana region

The population of Ferghana Province as of the 1890s was unclear, although various statistical materials were compiled. As S. Abashin wrote, Russian authorities could not determine the population of Ferghana Province. It might have increased from 1876 to 1897, but the precise increase could not be calculated (Abashin 2012).

From 1897 to 1914, the population of Ferghana Province increased from 1,572,214 to 2,190,424. It is noteworthy that the population increase rates of Kokand County and Osh County were lower than the expansion of irrigated land (Table 1). In Osh County, rain-fed cultivation expanded in that period, and the area of rain-fed farmland planted in 1914 was larger than irrigated farmland. On the other hand, the area of rain-fed cultivation in Kokand County was much smaller than irrigated farmland. From this analysis, we would expect to see a decline in farmland in Kokand County. We will examine this hypothesis later in relation to the change in household size.

Table 1. Irrigated land and population from 1895/97 to 1914 (%)

	Irrigated land change from 1895 to 1914 (%).	Population change from 1897 to 1914 (%).	Percentage of irrigated plamtation in 1914 (%)
Margilan County	168.5	152.4	90.3
Kokand County	113.9	137.1	96.9
Andijan County	135.6	128.7	79.9
Namangan County	213.7	135.2	86.3
Osh County	94.2	151.3	44.9

Source: *Статистический обзор Ферганской области за 1895 г. и 1914 г.,* 1896 and 1917, *Первая всеобщая перепись населения Российской империи, 1897 г., LXXXIX, Ферганская область,* 1904.

The outbreak of World War I put an end to a population increase in Ferghana Province. The impact of World War I destroyed the economy of the Russian Empire, including Russian Turkestan. The 1916 revolt in Turkestan also started in the context of socioeconomic disorder in World War I (Ueda 2013). After the Russian Revolution, the Ferghana Valley suffered civil war between the Red Army and the Basmachi movement. From 1917 to 1920, when the civil war spread throughout Ferghana Province, all counties (уезд) experienced a population decline (*Статистический ежегодник 1917–1923 г. г., Т. 1, Ч. 3.* 1924: 20–25, *Отчет Ферганского областного*

The 1907 survey of Ferghana Province started recording average household size, and it continued until 1914. The average household size of Ferghana Province increased from about 5.6 to 5.8 people in this period. The average household size of the province and that of the rural districts fell drastically from 1917 to 1920, from about 5.5 to 5.0 people. The economic disruption of World War I and the 1916 revolt probably influenced the decline in household size. After 1920, the household size of the rural districts decreased further until 1926, falling to fewer than four people. The main causes of this decline might have been the intense civil war and the severe famine that caused massive death by starvation (Figure 1).
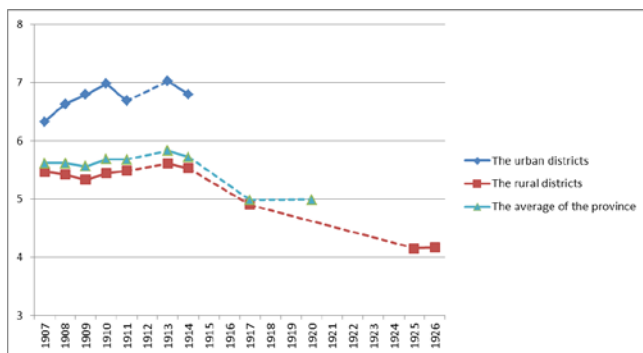
Figure 1. Household size in Ferghana Province

However, the data of 1925 and 1926 only covered the area of Uzbekistan, so comparisons with earlier data encounter several problems. Thus this study tries to analyze the change in household size in more detail by using GIS.

Figure 2 suggests the household size of each district in 1908, 1917, and 1925 as a column graph. The decrease in household size can be observed in most districts. The ranges without columns indicate a lack of data.

Figure 2. Household size in Ferghana Province in 1908, 1917, and 1925.

Next, this study prepares another multicolored GIS map from the same data sets to investigate quantitative data more directly. A triple circle suggests household size in 1908, 1917, and 1925. The outermost circle refers to the data of 1908, the middle circle those of 1917, and the innermost circle those of 1925 (Figure 3-1).
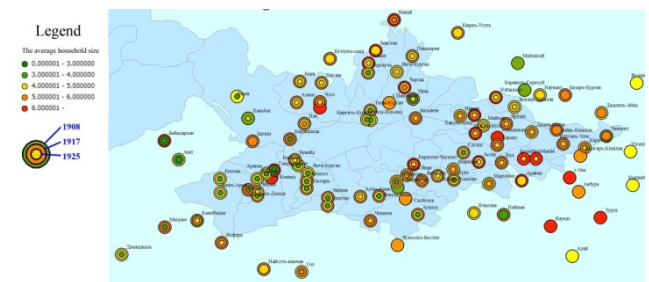
Figure 3-1. Household size in Ferghana Province in 1908, 1917, and 1925.
Source: Same as Figure 2.

From the household size of 1908, we can observe that the areas where the household sizes were more than six people, apart from Kokand city, were mainly distributed in the eastern part of the Ferghana Valley, especially in the area around Andijan city and from the north bank of the Syr Darya to Nanay. On the other hand, in the Sox river delta and the Isfayram river delta, where Kokand city and Margilan city are located, the household size of most places except Kokand city was smaller than in the eastern and northern areas. In these areas, the household size had already been somewhat small before the outbreak of World War I. As mentioned above, the expansion of irrigated land in Kokand County from the mid-1890s to 1914 was slower than the population increase. This might be one reason for the small household size in the Sox river delta (Figure 3-2).

Next, in the comparison between 1908 and 1917, the fall in household size in the north bank of the Syr Darya and the area around Andijan city is remarkable. The average household size of most districts in the Ferghana valley was between four and five people (indicated in yellow) by 1917 (Figure 3-3).

Comparing the data for 1917 and 1926, we can observe that, in most of the districts in the Sox river delta, the Isfayram river delta, and the area to the west of Namangan city, the average household size fell below four people. Such a drastic change in household composition could only be explained by the great famine that peaked in 1923 and the severe civil war from 1918 to 1925 (Figure 3-1).
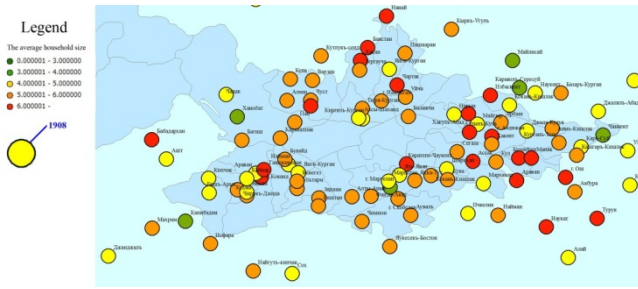
Figure 3-2. Household size in Ferghana Province in 1908.
Source: Same as Figure 2.
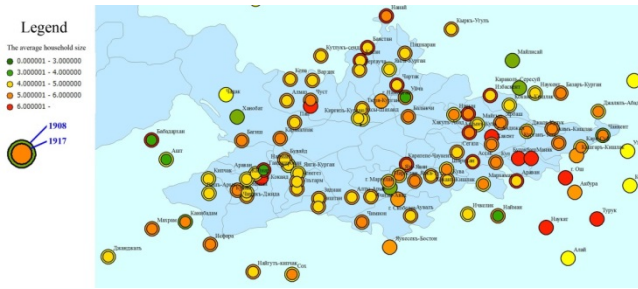
Figure 3-3. Household size in Ferghana Province in 1908 and 1917.
Source: Same as Figure 2.

By analyzing the 1926 census by GIS, it is possible to reconstruct the distribution of household size by village level. The small household size in the Sox river delta is also confirmed on Figure 4-1. Figure 4-2 suggests that the residents of these villages was mainly Uzbek; it is also characteristic that the household size in the Tajik villages in the Sox Valley was larger than in other villages.

The general tendency of the distribution of household size continued from 1908. In other words, the average household size of the north bank of Syr Darya and the area around Andijan city was larger than in other areas in the valley (Figure 4-1).
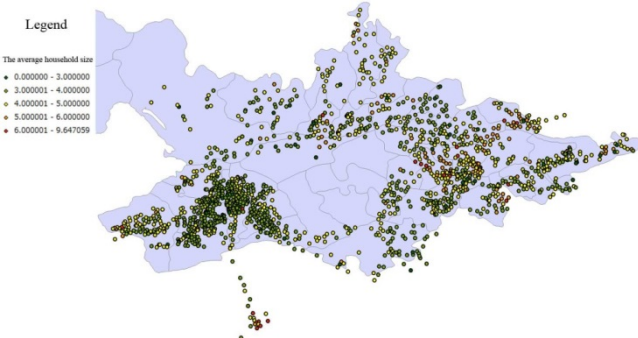
Figure 4-1. Household size in Ferghana Province in 1926.
Source: Inagamov 1948.
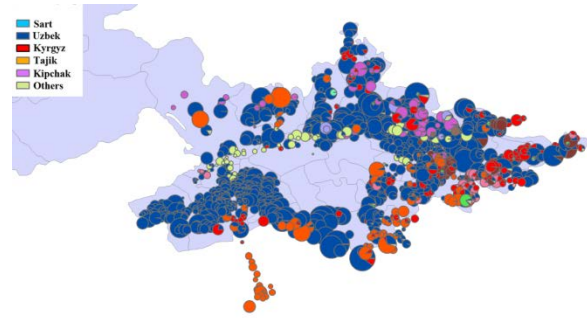
Figure 4-2. Ethnicity in Ferghana Province in 1926.
Source: same as Figure 4-1.

The 1970 census suggests this difference might disappear in the Soviet period. The average household size in the rural area of Fergana Province including the Sox river delta and Isfayram river delta was similar to those of Andijan Province and Namangan Province.

The average household sizes of some villages on the Sox river delta fell below three people. This shows the enormity of the damage from war and famine.

How did the population decline relate to the decline in household size? Figure 8 shows data for 74 districts containing the population data or the household size in both 1917 and 1926. As stated above, in some districts the population increased in wartime. In these districts, however, the household size declined in general. The drastic change of household composition was a more universal phenomenon than population decrease in the villages of Ferghana Province (Figure 5).
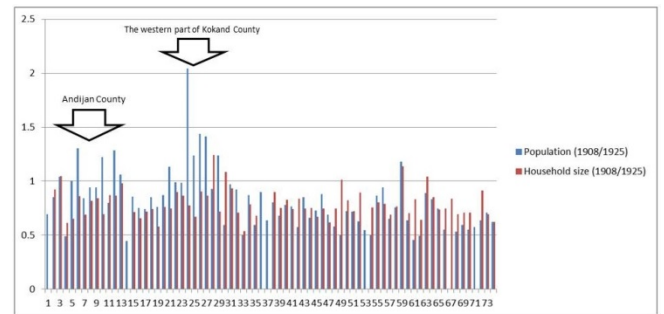
Figure 5. Population change and household size change.
Source: *Список населенных мест Ферганской области*. 1909., *Список населенных мест Узбекской ССР и Таджикской АССР, вып. 3, Ферганская область*. 1925.

3. Gender ratios by ethnicity in Ferghana Province

Figure 6 presents the average ratio of women to men in the province, that of urban population and that of rural population on the left side, and after that each ethnicity's ratio is arranged according to total population. Generally, the female ratio of the urban population was lower than that of the rural population.

Today we do not have enough time to analyze all characteristic ethnicities in this table. In general, most ethnicities with a gender ratio bias as Russian, Tatar, and Armenian, lived mainly in the cities, and these biases can be partly explained by their urban circumstances (Figure 6).
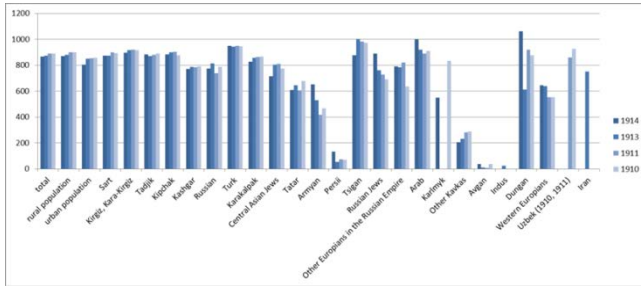
Figure 6. Gender ratios by ethnicity in Ferghana Province
(female population/male population x 1000)

Source: *Статистический обзор Ферганской области за 1910−1911 гг. и за 1913−1914 гг.,* 1909−1914 and 1916−1917.

Figure 7-1. Kashgars in Ferghana Province in 1908
Source: *Список населенных мест Ферганской области,* 1909.

Figure 7-2. Uygurs in Ferghana Province in 1926
Source: Inagamov 1948.

But the Uygur population was located mainly in rural districts, and their gender ratio bias is worth analyzing separately. This tendency of the gender ratio bias might have continued until the 1920s. The rural survey of the villages in Aravan District in 1925 recorded that the female/male ratio of the Uygurs was lower than that of the Uzbeks and the Kyrgyz. The gender ratio bias of Uygurs might have resulted from the fact that many male traders or laborers came from Xinjiang without their families, and there was a relatively high ratio of first-generation immigrants.

In the demographics of the Ferghana Valley, the population influx from Xinjiang was one of the most important factors. In particular, a series of massive immigrations from Xinjiang to the Ferghana Valley took place from the 18th to the 20th century in reaction to political events.

Before the 1917 Russian Revolution, many Uygur laborers crossed the Qing-Russian border every year and worked on cotton fields and coal mines. Some laborers from Xinjiang settled in the Ferghana Valley.

By using GIS, we can reconstruct the distribution of immigrants from Xinjiang who were identified as Kashgar or Uygur. Figure 7 shows that they settled the eastern part of the Ferghana Valley. Figure 7-2 also suggests that the Uygur villages concentrated around Asaka in particular in 1926.

The toponomastic analysis shows villages named Kashgar or Taglik located not only in the eastern part of the valley but also in the Sox river delta, where Uygur ethnicities were not counted in the 1897, 1908 and 1926 censuses (Figure 10-2, *Первая всеобщая перепись...,* 1904: 60). Earlier studies suggest that immigrants from Xinjiang occupied important political positions in the court of the Kokand Khanate (Beysembiev 1987: 80, 105–108). The political status of Uygurs in the Kokand Khanate might correlate to the immigration in the Sox river delta, including the city of Kokand. The residents of these villages in the Sox river delta were counted as Sarts in 1908 and as Uzbeks in 1926. This suggests that the immigrants from Xinjiang were quickly assimilated to the neighboring settled Muslim population.
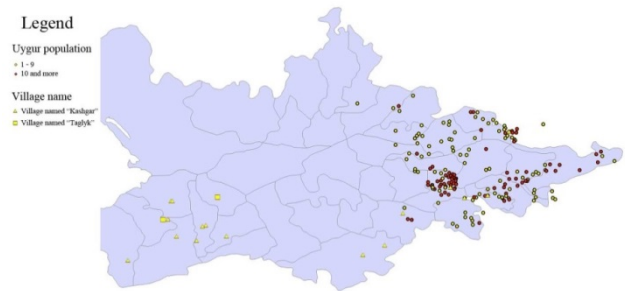
4. Conclusions

This study analyzed the ethno-demographic history of Ferghana Province up until the 1920s using Historical GIS. By analyzing household size, the distribution of household size in the valley and the relation between small household size and the stagnation of irrigation construction on the Sox river delta were clarified. The fall in household size was a more universal phenomenon in the valley than population decrease. It suggests the ubiquitous influence of the civil war on household composition in the valley. From 1908 to 1926, the average household size of the north bank of the Syr Darya and the area around Andijan city was larger than in the Sox river delta and in the Isfayram river delta. The 1970 census suggests this difference might disappear in the Soviet period. These results would give reliable base to future investigation on Central Asian demographics.

Concerning the gender ratio biases of ethnicities, this study suggests that among urban newcomers, the male ratios were clearly higher than for other major ethnicities, including the Sarts. This study also suggests that the high ratio of males among Uygurs who lived mainly in rural districts was caused by their relatively recent immigration and the inflow of male laborers. Some sources suggest that the gender ratio biases among each ethnic group persisted until the 1920s. This issue needs to be investigated more precisely in the future by incorporating other historical sources.

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Merchant's Migration and Typologies of Development inIndia: A Historical Perspective from Shekhawati Region

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Abstract: A quarter of the Indian names in the Forbes billionaires list are from the Marwari community. Marwari's from Shekhawatiregion(Rajasthan) are settled all across India and dominated the 'bazar' economy of north India for centuries. One group of Marwari's moved east with the Mughals and establishedbusiness along Ganga-Jumuna valley as also in Bengal. Later, they becamefavourite partners of East India and Dutch companies. Various rulers competed to get merchants to move to their territories. This competitionoften took the form of tax exemptions, including exemption of octroi, a duty on the intercity transport of goods. Shekhawatiregion continues to be a backwater and off the beaten path, despite their backwardness, towns have benefited from their historic role.

This study integrates socio economic datasets pertaining to Jhunjhanu district, part of Shekhawati region from 1961 to 2011 with information about population, occupation, caste, literacy to represents development over geographical space and timeusing geographical information system. And to further understand socio-political and economic development, this study exploresreferences from encyclopaedias, historical/geographical gazetteers and historical archives. It mapspeasants' movements, influence of various feudal chieftains to articulate and understand the historical and political situation. Thus, this study articulates and document the native towns from which communities migrated, development in Shekhawati region over periods of time and factors that led to migration of merchants in late eighteenth to harness the opportunity of rapid commercial growth, especially to those regions where competing trading groups were less organised and capital scarce.

Keywords: Social formation, mode of production, merchants migration, peasants movements, geographical information system, typologies of development

1. Introduction

The study of social formation of Shekhawati aims at the analysis of this complex situation talking into consideration the village community and its dynamics on the one hand, and the dominant mode of social relations on the other, and also keeping in view the regional social formation. But we also need to examine the concepts of caste, feaudalism, mode of production and buissness networks and peasantry, a dicourse on the notion of the social formation is in order[1].Along sideits important to analyse how villages have concomitantly been deserted by the erstwhile upper caste privilaged families and those who benefited from feudal structure and continue to leverage on existing networks during colonial period. Priests, moneylanders and salaried employees were significant groups. They were on the side of the landlords. Brahmins in India were privalaged as they did not pay taxes, and the pronces landlords received half the income from the lands of others (peasants). Thus nexus between the priest and the prince (caste and power) subjugated the cultivators (pesants and tenants) to the level of 'serfdom'[2].

2. Structure and mode of production in Shekhawati

No complete list of the *thikanas* and *jagirs* of Shekhawati is available. Generally, one finds refernces about the thikanas of Sikar, Khetri, Mandawa, Nawalgarh, Bisau, Surajgarh, Dundlod, Mukandgarh, Alasisar, Malsisar, Udaipurwati, Khandela, Amarsar, Fatehpur, Jhunjhanu, Manoharpur and Shahpura. The formation of *thikanas* in Shekhawati was charcterised by a well worked out gradation. Sikar, Khetri, Patan and Bisau were ranked as thikanas of the first category. Their relatios with state of Jaipur were comparable wih latter's relaions with raj. In second category were the thikanas of Nawalgarh, Dundlod, Mukandgarh. Alsisar, Malsisar and mandawa. The *thikanas* of Hikha, Dabari, Sultana, Chankari, tani, Gangisar, Balria and Ponkh were incuded in the third category. These thikanedars had differntial status and access to the ruler of Jaipur. They were also not uniform in terms of size, revenue or power enjoyed.

Shekhawati has a three-tier administration set up: 1. the *thikanedari/jagirdari*, 2. the Jaipur Raj, and 3. the Brish Raj. The first two were generally involved in an ongoing conflict, the Jaipur raj claiming its sovereignty over the thikanas, and the *thikanas*clamouring for autonomy. The bristish were always there to arbitrate between the two. The *thikanas*insistded upon levying taxex as they claimed antonomy in their internal affairs. They asserted that the khiraj paid to the Jaipur barbar was based on kinship rather than sovereignty of the durbar.

Tod gives 10,000 square miles where as in others accounts it is reported as 3500 or 5400 sq miles, there are different estimates of the total area of Shekhawati. According to the census of 1891 the population of Shekhawati was 4,88,917, and it rose to 6,01,814 according to 1941 census. The 1941 census reports the population to be 7,33,141. After 1941 one does not find Shakhwati as region in official records or in census reports. According to the 1941 census the population of Sikar thikana was 2,61,356, and that of Khetri was 1, 75260. Sikar consisted of 430 villages with an annual income of seven lakhs, where asKhetri had 258 villages with an annual income of five lakhs.

[1] Sharma, K.L, Caste , Feudalism and Peasantry: The Social Formation of Shekhawati, Manohar, 1998
[2]Cutler,Antonu et al., Marx's Capital and Capitalism Today, Vol.1, London: Routlege& Kegan Paul, 1977, pp.230-1

Table 1: Census data from 1961 to 2011

	Code	2011			2001			1991			1981			1961		
	S-dist	Town	Village	Total	Town	Village	Total	Town	Village	Total	Town	Village	Total	Town	Village	Total
Jhunjhunun	487	7	271	278	4	271	275	4	270	274	4	207	211	4	206	210
Chirawa	488	4	212	216	4	204	208	4	203	207	5	164	169	4	164	168
Buhana	489	1	137	138	0	126	126									
Khetri	490	3	103	106	2	85	87	1	202	203	2	191	193	1	193	194
Nawalgarh	491	2	109	111	2	88	90	2	71	73						
Udaipurwat	492	1	94	95	1	81	82	1	81	82	3	130	133	3	134	136
JJN	Total	18	**926**	**944**	13	**855**	**868**	12	**827**	**839**	14	**692**	**706**	12	**697**	**709**
JJNSDI			926			855			827			689			694	

The territory now known as district of Jhunjhanu was a Nizamat under the erstwhile Jaipur estate and was madeup of what once used to be called the thikana of Khetri, jagirs of Bissau, nawalgarh, mandawa, Dundlod and Udaipurwati region of Bhomias. In 1949, the princely state of Jaipur also merged in the united states of Greater Rajasthan. The total population of the district in 1981 was 12,11,583 and in recently concluded enumeration of 2011 it was 21,37,045.

3. Peasants movements, Feudalism and Social Formation

The feudalism functioned as an over-riding politico-administrative, social and economic formation undermining even the institution of caste. The feudal mode of social relations as a dominant force guided everyday life of the people of Shekhawati region in Rajasthan. Today a remarkable discontinuity in distributive processes and social relations, simultaneous occurence of the processes of upward and downward social mobility and a self-perpetuating process of social transformation could be witnessed in the Shekhawati region. This upward social mobility is discussed and nalysed using census datsets from 1961 to recent 2011.

The farmer movements in the Rajputana States developed in areas like Shekhawat and Marwar, where peasants constituted the predominant rural class and where Rajputs, the traditional landed aristocracy, were also found in large number. The movements became most highly organized and their activities most intense in areas ruled by jagirdars (large landlords) rather than in those under the direct rule of the royal house (khalsa). This confrontation against a single local caste which monopolized the instruments and symbols of social and economic status and power was important in kindling the peasants movements and in initially forging their cohesion. The peasants movement in Shekhawati differed from its Jodhpuri counterpart in impetus, organization and political strategy. The initial objectives and mobilization, however, were quite similar. The early phase of the Shekhawati movement was primarily devoted to instituting social reforms within the community.

Shekhawati-Center of Peasants movement in Rajasthan

Jaipur princely stste was controlling three-tier feudal structure for levying and collecting various taxes over peasants.The nature and form of taxes was exploitating, inhumane and erratic (*lag-bagar*).Shekhawats, a clan of Rajputs captured land in north eastern Rajasthan with the help of Jaipur state from Khamkhanis in 18th century. In 1793 Rao Devi Singh controlled over Khalsa villages of Sikar region. Peasants movements against the aristrocratic rulers started in 19th century.

1. Mass movement against atrocities and heavy taxes
2. Its took shape of class struggle and efforts of harressed and marginal classes.
3. SardarHarlal Singh, Laduram Kisari, Choudri Ghasiram and Com. Trilok Singh were tasked with spreading awareness about rights
4. Major bloodshed of farmers in Khudi. Chieftans were against social equality and levied heavy taxes.
5. Sikar Peasants movement in 1922. Second phase from 1923-35. Khudi and Kundan bloodsheds
6. 1925-28 land survey and land consolidation
7. Religious and social reforms; Sir Chotu Ram and Pushkar conference in 1925
8. Economic and social reasons for peasants movement;
9. Farmers struggle and mass movement 1920-1930 in Jhunjhanu district. Chirawa Seva Samiti.

10. Uprising in villagers in 1925 of Hanumanpura, Bhakhtavarpura, Devroad, Bhamarwasi and Sangashi.
11. All India Jat Mahasabha, Jhunjhanu February 11-13, 1932. Farmer leaders Radhavallbh, Choudhri Ghasiram, Sardar Harlal Singh, Netram Singh Gorir, Ghayaliram
12. Peasants movement 1930-1940. Major events at Trilokpura ki Dhani, Hanumanpura on May 16, 1934, killing of farmers at Jaisinghpuraon June 30, 1934, Ranoli, Mahensar, Alsisar, Lolri ki Dhani
13. Shekhawati Kisan Panchyat 1931-1937
14. Shekhawati Kisan Panchyat was merged in Prajya Mandal in 1938
15. Struggle of Shekhawati Kisan Panchyat in Jhunjhanu in 1939
16. Prajya Mandal and Congress, Events at Dhudwakhara in 1943, Dabra on March 13, 1947, Kangarh, Raisinghnagar.
17. Farmers killing at Village Pachari Sept 16, 1944.
18. Farmers struggle in Udaipurwati after independence, Ramdev and Karniram was shot dead in 1952 by the Jagirdars of Chanwara.
19. Land reforms act 1956

4. Migration of Merchants and rise of Materialism

The arid, drought-prone lands of Rajasthan are often credited with instilling its banias with practicality and perseverance. But it is the lush, riverine geoculture of Bengal that made this heterogeneous group into Marwaris in the colonial era. The way the community constitutes itself was historically determined by interactions with existing regimes (Mughal, Feudal and colonial) as well as interactions with other communities. Calcutta became the site of numerous antagonisms with Europeans, Bengalis, Muslim merchants and artisans, and reformers/nationalists, all of whom in their turn participated in the evolution of the modern polity of Marwaris. The history of merchant migration out of Rajasthan in the last two centuries and the resulting South Asia wide distribution of caste-based resource networks and communal institutions. In Annals and Antiquities of Rajasthan, James Tod has noted, "The wealthy bankers and merchants of these regions scattered throughout India, are all known under one denomination, Marwarí, which is erroneously supposed to apply to the Jodpoor territory." 3 The ethnonym was also applied externally by local communities (Bengali, Bihari, etc.) to give a name to the upcountry merchant phenomenon. As various upcountry banias (mercantile castes) moved towards colonial seaports and North Indian towns, the ethnonym Marwari came to be extended to include all merchants from the greater Rajasthan area, rather than just banias from the Marwar-Jodhpur region proper. The

broadening of commercial kinship solidarity, which enabled Marwari pre-eminence in native banking and trade, was predicated thus on key shared traits amongst Hindu and Jain banias such as religion, diet, customs, dress, language, jati, and most of all, sākh or social and fiscal credibility. The modern polity of Marwari, then, necessarily comes into being outside and independent of Marwar and indeed Rajasthan as a whole.

The Marwari firms in Calcutta date from the early nineteenth century. In the period from 1810 – 1860, Marwari money-lenders and traders had reached all parts of India, except the south. The next stage in migration, from 1860 – 1914, was an overwhelmingly eastward shift towards Bengal, Bihar, and Assam, where the Marwaris established clear dominance over regional trade and finance.4Anand Yang in his study of markets in northern Bihar details the extent to which the big Bihari Zamindars bid for prosperous merchants to strengthen the market centres under their jurisdication. Colonialism caused the destabilization of existing orders of power and commerce. This had advantages for Marwaris who made inroads into what would have been otherwise saturated and entrenched markets.

Some of the earliest Rajasthani merchantsaccompanied Raja Man Singh during his Bengal campaigns at the end of the seventeenth century. With the decline of central Mughal power and the rise of regional regimes, merchant bankers forged powerful alliances with emerging dynasties of Nawabs (provincial governors), the most famous example being the House of JagatSeth of Murshidabad in Bengal. 5 Oswal Jain merchants of Marwar, who came to be known as JagatSeths, were powerful bankers to the Nawabs of Murshidabad and its suburbs Azimganj and Jiaganj in the first half of the eighteenth century. Fateh Chand was given title of 'Jagat Seth' by the Mughal emperor in 1722. In 1717, fateh Chand took charge of Murshiadabad mint, and from that time onwards controlled a great deal of the money econmy of Bengal. He financed both local rulers and major forign trading companies and was state treasurer, reciving and allocating public revenues. Between 1718 and 1730,the east India company took an average credit of Rs 4 lakh per year from Jagat Seth firm. As late as 1757 they were lending Rs 4 lakh per year to Dutch east India company and Rs 15 lakhs to the franchest India company. They would come to represent a legitimizing tenure in Bengal for Marwaris. In the nineteenth century, subsequent waves of Marwari migrants settled in the marketing centers of Bengal with Calcutta's Barabazar at the apex of a pyramid6. They moved toward the new opportunities offered by the exportable surplus in opium, jute, cotton, and wool, leading Marwaris to the major British controlled ports in India (Calcutta and Bombay), where their 'capture of preeminence', as Thomas Timberg puts it, was due to their superior banking connections, availability of resource groups, and poorly organized competition. From the middle of the nineteenth century, they were in intense competition, but also engaged in collaboration and

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3 James Tod, Annals an Antiquities of Rajast'han, Popular ed. (New York: Routledge, [1832] 1914), Vol II, 234.

4Markovits, Pouchepadass, and Subrahmanyam, Society and Circulation, 134
5 J. H. Little, House of Jagatseth (Calcutta: Calcutta Historical Society, 1967).
6Pradip Sinha, Calcutta in Urban History, 1st ed. (Calcutta: Firma KLM, 1978), 260–261.

exchange, with other trading communities and European merchants. This process produced and reified the communal structure and solidarity of the Marwaris, as much as that of their rivals. For over three hundred years, merchant-traders from present day Rajasthan and adjacent areas have migrated to all regions of South Asia as well as parts of Central Asia and Russia,7 in search of new trade and mercantile opportunities.

The general migration and spread of the people who would become known as Marwaris has occurred in a couple of different stages and for different reasons. Successive famines, plagues, wars, and a general dearth of opportunity in the native land caused regular emigrations; this is particularly true of the Shekhawati region.[8] Claude Markovits' 'dry zone theory' offers some insights regarding merchant migration from arid parts of northwest India and the advantages these groups enjoyed. Markovits identifies the 'push factor,' which drove merchants to move from impoverished drought prone areas to seek the wealthy regions of riverine agriculture. The advantages that merchants from 'dry zones' enjoyed over others had to do with experience gained from their position on major land routes to central Asia and the sea routes to the Middle East, through which a massive portion of India's pre-19th century foreign trade passed.[9] Because of the paucity of investment opportunity in land in Rajasthan, merchants were left with surplus capital that would find its application as finance capital in the existing regimes. However during same duration, the thikanas followed normal practice of dividing their estates amongst their sons, which resulted in a large number of smaller states. The fragmentation of states drove many estate holders to banditary and the lawlessness of the area and was major factor that led to the migration of the merchants.

The key advantage of Marwaris was that they could command resources over much larger areas than local rulers and merchant groups, thus making them extremely useful to these new regimes. A long history of political connections with Rajput clans, in various financial capacities, enabled a certain political acumen for these merchants from the "dry zone."[10] The deterritorialization of Marwaris, generations living outside of Rajasthan, lent strategic mobility to the community and capital, giving them an advantage over Bengalis who were increasingly fixed in land investments. When Marwaris began to invest in land, it was more often than not confined to the dense, urban commercial center of the city.

The fact that capitalism pressed Marwaris into a cohesive polity runs counter to sociological theories of Marx, Weber, and Simmel: namely, the claim that any capitalist transformation entails (as cause, consequence, or both) a form of commodity fetishism and objectification of labor that brings about the dissolution of social groups and the creation of alienated individuals.[11]

The experience of Marwari deterritorialization and reterritorialization has never been adequately considered from their perspective and accounts – particularly in terms of literary production. Indeed, as Meenakshi Mukherjee[12] has pointed out, there has been very little work on displaced and migrant communities in India.

5. Typologies of Development after independence

Today a remarkable discontinuity in distributive processes and social relations, simultaneous occurence of the processes of upward and downward social mobility and a self-perpetuating process of social transformation could be witnessed in the Shekhawati region.

Cenus data from 1961 to 2011 is harmonised in GIS environment and further analysis is done across all villages to capture development processes related to shift in ocuppation, litracy, population growth and other locational relationships. After independence, land reforms act was passed in 1954-56 and tennant were given land right. This made them to realise their potenial and peasant class got an opportunity to look beyond farm based activities and got access to education. In mean time electrification of rural areas, incresed farm level productivety and eneabled a major shift in occupation i.e primary to service sector.

Now peasant caste associations and political leaders have been important agents in the politics of Rajasthan. Traditionally tenant farmers (Jats), constitute the largest single caste in the state. Members of the caste have achieved strategic positions of public authority since independence and have dem-onstrated consummate skill in political bargaining and administrative management. Figure 1 represents shift in occupation across rural areas, since there were more people were engaged in agriculture activities in 1961 and one can see that majority of those areas might have shifted to other buisness activities as reflected in 2011 census datasets. On the other hand upward mobility and historical migration of merchants have placed them in helm of corporate affairs, not only at national level, but globally as well. They are the major policy makers and fund raisers for poltical parties.

[7] Scott Levi, "The Indian Merchant Diaspora in Early Modern Central Asia and Iran," Iranian Studies 32, no. 4 (October 1, 1999): 483–512.
[8] Kudaisya, The Life and Times of G.D. Birla.
[9] Markovits, Pouchepadass, and Subrahmanyam, Society and Circulation, 134
[10] Ibid
[11] David West Rudner, Caste and Capitalism in Colonial India: The NattukottaiChettiars (University of California

Press, 1994), 15.
[12] Meenakshi Mukherjee, Elusive Terrain: Culture and Literary Memory (Oxford University Press, 2008).
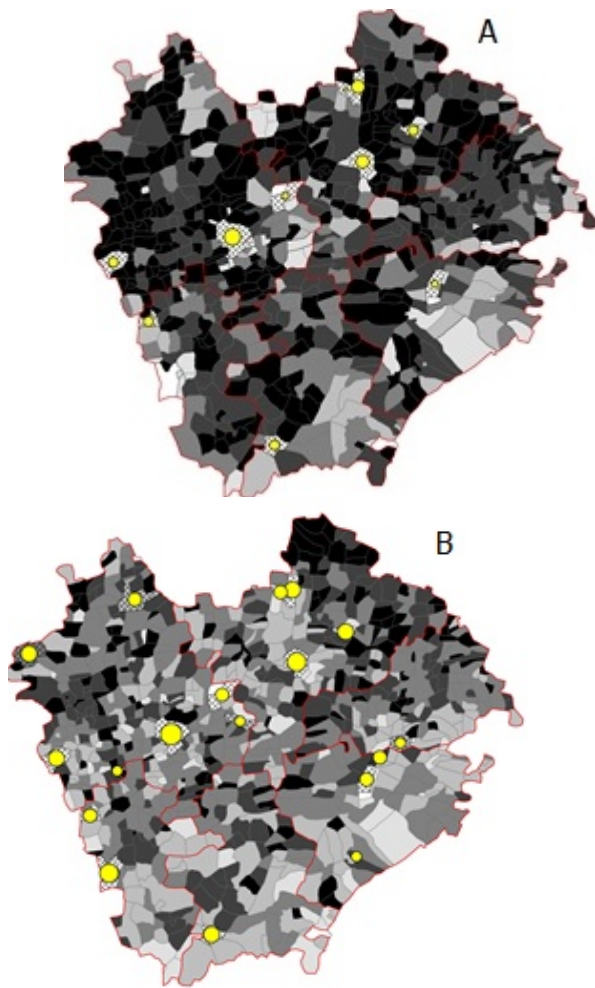
Figure 1: A. Percentage of agricultural workers in 1961 and B. in 2011

More importantly, even though the institution of caste and the social and economic structures sustaining it undergo significant changes, caste has not disappeared. Even in regions where the change in social and economic domains of rural life has been quite impressive and the older order of caste has nearly disintegrated, caste-based divisions and inequalities continue to matter and often overlap with the emergent disparities of the new economy, both rural and urban. The realities of caste in contemporary times are also not exhausted by analyses of electoral politics. Caste matters in multiple ways and in different spheres of social, economic and political life, sometimes visibly, sometimes not so visibly.

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SPATIAL PATTERNS OF MIGRATION IN 19TH CENTURY MANILA: AN EXPLORATORY CHARACTERIZATION OF MIGRANTS IN THE PUEBLOS OF DILAO, MALATE, AND PANDACAN FROM 1881-1895

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Abstract: To properly understand the characteristics of 19th century Manila, it is important to devote time to understanding its population, and in particular, its migrant component since such individuals may bring new skills, knowledge, and practices into an urbanizing area. Drawing from the pioneering work of Doeppers (1998) and focusing on the districts of Dilao, Malate, and Pandacan for selected years within 1881-1895, this paper attempts to provide a more nuanced look at the characteristics of migration in 19th century Manila with the use of baptismal information included in vecindario records as a proxy for place-of-origin. Key descriptors such as place of origin (movement and migration), as well as patterns such as migrant employment, migrant demographics (e.g. age, gender) among others, are explored per district and for the selected study areas via the use of Geographic Information Systems. Such an approach is an attempt to provide a spatial and temporal perspective to its analysis of this population segment of 19th century Manila.

Keywords: Manila, migration, vecindarios, Geographic Information Systems

1. Introduction

The middle to latter part of the nineteenth century has been described as a period of significant socioeconomic and demographic change in Philippine society (Doeppers and Xenos 1998). Widespread areas in the Philippine landscape and its inhabitants were significantly transformed by the increasing focus of its agriculture on the production of commodities for export to the world market (Corpuz 1997, Legarda Jr. 1998). The 1850s to 1890s was also a time of rapid population growth and migration into certain settlements in the country (Doeppers and Xenos 1998).

Perhaps in no other settlement or cluster of settlements were these changes was as evident as in Manila, which has been described as the only urban area (Le Roy 1968) and the center of commerce (March 1899) of the country. Urbanization has been defined as a process wherein an area's inhabitants are involved in non-rural work and where significant populations migrate or move from rural to more urban places (Brunn *et al.* 2008), and there are studies about Manila that describes the said settlement's urbanization using archival demographic data. Doeppers (1998a, 1998b) and Gealogo (2010), in particular, have come up with pioneering work that have attempted to describe and understand the urbanization of Manila by studying civil register records such as the *Vecindario*.

It has been pointed out that the Philippines, in Southeast Asia, has one of the richest sources archival demographic data from its colonial past that has yet to be fully exploited (Doeppers and Xenos 1998; Xenos 2010). As such, this preliminary study, which uses *Vecindarios* records of the Manila districts of Dilao, Pandacan and Malate from three different periods between 1881 to 1895, is an attempt to contribute to the literature on Manila's urbanization process from the demographic perspective. Moreover, this paper also seeks to show a more geographic or spatial analysis of such records by employing Geographic

Information Systems (GIS) approaches in analyzing and representing roughly 31,000 records that have so far been processed.
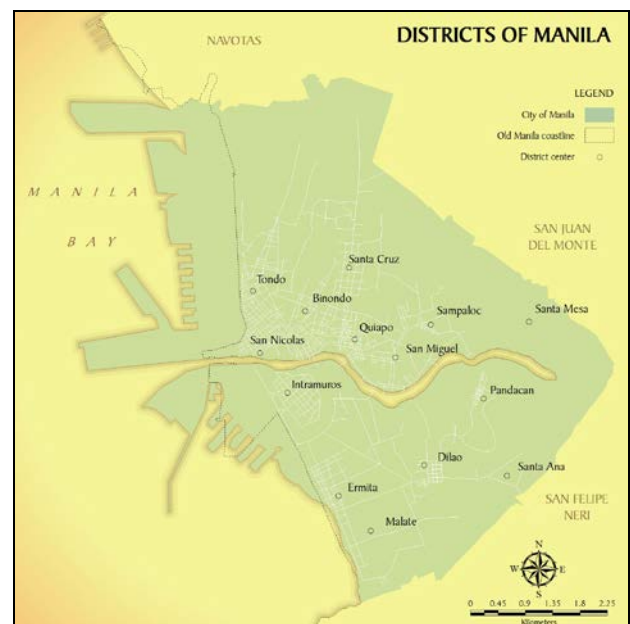
Figure 1. Districts of the City of Manila based on present-day boundaries.

2. Objectives

The main objective of this research is to demonstrate the potential of using GIS as a tool in portraying and in gaining a more nuanced understanding of the characteristics of migration that was recorded in selected districts of Manila from the 1880s to the middle 1890s. While this research is still on-going and the results are still in preliminary form, this paper, nonetheless, intends to describe the similarities and differences in the

migration patterns in the settlements of San Fernando de Dilao, Pandacan and Malate by: a) determining changes over time in the percentage share of migrants to these districts' total populations, b) determining and differentiating the geographic origins of the study area's migrants, c) present the distribution and characteristics of migrants according to their age and gender, and d) identify the distribution of occupational tendencies of migrants of the Dilao district.

Figure 2. Towns of Manila Province using the present-day boundaries of Metro Manila.

In addition to the availability of baptismal information in the *Vecindario* documents for the said communities, these aforementioned settlements were also selected due to certain attributes. For instance, Dilao has long been identified as one of the more economically active Manila districts south of the Pasig River (Lagman and Martinez *unpublished work*; Lagman and Villasper *unpublished work*), and, as such, migration data for the said settlement would likely to be both rich in terms of quantity and quality of information. The Malate area, on the other hand, serves as the southernmost point of Manila City, and is traditionally known for its embroidery industry in the 1800s (Mallat 2012). Pandacan, based on historical accounts, was said to be the primary source of animal fodder for Manila (Mallat

2012), and was likely to have a more rural environment compared to the other Manila districts.

3. Methods

This research, due to its reliance on archival data from the Spanish period, necessitated the devotion of considerable time and the undertaking of several labor intensive steps to consolidate them into a standardized database and be integrated into Geographic Information Systems for mapping and analysis.

Copies of the *vecindarios* of the districts of San Pedro de Dilao, Malate, and Pandacan were obtained from the National Archives by means of photocopying, photographing and scanning the sheets on site. These were then encoded on MS Excel per district and subsequently consolidated into a single spreadsheet file.

While *vecindario* records come as pro forma documents making them relatively easy to process and encode, several problems presented themselves during the encoding process. These were mainly due to how the entries were written and the quality of the documents. Quite common were unintelligible script or handwriting, incomplete entries, different and unusual abbreviations, variable spelling, variable terms used for the same occupation, variable spelling and abbreviations for the same places, and damaged pages. Irregularities such as these needed to be addressed to facilitate the creation of statistical summaries per district which would then be integrated into GIS.

Variations in occupational entries were typically due to abbreviations, misspellings, and the fact that a good number of Spanish and Filipino/Tagalog occupations are typically gendered or have evolved in context. To resolve this, abbreviated entries were rewritten in full, gendered occupational titles were changed to their male form whenever available, misspellings corrected, and variants standardized. In addition, occupations were translated into English basing on their current context usage in the local language as well as with the aid of online facilities such as Google Translate and old Spanish-Tagalog-English dictionaries.

Inconsistencies in place names referring to the place of baptism were resolved by standardizing spelling variations and abbreviations in reference to the official list of local government units in the Philippines as they appeared in the National Statistical Coordination Board's Philippine Standard Geographic Codes (PSGC) (National Statistical Coordination Board, 2014). Places not found on the PSGC were traced using various references, primarily Lagman and Martinez, 2014 and Lagman and Villasper 2014 as well as several old maps of Manila from the late 1800s (de Gamoneda, 1898), and in the early 1900s (Bach, 1920).

To map the compiled database onto GIS, points corresponding to each district and place of baptism were generated based on shapefiles of administrative boundaries downloaded from PhilGIS (www.philgis.org) Those that did not appear on the PhilGIS dataset were manually traced and added to the point dataset based on Lagman and Villasper 2014 as well as de Gamoneda, 1898 and Bach, 1920. From there, statistical summaries were generated from the databse and connected.

4. Results

4.1 Share of Migrants to Total District Population

Comparing proxy migrant data for the middle 1880s and early 1890s, it seems, on the surface, that only Dilao had a significant migrant population whose share slightly increased over the years. In the late 1880s, nearly 24% of the said area's population were born outside of Dilao; this increased slightly to 26% by the early 1890s. On the other hand, the share of migrants in the populations of both Malate and Pandacan never breached 10% and even experienced a slight decrease in the early 1890s (See Figure 3).
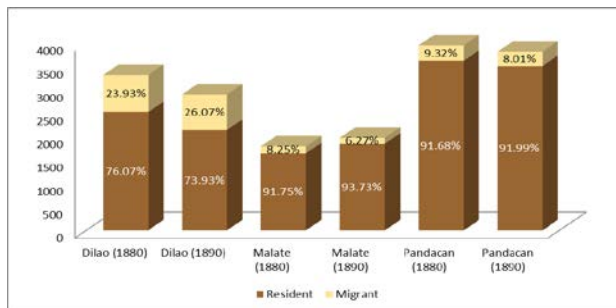

Figure 3. Percentage Share of Migrants to Total District Population

4.2 Origins of Migrants by Category

For the purposes of this study the migrants of the districts of Dilao, Malate and Pandacan were categorized into local, short-range, medium-range and long-range. Individuals who were baptized in other Manila-based districts other than the specific district being studied were considered "local" migrants as they hail from nearby communities that formed the suburbs of the Manila City which has Intramuros as its capital (citation). Those who hail from the cities and communities of current-day Metropolitan Manila were considered as short-range migrants given their proximity to Manila's districts. It has been argued that majority of Manila's nineteenth century migrants actually hailed from the nearby Central Luzon and Southern Luzon provinces of Bulacan, Rizal, Laguna, Cavite, Batangas and Quezon (Doeppers 1998a), which, with the exception of Bulacan comprises the present day Southern Tagalog Region called the CALABARZON. People who were baptized from the parishes of these provinces were considered as medium range migrants, while those who come from farther provinces in Luzon as well as those from the Visayas and Spanish-controlled Mindanao areas were classified as long-range migrants.

Overall, Dilao's recorded migrants during the 1890s originated from roughly 40 towns distributed all over the Philippines, with majority of them coming from the Luzon island. A few were from the present-day Visayan provinces of Cebu, Panay, Leyte, Samar, Eastern Samar and Negros Occidental, while there several individuals who hail from the Mindanao provinces of Davao, Cotabato, Zamboanga and Sulu. It should be noted that the Spanish colonial government never

had complete control of the Mindanao area, and Sulu was long considered as a site of resistance up until the end of colonial Spanish rule (Majul 1973, Warren 1985).

4.3 Long-Range and Mid-Range Migrants

Majority of Dilao's long-range migrants were originally based in the Ilocos Region in Northern Luzon and the provinces in Southeastern Luzon known as the Bicol Region. One would assume that as part of their process of assimilating to life in Manila, these migrants would have been compelled to learn the Tagalog language. As can be seen in Figure 4, overall, there were 115 Ilocanos from the provinces of Ilocos Sur (55), Ilocos Norte (26), Pangasinan (21) and La Union (13). On the other hand, majority of the Bicolano migrants in Dilao in the 1890s were from the provinces of Albay (18) and Camarines Sur (14). It should be noted that the Bicol Region at that time was one of the more prosperous areas in the Philippines since its uplands were one of the major sources of *Manila hemp*, one of the major exports of the country at that time (Owen 1984).
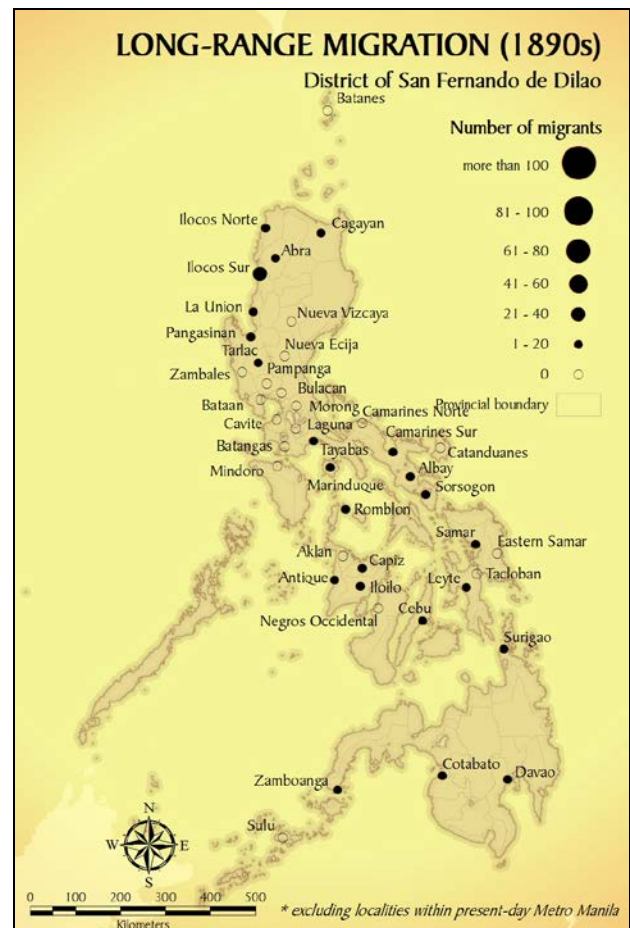

Figure 4. Long-range migration to San Fernando de Dilao in the 1890s

With respect to mid-range migrants, such individuals who belong to this category were primarily from the Bulacan (1st), Rizal (2nd), Cavite (3rd) and Pampanga provinces (See Figure 5). With the exception of Pampanga, all of these areas have Tagalog-speaking populations and share borders with Manila

Province. Aside from the clear advantages of having the same language that is used in Manila and their provinces being connected to the latter via waterways, constant contact and familiarity of its inhabitants with Manila may have encouraged people from these aforementioned areas to make that big decision to move to a still relatively far-away place (Doeppers 1998). It should be noted that among all migrant types, mid-range migrants formed the largest immigrant group in Dilao, making up 11% of all individuals in the said district's 1892 register.
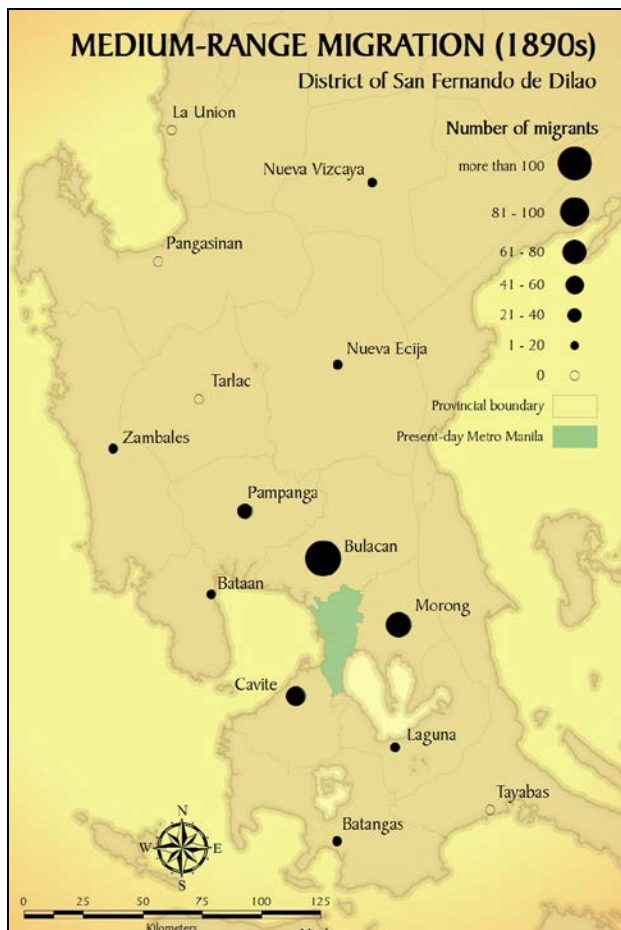

Figure 5. Medium-range migration to San Fernando de Dilao in the 1890s

4.4 Short-Range and Local Migrants

One advantage of studying the origins of migrants at the district level is that such scale of analysis makes it possible to compare the characteristics of migrants residing in different communities. At least with respect to short-range migrants, there are differences as to towns of origin of migrants in Dilao, Malate and Pandacan. In 1890s Dilao, 7 out of every 10 migrants came from the towns of Pasig (31%), Pineda (24%) and Tambobong (20%). The source of migrants for Malate is quite similar as 75% of its migrants were from either nearby Pineda (55%) or Tambobong (20%). On the other hand, Pandacan, who had a significant number of migrants from Pineda (14%), also had migrants from nearby Mandaluyong

(27%) as well as in *pueblos* along the periphery of Manila Province such as Pasig (19%) and Marikina (16%) (See Figure 6).

Majority of Dilao's local migrants, as shown in Figure 7, were Binondo (17%), Pandacan (14%), Malate (12%), Sta. Cruz (11%) and the capital of Manila, Intramuros (11%). This demographic information clearly demonstrates that Pandacan and Malate, the two other districts that are the focus of this study, had relatively active relations with Dilao's communities. Moreover, Binondo, Sta. Cruz and Intramuros were the most prosperous settlements of Manila (Lagman and Martinez *unpublished work*) and are all located north of the Pasig River.
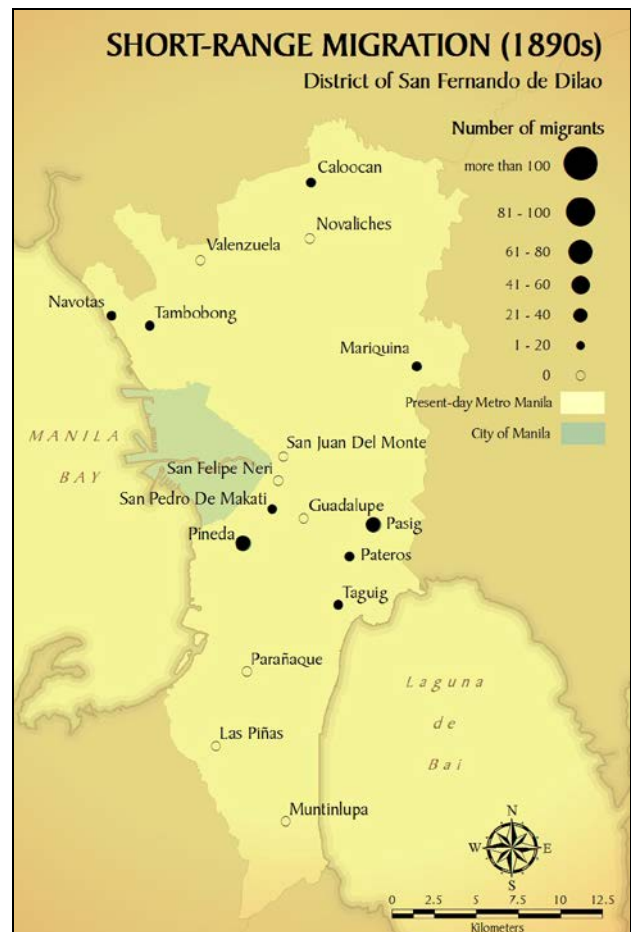
Figure 6. Short-range migration to San Fernando de Dilao in the 1890s

4.5 Migrants by Gender

Literature on migration in the nineteenth century Philippines indicates that, contrary to what has been previously been considered, a significant number of women were already migrating to Manila more than 50 years before such a pattern was said to have been observed (Doeppers 1998a). Results from the analysis of 1890s civil register data supports such a contention, particularly in the communities of Dilao and Malate. In these districts, around 54 to 55% of those baptized elsewhere were females. In addition, while there were more males in Pandacan's migrant population, nearly half (45%) were predominantly working women (See Figure 8).
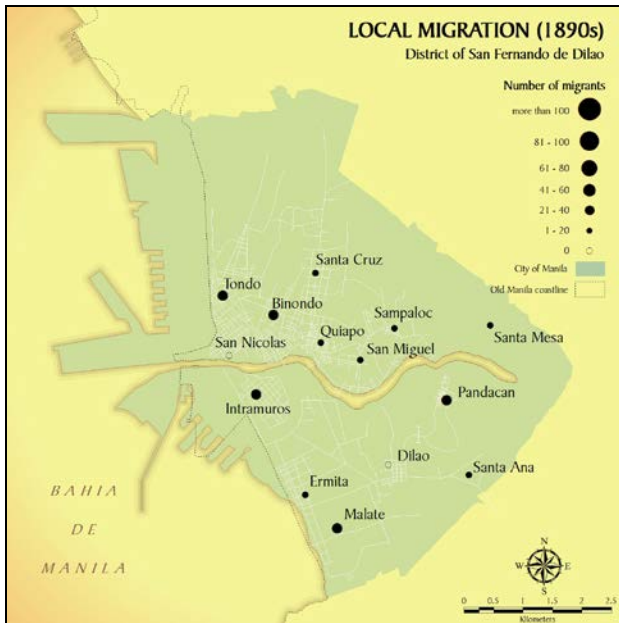
Figure 7. Local migration to San Fernando de Dilao in the 1890s
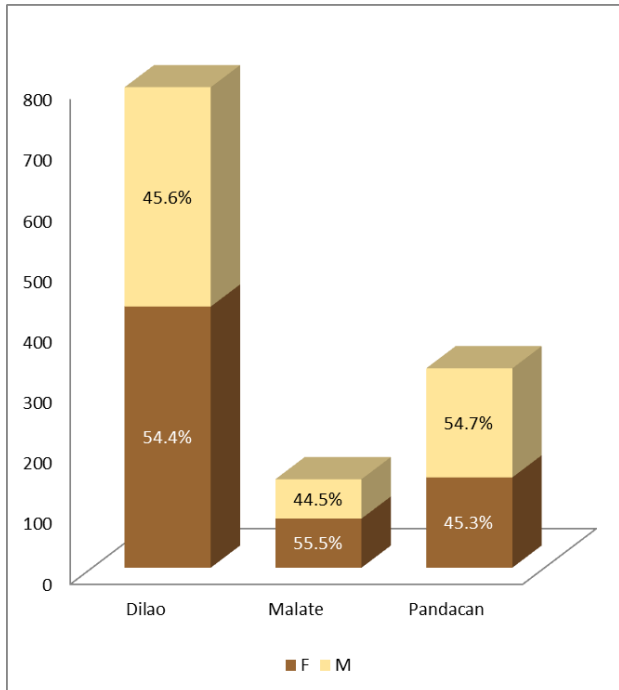
Figure 8. Gender distribution of migrants in the three districts

4.6 Occupations by Migrant Type, Dilao (1890s)

Analysis of the occupational data collected for Dilao-based migrants indicate that there are commonly held jobs across the different migrant classifications. For instance, seamstresses, a low-paying female-dominated occupation (Camagay 1995), were either the most or second most common occupation in all four migrant categories. As such female workers, who included *cigarreras* and laundry washers, made up a significant portion of the said district's migrant labor pool. In like manner, laborers, mostly held by males, was always within the top three occupations among local, short-range, mid-range and long

-range migrant workers in Dilao. Those who migrated to Dilao to work in factories manufacturing cigars came from nearby local districts and even as far as Southern and Central Luzon, but rarely did migrants who came from farther places found it worth their while to work as a *cigarrera*.
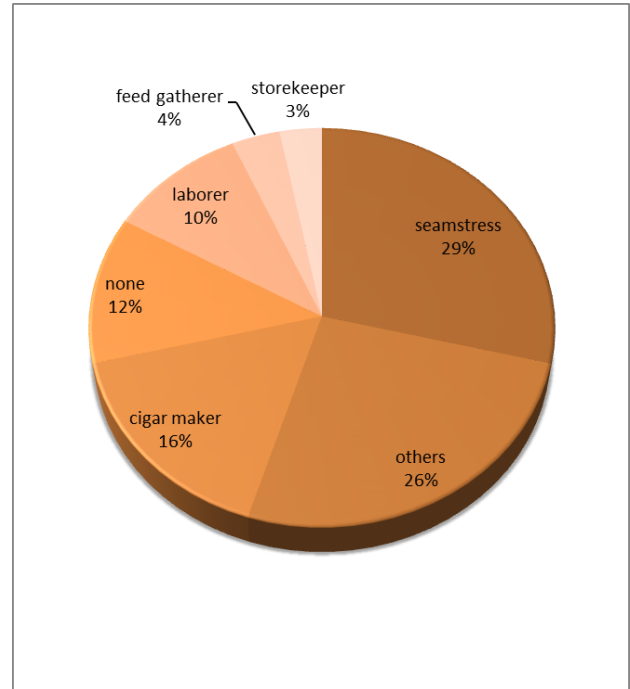
Figure 9. Local migrant occupations in San Fernando de Dilao, 1890s
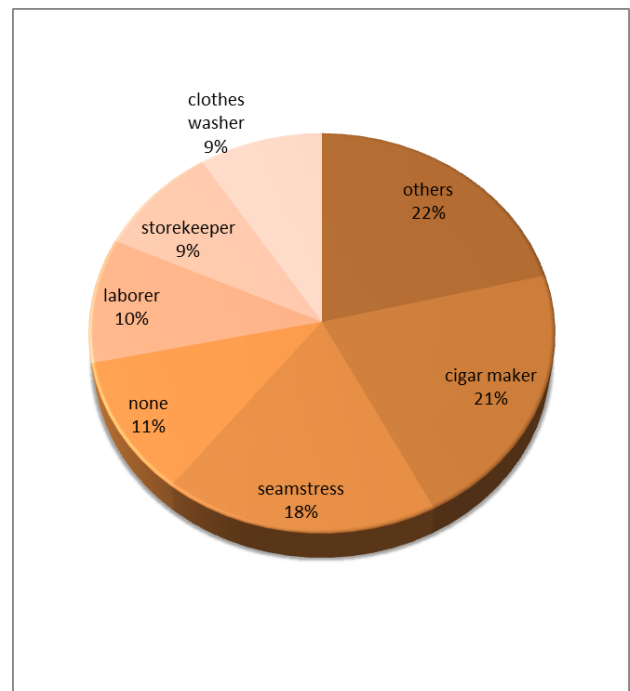
Figure 10. Short-range migrant occupations in San Fernando de Dilao, 1890s
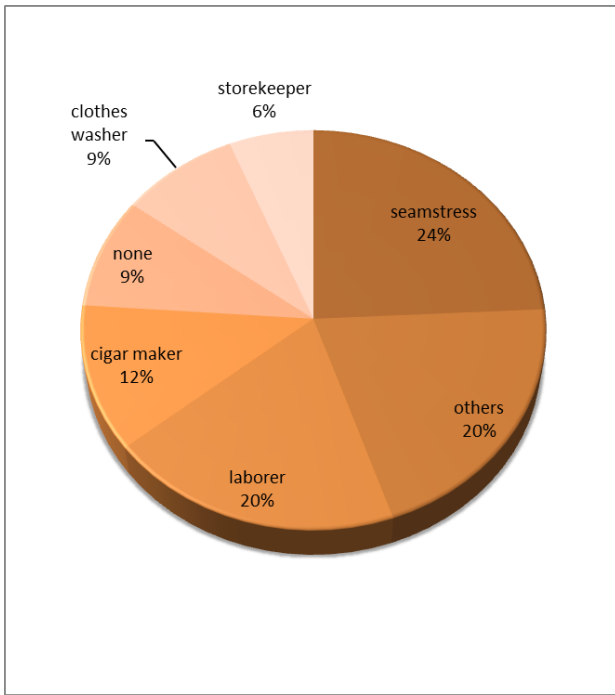
Figure 11. Mid-range migrant occupations in San Fernando de Dilao, 1890s
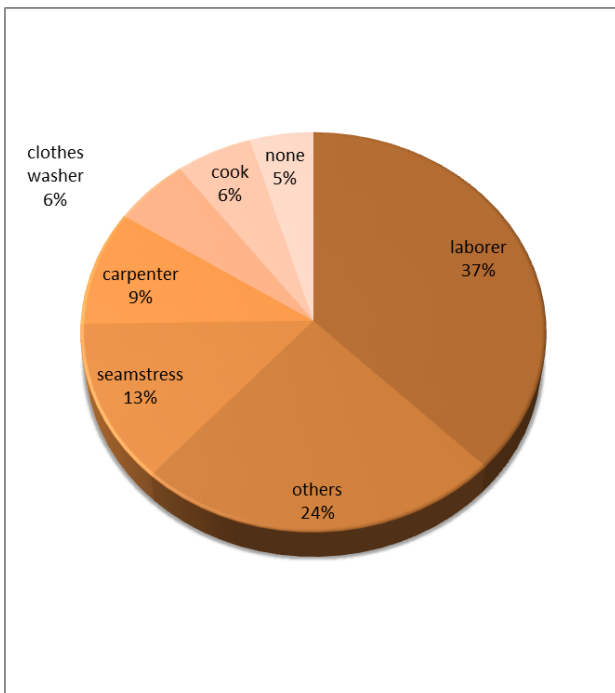
Figure 12. Long-range migrant occupations in San Fernando de Dilao, 1890s

While it is still too early to consider it as a fixed and clear pattern, the most common occupations of migrants in every category seemed to reflect certain tendencies. Among local migrants, all top five occupations, with the exception of the cigar-makers, can be considered as menial, low-paying forms of employment. The same tendency can be observed in the most common jobs among those who hailed from the localities of current-day Metro Manila, Central Luzon and Southern Luzon ,

except that two occupations, storekeeper (4th) and carpenter (6th), required a certain skill-level that had to be innate or learned through time and effort.

Higher level skills seem to become more prevalent with long-range migrants as compared to other categories. It is only in this type of migrant wherein two skilled occupations, carpenter and cook, became a top five occupation. In addition, while, they are not forms of employment that a long-rage migrant would engage in, work as a silversmith, blacksmith or coachman, there were proportionally more migrants from the Ilocos and Bicol Region who were classified as having such occupations in late 19th century Dilao.

5. Observations

While the maps for this research focused mainly on answering questions on where from and how many, it is our belief that we have barely scratched the surface on the use of GIS in putting   spatial and temporal perspectives on characterizing migration and migration statistics.

Our initial experiences from working with archival data on a large scale gave us interesting challenges in terms of collection and management especially when considering the intention of establishing a global spatial database under the ANGIS umbrella.

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Spatial Variation and Temporal Change in Rural Wages and Poverty in India

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Abstract: One of the major causes of poverty and other forms of deprivations in developing countries is low wage income of the labour. A disproportionately large share of labour force in the developing countries is engaged the primary sector occupations, especially agriculture and allied activities. Since wages of labour engaged in these activities are to a large extent affected by the agricultural productivity, economists (e.g. Ahluwalia (1976, 1978)) articulated that it is important to raise productivity in the agriculture sector for reducing widespread poverty and associated deprivations. However, a major factor in determining productivity in primary sector activities at the initial stages of development is agro-climatic conditions. It is a well recognized that the agro-climatic conditions in India vary significantly across regions. Therefore, historically it (agro-climatic conditions) could be a major factor in explaining the variation in wages in rural areas across regions. In this paper, we hypothesize that historically the initial variation in the wages of unskilled labour and, consequently, incidence of poverty in India across regions could be explained by the region specific agro-climatic conditions.

In this paper we test this hypothesis by deploying unit level data on Employment and Unemployment collected by the Indian National Sample Survey Organisation (NSSO). These data are taken from large sample surveys conducted by the NSSO roughly every five years since 1973. In its surveys, the NSSO divides entire Indian territory into about 77 agro-climatic regions (in the latest round of survey there are 88 regions). The data are collected on a range of socioeconomic as well as employment variables including wages and total expenditure of the households. In this paper, we exploit the representativeness of this data at the level of agro-climatic regions and use GIS to map the real wages and poverty levels in each one of the regions in India in 1983 to highlight the spatial variation. We then trace the changes in wages and poverty incidence during 1983 to 2011/12.

Mapping the Transition of the Land Revenue System in Western India from the pre-colonial to the early colonial India With special reference to Indapur Pargana (1761-1836)

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Abstract: This Paper considered the transition of the Land Revenue System in Western India from the precolonial period to the coronial period. Under the British Rule, the Ryotwari Settlement in which the British government settled the land revenue with cultivators directly, was introduced into Indapur Pargana first within the Bombay Presidency, which covered Western India, in 1836. *First*, the paper focuses on the Maratha, which was defeated by the East India Company in Western India in 1818, shows the collage of the land system called Jagir system in the last phase of the Maratha period made the introduction of the new settlement under the British rule possible in Indapur Pargana. *Second*, the paper analyzes Jagir System in the precolonial periol. Under Jagir system, the the land revenue was assigned to commanders etc., who were stationed there to raise their horses. The paper shows not only the revenue under this system but the space of a village itself was important. *Third*, it geographically shows how the government arranged the space in Indapuur Pargana in the precolonial and how this system changed into the new settlement the colonial period.

Keywords: Colonization, Land System , India, Maratha

1. Introduction

In the economic history of Modern or Colonial India, the land revenue system is one of the main topics because this tax had brought the largest income to the British India at least by the late nineteenth century. IN the late eighteenth and the early nineteenth centuries, two types of new land revenue settlements *viz., Zamindari* Settlement and *Ryotwari* Settlement were introduced in the British India. The Bengal Presidency in Eastern India adopted the former settlement and settled with *Zamindars*, who were landlords and gentry in Eastern India, without investigating each village under *Zamindars*. The Bombay Presidency in Western India and The Madras Presidency in Southern India adopted the latter settlement and settled with every *Ryot* or farmer investigating every village at thirty-year intervals. Many scholars including the contemporary British officers-cum-scholars a have studied the introduction and the development of these types of the settlements under the British rule using the colonial documents in English. However few scholars have considered the backgrounds of the introduction of the new settlements and the historical transition of the land system using the pre-colonial documents. This paper focuses on this point. In order to do that, the Bombay Presidency in Western India was selected for this study because the pre-colonial rich documents under the Marathas that were defeated by the East India Company in 1818, are available. Indapur Paragana, which this paper focuses on, is the first area into which the *Ryotwari* Settlement was introduced in 1836.

Under the Marathas, Indapur Pargana was a very important area because this area was the private territory of the Maratha King in 1674 when the Maratha Kingdom was built and because it was the nearest fertile area from Pune which was the central city of the Marathas b.

The following figure shows the arrangement of villages of Indapur Pargana, which consisted of 85 villages, in the period of 1761-1821 c:
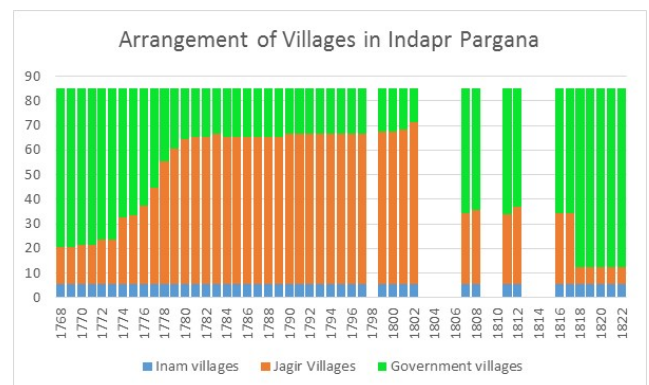
Fig. 1. The Arrangement of Villages in Indpur Pargana in the Period of 1766-1818

As this chart shows, Indapur Pargana consisted of three kinds of villages *viz.*, Inam villages, Jagir villages, and Government villages. Inam villages were tax-free villages, more precisely, the villages in which the person given Inam by the Government collected land tax at the place of the Government. Jagir villages were the villages in which the collection of land tax was assigned to commanders etc. for military purposes. The

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a For example, B.H. Baden-Powell, The Land Systems of British India, 3 vols, reprint, Delhi, 1892/1990.

b While expanding the territory in the early eighteenth century, the premier called *peshwa* came to have power in the Maratha Kingdom. Most commanders, who expanded the territory on the front line, were loyal to *peshwa* actually and to the Maratha King nominally. This polity was called the Maratha Confederacy. *Peshwa* set up the government in Pune in 1730s. In this paper, the word Marathas stands for the Maratha Confederacy and all the powers forming this confederacy.

c Taleband (Annual Account) of Indapur Pargana, Prant Ajmas, Pune, Rumal no. 56-63, Maharashtra State Archives, Pune.

government collected land tax in Government villages only. The bottom part on this chart represents Inam villages. The middle is for Jagir villages, and the top for Government villages. During this period, the number of Inam villages was invariably five and a half. The number of Jagir villages increased greatly in the latter part of 1770s, and finally reached 62 in 1799. In 1802, the civil war occurred, and the Holkar army attacked Indapur Pargana, and in 1803 drought hit this *pargana*. These two disasters devastated Indapur Pargana. After these two disasters, the number of Jagir villages decreased drastically and many Jagirdars left Indapur Pargana. Accordingly the number of the Government villages increased greatly, in which the Government officer called Kamavidsar collected land tax. And his importance had risen highly in the administration of Indapur Pargana just before the British rule started in 1818. After the battle between the Marathas and the English East India Company in 1818, the number of Jagir villages reduced into seven. And most of villages were the Government villages in this phase. The Assistant Collector, who replaced the position of Kamavisdar under the Marathas, carried out the introduction of the Ryotwari Settlement. In this context, the collapse of Jagir system in the last phase of the Maratha period made the introduction of the Ryotwari Settlement in the British period possible. This process indicates the importance of Jagir system in investigating the historical backgrounds of the introduction of the Ryotwari Settlement, which is studied briefly in the next section.

2. Jagir System under the Marathas

In order to refer to assigned revenue, the term "Jagir" was broadly used in the Medieval India. According to Iqtibar Alam Khan, the term "Jagir" came to be accepted as the standard term for a revenue assignment under the Mughals by the end of the sixteenth century[d]. The Marathas inherited this system from the Mughal Empire. This section considered the Jagir system under the Marathas by seeing who held Jagir villages and how the holders managed Jagir villages.

2.1 Holders of Jagir

Under the Marathas, Indapur Pargana saw 138 assignees, who were called Jagirdars, at the total. Their names of Jagirdars are found in the annual accounts of Indapur Pargana in Pune Archives. In many cases, Jagir was given to Paga (a regular cavalry)-holders and Silahdars or the irregular soldiers who equipped with arms and horses for himself, and then participate in military activities. Siledars were placed under the jurisdiction of Pagae. In a few cases, Jagir was given to commanders called Sardars under Daulatdars. In the eighteenth century, some powerful chief commanders such as Shinde, Holkar, Pawar, Bhonsle of Nagpur, and Gaikwad conquered Northern and Central India and held large territories as Jagir, which were actually inherited for generations. Their territories were called

Daulat and they were called Daulatdars. In Indapur Pargana, Jagir was given to two commanders under Shinde family and one commander under Holkar family. In can be said Jagir was indirectly given to Daulatdars in these cases. As Jagir one village was assigned to Patwardhan family or the powerful commanders under *peshwa*, who was in the southern part of Western India. Jagirdars except a few holders including Patwardhan family were stationed in Indapur Pargana.

2.2 Management of Jagir Villages

Unfortunately the expenditure list in assigned villages was not found in Pune Archives. So it is difficult to realize how a Saranjamdar in Indapur Pargana used his Saranjam. But his main duty was the maintenance of his equipment and the military service to the Government. From this point it is possible to comprehend his activity in his assigned village partly.

For Siledars and Paga-holders, horses were the most important equipment. According to the list of feed and allowance, horses were fed with vetch, sorghum, and other cereal crops as well as fodder. Besides, rice, wheaten flour, salt, butter, ghee, jaggery, pepper, and mixed spices were sometimes given as nutritious foods. In the case of Sakhoji Kate to whom village Kalasi was assigned at Rs.588-8, it was fortunately found that it cost Rs.40 per year in 1787 to feed his horses with vetch, cereal crops, salt and sugar[f]. But basically the information about the price of the crops which were given to horses was not available in the list of feed and allowance etc. It is inferred that these crops were not procured by purchase in a market but brought to a Jagirdar directly from the fields in a village. It is more clear how fodder was supplied. The fodder which was given to the horses of a Jagirdar was cut in meadows of his assigned village. The forced labourers who were brought from the villages in Indapur Pargana except other assigned villages worked there[g]. And fragmentary information about the price of a horse is available in the original Modi documents. It seemed that a horse cost at least Rs.80[h] in the later 1780s. The purchase of a horse could be the financial burden especially on a Jagirdar. The Government paid the subsidy for the purchase of animals[i].

According to the list of feed and allowance, mainly female domestic slaves, Mahars (untouchables) and boys worked for a Jagirdar. Their allowance was pain in kind only. To manage the above-mentioned equipment smoothly, a Jagirdar employed some staffs. Although the members of these staffs varied according to a village, they mainly consisted of one or two clerks, a water-carrier, a guard of meadow and bodyguards who were made up of Marathas, Mahars, and Mangs (untouchables). Sometimes a goatherd and a cowherd were

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d Iqtidar Alam Khan, "The Mughal Assignment System During Akbar's Early Years, 1556-1575," in Irfan Habib ed., *Medieval India 1, Research in the History of India 1200-1750,* New Delhi, 1992/2009, pp.66-67.
e Surendra Nath Sen, *The Military System of the Marathas,* Calcutta and Delhi, 1928/1979, pp. 4-5 and 8.

f Prant Ajmas, Pune, Rumal nos.503 and 504, Maharashtra State Archives, Pune.
g Prant Ajmas, Pune, Rumal no.547, Maharashtra State Archives, Pune.
h Prant Ajmas, Pune, Rumal nos. 503 and 547, Maharashtra State Archives, Pune.
i For example, one Jagirdar kept camels, bullocks, and sometimes elephants, besides horses. Prant Ajmas, Pune, Rumal no.504, Maharashtra State Archives, Pune.

added in the list of allowancej. The allowance to these staffs was paid in money. Besides, carpenters, Mahars and Mangs in a Jagir village were demanded to work for a Jagirdar at the forced labours annually.

The duties of a Jagirdar such as the keeping of horses were not completely monetized. So the assignment of a village by which not only moneyk but also provisions for his duties were easily available was favourable to a Jagirdar as payment for his military service.

And the following Sanad or a deed shows the significance of Jagir from another view:

19 Rabilakhar (the 4th Muslim month) Kumbharganv in Indapur Pargana was under Kanhoji Khalate as Jagir. The Government settled the exchange of Jagir between this village and Sirsodi in Indapur Pargana. And the assignment of the revenue of Sirsodi was settled, and given to him. The Government took the revenue of Kunbharganv which had been assigned and then wrote down the revenue of Sirsodi as expenditure in the account of Indapur Pargana. And meadows lying in the boundary area between Village Takli and Village Padasthal in Indapur Pargana will be also given for his military service. This is the Sanad or the deed issued under the name mentioned above [= Sawai Madhavrao Peshwa]l.

With the transfer of Jagir, Kanhoji Khalate himself shifted to Sirsodi in order to deploy his horses and then stationed therem. The revenue of Kumbharganv was assigned to Manshing Khalate and he was stationed there for his military servicen. This case tells that the assignment of a village means not only to give the income for his military service but also to furnish Jagirdars with the area in which to deploy his horses. A lot of deeds in which Jagir was given for a Jagirdar to procure the field in which to raise horses are found in Maharashtra State Archives, Pune. This indicates that the Peshwa Government arranged Jagir villages in the territory under the Marathas. By use of GIS, the arrangement of Jagir are studied in the next section. This approach makes it possible to show the transition from Jagir to the Ryotwari settlement clearly.

3. Mapping the Transition of the Land Revenue System in Indapur Pargana

This section overviews the transition from Jagir to the Ryotwari Settlement in order to understand the historical

Fig. 2. The Locations of Jagir Villages in Indapur Pargana in 1766

Fig. 3. The Locations of Jagir Villages in Indapur Pargana in 1773
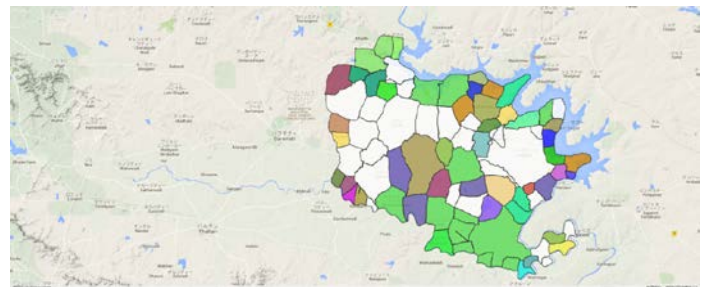
Fig. 4. The Locations of Jagir Villages in Indapur Pargana in 1783
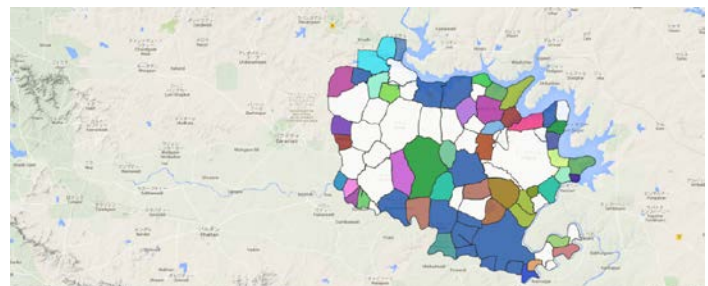
Fig. 5. The Locations of Jagir villages in Indapur Pargana in 1795
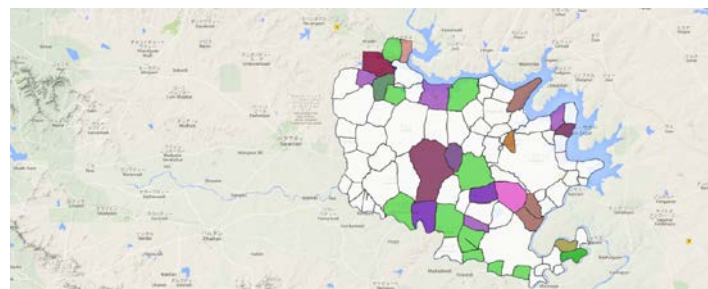
Fig. 6. The locations of Jagir villages in Indapur Pargana in 1807

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j Prant Ajmas Pune, Rumal nos. 503 and 547, Maharashtra State Archives, Pune.
k Andre Wink argued monetization in the collection of the land revenue was established in the later eighteenth century. Andre Wink, *Land and Sovereignty in India –Agrarian Society and Politics under the Eighteenth-century Maratha Svarajya,* Cambridge, 1986/2008, p.331.
l 19 Ravilakhar 1174, Prant Ajmas, Pune, Rumal no.503, Maharashtra State Archives, Pune.
m 21 Rajab Shuhur 1180, Prant Ajmas, Pune, Rumal no.547, Maharashtra State Archives, Pune.
n 30 Rabilawal Shuhur 1181, Prant Ajmas, Pune, Rumal no.547, Maharashtra State Archives, Pune.
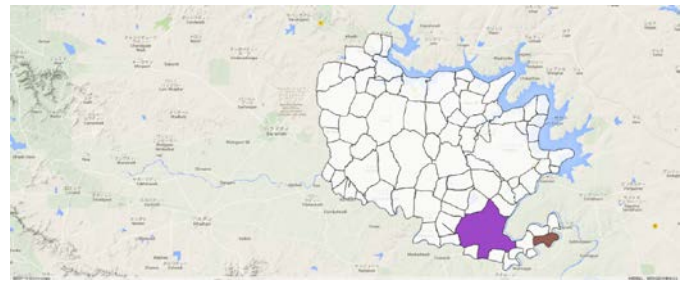
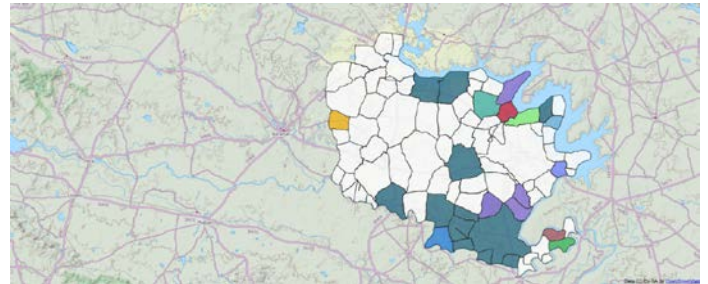Fig. 7. The locations of Jagir villages in Indapur Pargana in 1818

background to introduce the Ryotwari Settlement spatially.

In 1766, two villages were assigned as Jagir (See Figure 1). In 1761 the Afghans defeated the Marathas in the battle of the third Panipat. And the Marathas abandoned the extension of their power in Northern India and began the internal reform within Western India. In this new policy, the Peshwa Government stationed many Jagirdars in the areas around Pune or the central city, which included Indapur Pargana. And this pargana was especially important because it was the nearest field in which to raise horses from Pune. The number of Jagir villages greatly increased in the 1770s. As Figure 2 shows, the villages on the banks of the Bhima and the Nira Rivers were assigned as Jagir in this phase because these villages were covered with fertile soil which was brought by the rivers. In short, most of the area with rich fertility was used to raise horses. According to the new Government policy, raising horses had priority over collecting land tax in in Indapur Pargana. In the 1780s, more and more villages were assignd as Jagir. In this phase, villages in the inland area became Jagir villages (See Figure 3). In the period of 1785-1799, the number of Jagir villages slightly increased. As Figure 4 shows, most of the villages were assigned.

After the two disasters in 1802-1803, the number of Jagir villages greatly decreased. In 1803, the battle between the East India Company and some Daulatdars occurred. In the treaty after this battle, the Peshwa Government became a princely state under the British. According to this treaty, the artillery and the army under the English East India Company were stationed in Pune to protect the Peshwa Government. In other words, horses and the cavalry because useless in this phase. As Figure 5 shows, however, jagir villages were located on the banks. It is inferred that it was still important to raise horses in Indapur Pargana.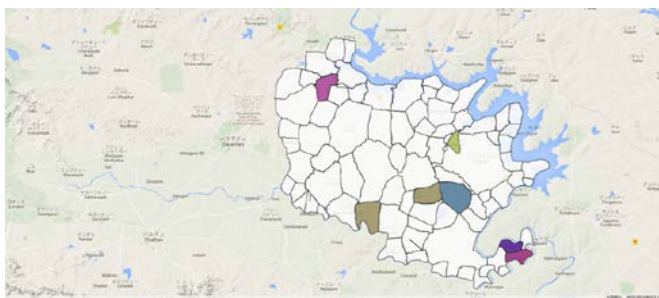 Under the British rule, most of the Jagir villages which had remained in the last phase of the Maratha period were changed into the Government villages. The location of seven villages were not always suitable for raising horses. Jagirdars in these seven villages were the Patwardhan family and commanders under the Holkar family. The two families became princely states after 1818. Some political matters make it possible for the Jagirdars to survive. But the Jagir system itself was totally collapsed in this phase. In this sense, Indapur Pargana was ready for a new system in 1818.

4. Concluding Remarks

This paper considers the transition of the land revenue system from the pre-colonial period to the early colonial period focusing on Indapur Pargana in Western India. As Chart 1 shows, the collapse of Jagir system under the Marathas made it possible for the British to introduce the Ryotwari system in 1836. And GIS shows most of the fertile land was assigned as jagir and used for raising horses rather than making crops in the late eighteenth century in Indapur Pargana. This arrangement corresponded to the then policy of the Peshwa Government. After the two disasters in 1802 and 1803, the arrangement of villages looked different. Interestingly some of villages on the banks of the rivers still belonged to Jagirdars though the Peshwa Government abandoned the military policy to rely on the cavalry consisting of the horses which grew up in its territory. It can be seen in this inconsistency that the Peshwa Government groped for various ways to survive. So this consistency have to be made more clear by using the descriptive data such as the Government orders in the last phase of the Maratha period. After the British rule started the appearance of the arrangement changed again into the shape which was ready for a new system.

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GIS APLICATION FOR ARCHAEOLOGICAL PREDICTIVE MODELING: The case studies in fluvio-volcanic and karstic landscapes in Yogyakarta and surrounding area, Indonesia

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Abstract: Archaeology is a science that requires a lot of interpretation. It is very necessary not only to reconstruct the shape, function and processes behind the data found, but also in finding locations that potentially contain archaeological data (archaeological site), without neglecting data transformation that have occurred during occupation, abandoned, until were rediscovered in many ways. Archaeological site is a part of landscape that is integral to human ecosystem. The selection of a location to be occupied, the dynamics that occur during occupancy, until finally abandoned and gradually became a buried archaeological sites, was controlled by two main aspects, both natural and cultural aspects. In other words, character of nature and culture in the past have played a major role in formation and change or modification of site and its context, ranging from the smallest scale (intra-site) until the most extensive scale (region).

Through several variables of culture and nature, the location of an archaeological site or many sites can be predicted. These variables become materials for hypothesis preparation underlying a research in order to site exploration or to give explanation for specific problem (problem solving). For these purposes, therefore, Archaeological Predictive Modeling needs to be designed according to the character of landscape, and Geographic Information System (GIS) as a tool to optimize this analysis.

This paper presents Archaeological Predictive Modeling through spatial and environmental analysis in GIS. Two models will be compared, these are the prediction of temple or clasic monument sites in fluvio-volcanic landscape and cave sites in karstic landscape. Both landscapes have different spatio-temporal characters could be found in Yogyakarta and surrounding area (Indonesia). These modeling are to streamline the exploration of new sites and solve some unresolved research problems.

Keywords: Geographic Information System, Archaeological predictive modeling, Fluvio-volcanic landscape, Karstic landscape, Spatio-temporal characters

Preliminary Analysis using Middle Mekong Archaeological Project GIS data: A Model to Recommend Prehistoric Agrarian Sites in the Middle Mekong Basin for Excavation

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Abstract: The middle Mekong river basin rests in an intermediate position between China to the north, Vietnam to the northeast, and Thailand to the southwest. This location is potentially important for early agriculture in Southeast Asia; however, very little archaeological work has been done and the area remains little understood. Over the course of eight years of survey, the Middle Mekong Archaeological Project (MMAP) has located 83 sites in the Luang Prabang region of Laos. Some of these sites could potentially yield data regarding early agriculture; however, to excavate all sites would be extremely expensive and time consuming. In this paper, we use GIS software to create a robust model of access to arable land for each site for paddy rice, dry rice, and Foxtail millet. These outputs are used in an inter-site comparison to recommend sites for excavation that are most likely to have evidence of early agriculture.

Keywords: Mekong, Laos, GIS Model, Early Agriculture

1. Introduction

The Mekong is one of the longest rivers in the world, and has long been viewed as a highway through which people, technologies, and cultures moved between East and Southeast Asia, and within Southeast Asia itself. Because of its location, the river basin has provided the context for a longstanding archaeological debate about the introduction of agriculture to Southeast Asia. Yet despite its abundance of archaeological remains, the area has not yet been fully investigated as a possible conduit for early agriculturalists from the Yangtze River basin in southern China to mainland Southeast Asia. A lack of archaeobotanical, palynological, and archaeological empirical data in the region makes it impossible to construct even a basic conception of early cultivation systems (White 1995:37). Field excavations are needed to elucidate the possible role of the basin in the transition to agriculture, but an archaeological investigation of all of the region's known sites would be extremely time consuming, labor intensive, and expensive.

Contemporary rice cultivation in Laos and Northeast Thailand mimics annual wild rice regimes, with monospecific stands in fields near seasonal streams that are naturally inundated and dried with the coming and going of monsoon rains. This type of paddy rice production is referred to as rain-fed rice agriculture and contrasts with irrigated rice agriculture, which requires extensive anthropogenic modification of the landscape (White 1995:51). Early rice cultivation in the region may have begun as an exploitation of wild rice in seasonally inundated natural habitats, which led to the domestication of wetland varieties of rice in permanent plots. The cultivation of dry rice may have developed later as a parallel dry cropping strategy incorporated into pre-existing swidden (slash-and-burn) systems for growing crops like Foxtail millet. This strategy would have allowed early agriculturalists to exploit a diversity of upland and lowland resources for subsistence (White 1995:37–38).

In this paper, we use geospatial statistical modelling to determine the relative potential agricultural productivity of the landscape for paddy rice, swidden rice, and Foxtail millet. Based on White's (1995) model of early agriculture in the region, we assume that if there is early evidence for agriculture it will likely be found at sites with access to land suitable for both inundated and swidden crop cultivation. Using the geospatial analysis, we determine how sites are positioned relative to the landscape's suitability for crop production, and recommend sites for excavation that are most likely to yield evidence about early agriculture in the region.

2. GIS Model

The Middle Mekong Archaeological Project (MMAP) has identified 83 sites over eight years of survey in the Laos along the Mekong River near Luang Prabang. We are interested in using geospatial modelling to identify sites for excavation that might yield evidence for early agriculture.

Geospatial modelling is a non-destructive tool for predictive scientific research. It can be used to create testable land-use hypotheses to compare against the archaeological record. These quantitative models allow archaeologists to create and test more-explicit hypotheses than they could using the archaeological record alone (Barton et al. 2010; Harrower 2010; Peeples et al. 2006; Stoner 2012; Altaweel 2010; Ullah 2011; Alexakis et al. 2011).

3. Model Construction

We constructed four geoprocessing models using Geographic Resource Analysis and Support System (GRASS) 7.0. Each crop-requirement component (hydrology, slope, and soil) was modeled, and then the three models were overlaid to create a composite landscape suitability model. All criteria and weights in the model were determined based on ethnographic and contemporary agricultural studies and are independent of

archaeological traces of agriculture in the study region.

The sites in this study date from the terminal Pleistocene through the late Holocene, and were identified on survey over the course of eight years by the Middle Mekong Archaeological Project. Site locations were recorded in latitude and longitude projection using the Indian 1954 datum; they were incorporated into GRASS 7.0 and then reprojected into UTM48 (WGS84N). The study area is comprised of 90m by 90m pixels over an area of 4000km^2.

Four variables were used to determine how prehistoric hydrology might have influenced crop production: precipitation, run-on, excessive flow, and the hydrological requirements of paddy rice, dry rice, and millet. Raster layers for these variables were created and overlaid to create hydrology rasters for each crop.

4. Landscape Suitability in Relation to Sites

Once we had evaluated landscape suitability for cultivation of paddy rice, dry rice, and millet production, we could relate the location of the known archaeological sites to landscape suitability.

Ethnographic studies suggest that people will walk up to 1–2km from their villages to their fields on a daily basis (Mudar 1995:180). In Thailand and Laos, it is customary for farmers to move from their villages to their fields for much of the growing season, which allows them to cultivate landscapes further away from the villages. Farmers often construct field huts (*thieng hai*) in upland rice fields in order to rest during the day, cook meals, and stay overnight during planting and harvest times (Linquist et al. 2006: 40). Some Katu villages are located near rivers, but farmers from those villages may plant swidden fields up to 3km from the village, depending on earlier use of the landscape and population pressures (Costello 2006). To account for the surrounding landscape that may have functioned as part of the subsistence base of the prehistoric sites, we created 1km diameter catchment zones, using buffers around each site. Although this value is lower than some suggested ranges, we think it characterizes the landscapes immediately surrounding the sites. We then determined, for each site, the percentage of area in the 1km catchment zone that was of below-average, average, and above-average suitability for the production of paddy rice, dry rice, and millet (Figure 1).

The data on site chronology in the area is poor, and we wanted to avoid recommending hunter-gatherer sites, where occupants were unlikely to have been participating in agriculture, for excavation. To do this, we compared sites with pottery to those with lithic assemblages only. The box plots suggest that in terms of suitability for paddy rice cultivation, sites with pottery are located in more advantageous spots on the landscape than sites with lithics only, but this is not the case in terms of suitability for dry rice or millet cultivation. This finding correlates well with known hunter-gatherer settlement patterns in upland areas, which have more access to foraging resources and less susceptibility to high-risk malaria zones. The box plots also indicate that average or above-average access to areas that are good for millet is not a particularly good indicator to use for future tests, because almost every site has 100% access to average and above average-land for producing Foxtail millet.

To identify sites with access to land of above-average suitability for paddy rice production, in addition to areas that are at least average for swidden agriculture, we did a cluster analysis using the model outputs for each site's catchment zone to get a sense of how the sites group in terms of overall productivity for these two variables. The cluster analysis identified four sites with pottery assemblages (Ban Kia Luang, Ban Na Taan, Phra Cave, and Tamarind Cave) that had the best access to land

Millet   Dry Rice   Paddy Rice

Below Average (<50% - 1 standard deviation)

Average (=50% +/- 1 standard deviation)

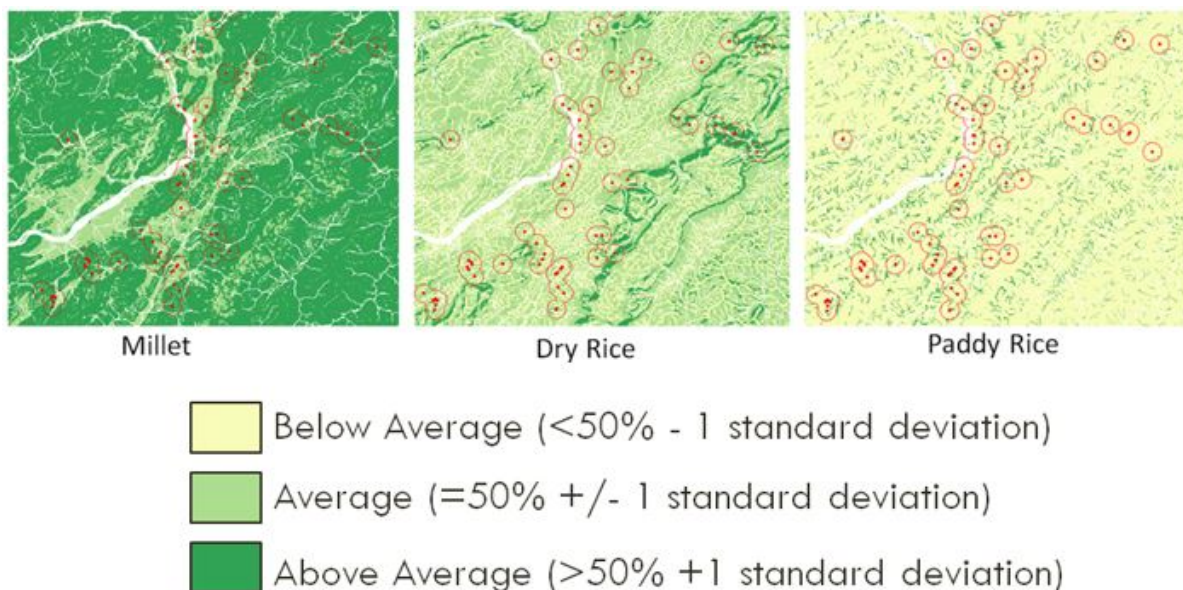Above Average (>50% +1 standard deviation)

Figure 1: Relative access to arable land for millet, dry rice, and paddy rice. Sites and catchment zones are indicated in red.

for paddy rice and good access to land for dry rice cultivation, and may be the best sites to excavate for evidence of prehistoric agriculture. In addition to these four sites, we would also recommend sites for excavation from a second cluster (Ban Lesivilay, Ban Sanghai East, Tham An Mah, Long Kwian Cave) if sufficient funding is available.

5. Concluding Remarks

In this study, we used geospatial statistical modelling to suggest which sites in the MMAP survey region are most likely to yield evidence related to early agriculture. The study identified four (Ban Kia Luang, Ban Na Taan, Phra Cave, and Tamarind Cave) that have excellent access to land suitable for paddy rice that also have access to land suitable for dry rice production. Four additional sites (Ban Lesivilay, Ban Sanghai East, Tham An Mah, Long Kwian Cave) were also suggested as secondary sites that might be good for excavation. We used geospatial statistical modelling as a predictive tool for identifying sites for excavation. The utility of this model as a tool for predictive research should be tested through excavation of the sites which will hopefully yield evidence related to early agriculture in the region.

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Majapahit Short Inscriptions and the Relation with a Spatial Context

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Abstract: Inscription is a historical source from the past which is written on stones or metals. It is a king edict telling an event which is written on stones or metals. From Majapahit period, there were short inscriptions which consisted of one or two plates. This inscription has a short content and its formulation is unlike with the other inscriptions in general. It is named rajaprasasti. Thus, this research paper discusses rajaprasasti specifically, such as its characteristics and the relations with a spatial context. The hypothesis is that the inscriptions with those specific characteristics were not produced by the central of kingdom. It concludes that Rajaprasasti is an inscription which was pointed for certain villagers that are mentioned on the inscription. Furthermore, the inscription is inherited.

Keywords: inscription, tiponim, majapahit era

1. Background

Inscription is one of various data for archaeological research. According to Boechari (2012:4), inscription is a historical source from the past which is written on stones or metals. In addition, inscription is a king edict telling an event which is written on stones or metals (Boechari, 2012: 4).

In telling the ancient history, inscription becomes important because it is the primary source of various information about social and cultural condition in the past, such as kingdom infrastructure, bureaucratic structure, social structure, economic structure, religion, belief, and customs among Indonesian ancient society (Boechari, 2012: 6-7).

In Majapahit period, there were short inscriptions which consisted of one or two plates. This inscription has a short content and its formulation is unlike with the other inscriptions in general. Soehadi (1993:230) named this inscription as rajaprasasti or rajamuda. Thus, this research paper discusses rajaprasasti specifically, such as its characteristics and the relations with a spatial context.

2. Majapahit Inscriptions

There are several kinds of inscriptions that are found in Indonesia.These are jayapatra or jayasong , suddhapatra , piagem, inscription on gravestone , inscription from colonial period, and Buddha's and Hindu's spells.

Most of the inscriptions in the period of ancient Java contain a ratification of a certain region which became a region of sima (Boechari, 2012:6). Sima inscription contains a king edict to ratify a region which is changed its status in terms of taxation due to the new task for the maintenance of religious building, public facilities, and the king's recompensation to a person or a group of people. Some examples of sima inscriptions are Kudadu and Sukamrta inscriptions (Boechari, 2012:13-14).

Inscriptions that were found in Majapahit period also contain about the ratification of sima. However, there are several inscriptions that contain an affirmation on the ratification of sima from the previous period.

The length of an inscription in Majapahit period is determined on the medium that is used or the content that is short indeed.

Besides those inscriptions, there are also short inscriptions that have different characteristics with the inscriptions that were found so far. Based on the year, it is noted that these inscriptions came from the end of Majapahit period. However, there is different characteristic comparing with other Majapahit inscriptions. Some examples of these inscriptions are inscription of a statement and rajamuda inscription. Although these inscriptions contain a king's edict or statement, the characteristics of these inscriptions are different with another sima inscription in general. Thus, this difference gives a hypothesis that the inscriptions with those specific characteristics were not produced by the central of kingdom.

In terms of physical characteristic, these inscriptions are always carved on metals. Unlike the other sima inscriptions, these inscriptions are not consisted of several plates but only one plate. Generally, these inscriptions are carved collated with the front side consisting of five or six lines and one or two lines on the back sides. Two certain inscriptions have ornament, which are Karang Bogem which has an ornament shaped like cows and Marinci inscription that has cockatoo drawing. Other inscriptions do not have those ornaments which can be called as lancana, as well written on airlangga or kadiri inscriptions.

The inscriptions that contain an edict like a legal decision on a certain land's status, usually state that people who gave order are kingdom officers or the rulers. This seems interesting regarding that inscriptions are released by the king. However, there are several inscriptions from the previous period that contain an edict which ordered by the head of a region or penguasa watak, such as inscriptions from Kanyuwangi period. Those inscriptions are carved on stones, while the ruler in Majapahit period carved the inscription on metals with inserting lancana. In addition, the inscription was released by the kingdom's relatives, such as

    a. Sang Mokta ring Paramalaya

Mentioned on Paguhan inscription (13338 S). According to J. Noordyn (1975:481), it is an alternative name of Bhre Paguhan or Singhawardana yan which is a brother-in-law of Hayam Wuruk.

    b. Sang Mokta ring Paringmalaya

Mentioned on Patapan inscription (no date). According to J. Noordyn (1975:481), it is probably sang Mokta

ring Paramalaya which is Bhre Paguhan.

c. Sang Mokta ring Wisnubhawana

Mentioned on Biluluk II (1313 S), Biluluk I (1288 S), and Katiden II (1317 S) inscriptions. Nastiti (1990:257) argued that sang mokta ring wisnubhawana is Raden Kudamerta or Bhre Parameswara or Bhre Wengker Sri Wijayarasa.

d. Sang Mokta ri Krtabhuwana

Mentioned on Katiden I (1314 S) and Katiden II (1317 S) inscriptions.

e. Sang Mokta ring Amrtabhuwana

Mentioned on Marinci inscription (no date). Probably, sang mokta ring Amrtabhawana is Raden Sotor, brother-in-law of king Hayam Wuruk, the son of Krtawardhana from a consort (Weatherbee,1985:350-351).

Based on the explanation, it is clear that the rulers who gave the order on the inscriptions of the second category are the kingdom's relatives. However, further research is needed to see how these rulers legitimized their powers, and the interaction among the central rulers, the region rulers, and civilians depicted on the inscriptions.

Another element that will be discussed is the language use. The inscription of the second category uses different language with language used on other sima inscriptions. Wurjantoro (2008:159) said that the language that is used in these short inscriptions is similar with the language in the book of Pararaton and Kidung Harsawijaya. The language could be called as the language of "Javanese in the middle age" which is a transitional language from ancient Javanese to the new Javanese.

The following are some examples of the language differences.

a. An addition of the "h" letter on ancient Javanese, such as iku, apan, ing, iya,

adagang, antiga, angraksa become hiku, hapan, hing, hiya, hadagang,

hantiga, and hangraksa.

b. An addition of changes related with sandhi law, such as the word "pwa" becomes "po", "saka i" that should be "sake" changes into "saki".

c. The word "wineh" becomes "wehi"

d. The word "de" becomes "dene"

The third element is the difference in calendar. These short inscriptions wrote the calendar briefly, which only mentioned the year of saka and the date. The following are the details of the calendar in each inscription.

a. Biluluk I inscription only mentioned i saka 1288 in its end

b. Paguhan inscription only mentioned i saka 1338 in its beginning

c. Biluluk III inscription mentioned tithi masa jyestha i saka 1317 (date, jyestha month, year 1317) in its end

d. Patapan inscription mentioned tithi jyestha sirah 7 (date, jyestha month, sirah 7) in its end

e. Biluluk II inscription mentioned tithi ka 2 i saka 1313 (date ka 2 year 1313) in its end

f. Katiden I inscription mentioned tithi ka 9 i saka 1314 (date ka 9 year 1314) in its end

g. Selamandi I mentioned tithi ka 8 i saka 1316 (date ka 8 year 1316) in its end

h. Selamandi II mentioned tithi ka 2 i saka 1317 (date ka 2 year 1317) in its end

i. Katiden II inscription mentioned tithi ka 1 i saka 1317 (date ka 1 year 1317) in its end

j. Walandit inscription mentioned tithi masa 5 sirah 3 i sakakala 1327 asadamasa (date, 5th month, sirah 3 year 1327, asadha month)

k. Karang Bogem inscription mentioned tithi ka 7 sirah 8 (date ka 7 sirah 8) in its end

l. Marinci inscription mentioned tithi ka 4 sirah 5 (date ka 4 sirah 5) in its end

m. Renek inscription mentioned 9 tithī wa pang b aka 9 śīrāḥ in its end

n. Ambetra inscription mentioned i śaka 1295 in its end

o. Biluluk IV inscription did not mention its calendar

Based on the description above, it is noted that the calendar used in the inscriptions of the second category is only the date, month, and year. This differs with the inscriptions of the first category which mentioned the calendar completely.

The inscriptions of the second category have physical characteristics, which are:

· Carved on metals

· The script is the usual script used in Majapahit period

In terms of the content, the inscriptions of the second category have these characteristics.

· The content is short containing the year, name of the figure, and its edict.

· An affirmation of order from a figure or a certain ruler.

· The calendar sometimes only mentioned the year and month and usually placed in the end of the inscription.

Examples of these inscriptions are Patapan, Walandit, Katiden I, Biluluk II, Selamandi I, Biluluk III, Katiden II, Selamandi II, Ambetra, Biluluk I, Renek, Karangbogem, Biluluk IV, Paguhan, and Marinci.These kind of inscription are called rajaprasasti or the king's order.

From the characteristics above, it suggests that rajaprasasti is a kind of inscription that affirmed a ruler decision. In addition, name of the figure appeared on the inscriptions is not the king but the ruler of a region or the kingdom's relatives. This is proven by an institution that functioned as Supreme Advisory Council which called Bhattara Sapta Prabhu which functioned as Pahom Narendra (Boechari, 2012: 522-523)

Pupuh 71 in the second stanza of Nagarakrtagama also mentioned about Pahom Narendra while in discussing about whom deserved in replacing Gajah Mada after he died. It is mentioned that those who involved in the discussion are the king, both of the fathers' king, the mother's king, the sisters and their husbands (Riana,2009: 100)

From the quotation above, it clearly depicts that the king's

relatives involved in giving their perspectives towards problems appeared in the kingdom. It is possible that they also have authority to release an inscription.

Rajaprasasti is an affirmation of the order from king's relatives or a regional ruler. Unfortunately, inscription that can be the basis of that affirmation is not found. However, it is probably written over palm leaves. As what has been known that before the inscription is carved on stones or metals, it is firstly written on palm leaves.

In terms of the content which is about the decision related with a status of a village and the use of Javanese dialect of the middle age, suggesting that rajaprasasti is a kind of decision letter which is used by related civilians as the basic legitimacy. Thus, the language that is used is not an ancient Javanese that usually used on sima inscriptions released by the king.

3. Toponim from places that was mentioned on Rajaprasasti

This subchapter discusses the sites and places that were mentioned on the inscription. There are two regions that will be mapped, which are the sites and the toponim identification from the places mentioned on the inscription.

The determination basis is toponimi, which is a knowledge of analyzing records or the origin of places' names (Ayatrohaedi, 2008: 53-54).

Several things that become the determination basis of a certain region that is related with places mentioned on the inscription are

a. The proximity of names, the changes of names can be linguistically

responsible of

b. The proximity of regions

For further details see table 1

Table 1. Tiponim of Place in the Inscription

No	Inscription	Place where the inscription founded	Places appears on inscription	Toponim Identification
1	Himad (tt)	Surabaya	Walandit village and *para-dapur* Himad	Blandit, Wonorejo, Malang
2	Biluluk I	Beluluk village, Bluluk, Lamongan	Bluluk village	Bluluk, Lamongan
3	Renek	Surabaya	-	-
4	Patapan I	Trowulan, Mojokerto	-	-
5	Karang Bogem	Trowulan, Mojokerto	Karang Bogem	-
6	Biluluk II	Biluluk village, Lamongan	Biluluk	Bluluk, Lamongan
7	Katiden I	Malang	-	-
8	Selamandi I	Surabaya	Selamandi	-
9	Biluluk III	Biluluk, Lamongan	Biluluk village	Bluluk, Lamongan
10	Biluluk IV	Biluluk, Lamongan	Biluluk village	Bluluk, Lamongan
11	Katiden II	Malang	Turen, Ketiden	Ketindan, Lawang, Malang
12	Selamandi IIa	Surabaya	Selamandi	-
13	Selamandi IIb	Surabaya	Selamandi	-
14	Walandit	Wonojoyo, Penanjangan, Peg. Tengger	Walandit village, Mamanggis Lili, Jebing, Kacaba	Blandit, Wonorejo, Malang
15	Patapan II	Surabaya	-	-
16	Marinci	Princi village, Batu, Malang	Marinci village	Princi, Malang

In terms of tiponim, there are several places that can be tracked its identification in the present time, which are

a) Blandit, Wonorejo, Malang.

The tiponim comes from Walandit, a region which is also mentioned on Himad inscription. The site of this inscription is not clearly explained in Surabaya.

b) Bluluk, Lamongan.

The tiponim comes from Biluluk which was mentioned on Biluluk inscription I-IV, and this inscription was found in Bluluk, Lamongan.

c) Ketindan, Lawang, Malang.

The tiponim from Katidan was mentioned on Katiden inscription. This inscription was found in Malang. Unfortunately, the exact place of this incription is unknown.

d) Princi, Malang,

The tiponim from Marinci was mentioned on Marinci inscription. The sites of this inscription is Princi, Batu, Malang.

Based on that tiponim identification, there are several

interesting issues. First, there is a tiponim identification which has similar areas with the sites of inscription found, such as Biluluk and Marinci inscriptions. This is interesting because these two inscriptions includes to the type of Rajaprasasti, which shows an affirmation of a ruler's order or a king relatives'. Due to the characteristic of Rajaprasasti that uses Javanese with a mid dialect and has a short content, it guesses that Rajaprasasti is indeed pointed for the villagers which mentioned in the inscription. Furthermore, the tiponim identification which is similar with the sites of those two inscriptions, strengthens the idea. It is probably that Rajaprasasti is indeed for the villagers and inherited.

4. Conclusion

In conclusion, Rajaprasasti has several unique characteristics which differ with other inscriptions from Majapahit. Those characteristics are found in the content which only show its year, the name of figure, and the edict. It implies an affirmation of an order from a figure or a ruler at certain period. As for the calendar on the inscription, it only lists the year or month and commonly put in the end of the inscriptions. In addition, the calendar on inscriptions usually uses Javanese with the mid dialect, mentioning the similar place with the sites of the inscription. Based on that explanation, it concludes that Rajaprasasti is an inscription which was pointed for certain villagers that are mentioned on the inscription. Furthermore, the inscription is inherited.

Notes

1 Jayapatra or jayasong inscription is an inscription containing a legal decision which is won by the receiver of inscription. Jayapatra inscription gives information about the juridicial process which occurred in the ancient Java period. An example of this inscription is Wurudu Kidul insccription (Boechari, 2012:24-25).

2 Suddhapatra inscription is an inscription which has a content relates to the problem of loan and pawning. However, Boechari (2012: 24) grouped suddhapatra inscription into jayapatra due to the loaning problems that are mentioned in the inscriptions solved in the court.

3 In the Islamic period, the inscriptions are generally written on gravestone, such as the gravestone of Fatimah binti Maimun in Leran, Gresik. Meanwhile, the inscriptions in the colonial period are usually found on tomb, a monument, and an inscription of building inauguration. For example, a monument of Piter Eberveldt's betrayal in Jakarta, Hindu-Buddha's spells that were found in Indonesia are usually written on gold and silver plates which are related with the religious rituals.

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Tools and basic data for temporal information analysis

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Abstract: Needless to say, spatiotemporal information analysis requires both analysis methods for spatial and temporal information. However, there are few tools for temporal information analysis. The HuTime project of Humanities GIS Research Group has developed various types of software tools, web applications and datasets for temporal information analysis. HuTime is, as it were, "Time Information System", and enables to visualize and analyze temporal information by GIS-like operation. Time basic data is basic knowledge about temporal information, and consists of base chronological tables, event index and calendar conversion, corresponding to base maps, gazetteers and geodetic system conversion in GIS, respectively. The project is trying to integrate these resources for temporal information analysis and aiming to establish new scientific field "Temporal Information Science" like geographic information science. In this paper, major activities and current status of the project are reviewed.

Keywords: HuTime, chronological table, calendar, spatiotemporal analysis, GIS

1. Introduction

Geographic Information System (GIS) which has various functions to analyze spatial information, become popular as an essential software tool for various scientific fields. However, there are few tools for temporal information analysis. Although some kinds of GIS software have function for spatiotemporal system, the most of the function is not necessarily sufficient. These types of software are derivation of GIS, and cannot display information without location data. Consequently, spatiotemporal analysis has been considered only from spatial information side. If there is software specialized for temporal information, the spatiotemporal analysis can be reconsidered from the opposite side. Analysis environment for temporal information must be improved to the same level of GIS to realize real spatiotemporal analysis.

The HuTime project of Humanities GIS Research Group (Humanities GIS Research Group 2009) is aiming to establish a new scientific field "Temporal Information Science" which contributes for studies using temporal information, and is trying to construct analysis environment which consists of various types of software tools, web applications and datasets. In this paper, major activities of the project are reviewed.

2. Concept of the Temporal Information Science (TIS)

2-1. Visualization and analysis of geographic and temporal information

For visualization of geographic information, GIS displays data on a map according to geographic coordinate, and overlays these maps to consider geographic relationships among various kinds of data (Fig. 1). It is possible to visualize temporal information in the same way. Text data with temporal information is displayed as a chronological table, while numerical data with temporal information is displayed as a time series chart such as line chart. These data are placed according to temporal axis though displayed forms are different. Therefore,

if these tables and charts use common temporal axis, they can be stacked on the same temporal axis, and enables to consider temporal relationships among various kinds of data.

In the next step of GIS, visualized data are analyzed using some kinds of operations (Shekhar & Xiong 2007). For example, merge is an operation to combine datasets on different maps into a map. Clip is an operation to extract spatial ranges according to a specific condition. It is possible to apply these analysis operations in GIS for temporal information analysis. It means that data in temporal ranges according to a specific condition are extracted in the same way of clipping operation in GIS (Fig. 1).

If there is a software tool which can visualize and analyze temporal information like GIS, temporal information can be analyzed at the same level of spatial information analysis. Although there had not been a software tool satisfying those requirements, the HuTime project developed a software tool HuTime which is implemented functions to visualize and analysis of temporal information by GIS-like operation (Sekino 2009). The project places the software tool HuTime as a leading system in the analysis environment of the temporal information science, and continues to develop it.
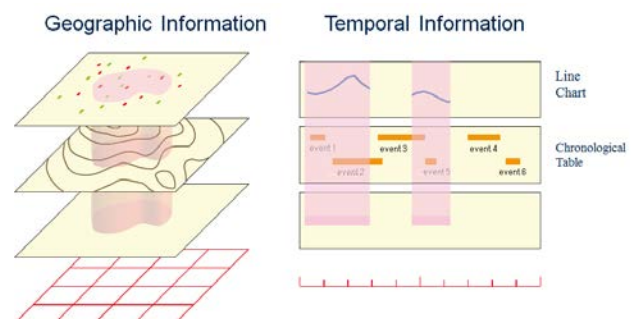

Fig. 1 Comparison of visualization and analysis between geographic and temporal information
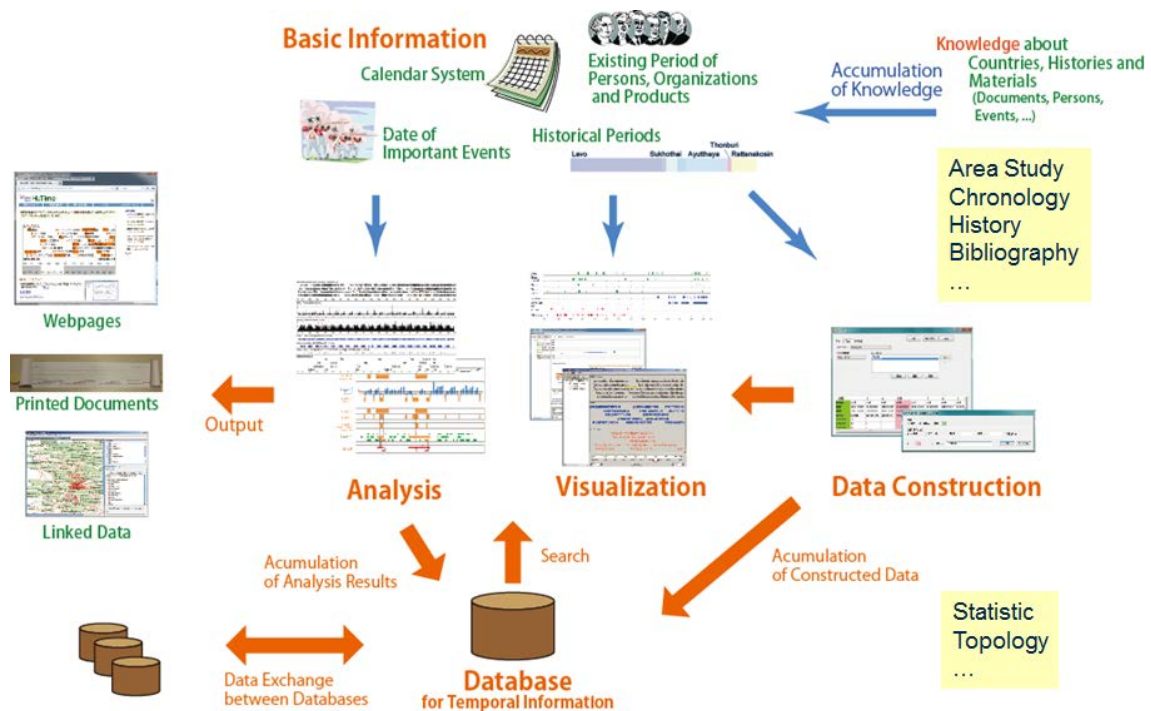
Fig. 2 Overview of the Time Information Science (TIS).

2-2. Components of Temporal Information Science

Fig. 2 shows an overview of the temporal information science. There are two important components. One is tools related with visualization and analysis. Another is time basic data. The process of visualization and analysis is the main stream of temporal information science and is realized by a software tool HuTime which is a time information system specialized for visualization and analysis of temporal information (see 3. HuTime for detail). Time basic data which is another important components support the process. For example, calendar conversion is essential to make dataset, and basic chronological table is useful as a back ground in visualization (see 4. Time basic data for detail).

Since a dataset made by a user is often reused by other users for different objectives as well, datasets should be scientific resources shared among users. Clearinghouses are popular to accumulate and exchange datasets in GIS. The similar mechanism of the clearinghouse should be contained in the concept of time information science to accumulate and exchange datasets of temporal information.

Studies using temporal information cannot be done not only by informatics, because datasets usually contain data other than temporal data such as locations, histories and materials. Therefore, knowledge of various kinds of natural sciences and humanities is required to use those data appropriately (e.g. chronology, history, bibliography and area study). Additionally, knowledge of statistics and topology are also required for the temporal information analysis. Geographic information science is an integrated study including techniques and knowledge about visualization, analysis, data construction. Similarly, temporal information science is assumed as an integrated study which includes

various scientific fields relating with temporal information.

3. Time Information System HuTime

HuTime is, as it were, "Time Information System", and enables to visualize and analyze temporal information by GIS-like operation. HuTime has already been released and available from HuTime Web site (http://www.hutime.org).

3-1. Features of HuTime

HuTime can visualize and analyze temporal information based on its temporal data, and is specialized for temporal information analysis. HuTime expresses character data as a chronological table, and numerical data as a time series chart such as line chart, and stacks these various types of information on the same temporal axis (Fig. 3). There are some kinds of software to make chronological table or time series chart, but only HuTime support to display both simultaneously. This function helps user to consider relationships between numerical data such as information about meteorology and economy and character data such as information about history. Similar to GIS, HuTime has functions of event search and extraction like clipping operation of GIS, and also has logical operation function between layers like intersect and union of GIS.

HuTime uses GIS-like operation, but does not have functions relating with spatial information. There are some kinds of software to visualize and analyze spatiotemporal information, but they are the derivation of GIS which displayed all data on maps. This means these derivations of GIS cannot visualize nor analyze data without location. However, there are many events of which location does not

exist or is not decided. For example, events of Great Depression in 1929 and Subprime mortgage crisis in 2007 have temporal information, but spatial position on the map cannot be decided. Therefore, this type of events cannot be visualized and analyzed using the derivation of GIS. To solve this issue, HuTime does not use maps for data display, and all data are displayed on the temporal axis.
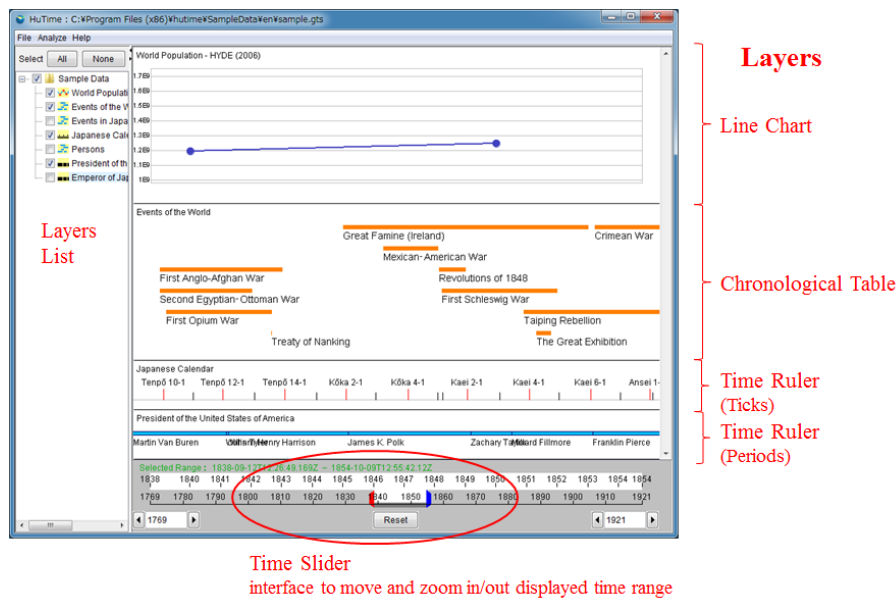

Fig. 3　A screenshot of HuTime

4. Time Basic Data

Time basic data is basic knowledge about temporal information. These types of data are required to temporal information analysis using HuTime, and are essential resources for temporal information analysis as well as HuTime itself. However, there is less basic information for temporal analysis. For spatial information analysis, base maps used as background image in GIS can be obtained easily. On the other hand, for temporal information analysis, there is no available data corresponding to base map. Additionally, there are not enough information resources corresponding to gazetteers for spatial information. Calendar conversion is required to make data for HuTime as well. Therefor the HuTime project try to construct time basic data which consists of base chronological tables, event index and calendar conversion, corresponding to base maps, gazetteers and geodetic system conversion in GIS, respectively.

4-1. Basic chronological table

There are some types of basic chronological tables such as eras or historical periods, major historical events, and information about existing period of a person and organization. These basic chronological tables have some roles, and are similar to that of base maps in GIS. First is the presenting relative position on a temporal axis. Borders and landmarks in a base map let the users know relative position or inclusion property of the focusing spatial object. Similarly, users can know relative position of the focusing event, when eras or major events are given. Another role of the basic

chronological table is background of events. Users can know which and how an event in the basic chronological table affects focusing event. This role is essential for temporal information analysis to know causes and results of the focusing events.

4-2. Event Index

Event index corresponds to a gazetteer in GIS. The index answers position on time coordinates system (i.e. date and time) when an event name is given, and then, the event can be placed on a temporal axis using the obtained position. For example, when an event name of the "Apparition of Halley's Comet in 1986" is given, date and time of events relating with the "Apparition of Halley's Comet in 1986" can be obtained. An event has hierarchical structure like place name, and the event index should have function to keep that. For example, the apparition in 1986 is one of apparition events, while perihelion is a part of the apparition in 1986. The event index is in developing process, and test version is available.

4-3. Calendar Conversion

There are many kinds of calendar system in whole of the world. Calendar system is different not only among countries and locations, but also in historical periods even in the same country. The calendar conversion bridges these gaps in calendar system, and is available in HuTime Web Site (Fig. 4). The calendar conversion requires common temporal axis. Julian date is used as the common time axis in the system. Julian Date is total day count from noon on 1 January 4713 B.C.E., and is contiguous to the present day, while Julian / Gregorian calendar used in the world has at least 10 days gap

when the calendar was switched (Dershowitz & Reingold 2008).

The calendar conversion system of the HuTime project has unique features. Since the system interprets character strings expressing date, a user can enter the character strings as is (e.g. 2015-01-05) into the system to convert calendar, though the user has to enter year, month and day into separated textbox in usual calendar conversion service (Sekino & Yamada 2013). Additionally, the system has other feature such as multiple record conversion and input and output formatting.
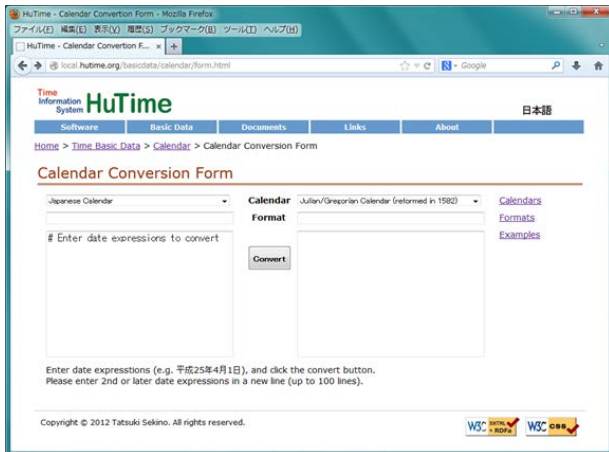

Fig. 4   Calendar conversion service on HuTime website
(http://www.hutime.org/basicdata/calendar/)

5. Concluded Remarks

As mentioned above, the HuTime project will integrate these software tools, web applications and datasets. Additionally, the project is trying to make a concept of "Semantic Chronology" which is an application of semantic web technologies into temporal information analysis. It is expected that these activities of the project will be contribute to establish the Temporal Information Science.

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Cholera Pandemics and the 19th Century India:
A Pilot Study of Spatial Analysis

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Abstract: Many epidemics occurred in 19th century India. Smallpox, plague, and malaria caused human suffering on an immense scale, but cholera was especially prominent in terms of death-toll, killing tens of millions of people. It is notable that cholera pandemics mostly originated in India. During the 19th century alone, 6 such pandemics started in India. The first purpose of this paper is to look at the process of cholera diffusion from India to the neighboring regions, though we will confine our attention mainly to British India and directly neighboring regions. Communication is a necessary condition of cholera epidemics, but cholera infections developed only after the emergence of relevant environmental factors as a sufficient condition, such as contamination of water supplies by cholera vibrio. Therefore the second purpose of this paper is to examine the environmental factors, particularly water factor giving rise to cholera epidemics. In the first half of this paper, we will trace the diffusion routes inside and outside India in a very simple and macro way. In the second part of paper we will try to use the GIS approach to clarify a temporal and spatial of cholera diffusion in Bengal, particularly focusing on the late 1870s.

Keywords:

1. Introduction

Many epidemics occurred in 19th century India. Smallpox, plague, and malaria caused human suffering on an immense scale, but cholera was especially prominent in terms of death-toll, killing tens of millions of people. It is notable that cholera pandemics mostly originated in India. During the 19th century alone, 6 such pandemics started in India, the outcome of the process of globalization that incorporated the subcontinent into the world economy. Consequently, cholera can be regarded as the disease of trade or communication. The first purpose of this paper is to look at the process of cholera diffusion from India to the neighboring regions, though we will confine our attention mainly to British India and directly neighboring regions.

As is well-known, cholera is not directly transmitted from person to person, but is transmitted through drinking water contaminated with human excreta. Communication is a necessary condition of cholera epidemics, but cholera infections developed only after the emergence of relevant environmental factors as a sufficient condition, such as contamination of water supplies by cholera vibrio. Therefore the second purpose of this paper is to examine the environmental factors, particularly water factor giving rise to cholera epidemics.

This paper is a just beginning of spatial analysis of the cholera pandemics in the 19th century, focusing on India. In the first half of this paper, we will trace the diffusion routes inside and outside India in a very simple and macro way just in order to obtain a kind of rough image. In the last part of paper we will try to use the GIS approach to clarify a temporal and spatial of cholera diffusion in Bengal, particularly focusing on the late 1870s which was the period just before the fifth Cholera Pandemic, 1881-1896.

2. How did cholera diffuse? : communication and cholera

The source of cholera pandemics during the 19th century was Bengal in India. How did they diffuse from there? We will show routes of their diffusions, depending on two important works on the history of cholera pandemic. (Macnamara 1876; Pollitzer 1959) We could identify three patterns of diffusion routes within the Indian subcontinent.

Inside the Indian Subcontinent

i. From Bengal to upper Ganges
ii. From the middle reaches of the Ganges through central India, then to west India or south India
iii. From Bengal through the Bay of Bengal to west India or south India

In the pre-railroad era, how did cholera move from Bengal toward the northwest? Cholera moved in this direction during the southwest monsoon season. In Bengal, the southwest monsoon winds blew toward the northwest in June and July. During this season, river traffic was very active. (Macnamara 1892)

From the Indian subcontinent how did cholera diffuse to the neighboring regions? Again, we could identify three patterns of diffusion. (Hays 2005)

Outside the Indian Subcontinent

i. From northwest India to Central Asia or Persia, then to Russia and Europe
ii. From west India to the Arabian Peninsula or Persia
iii. From Bengal to Southeast Asia

Trade in the western Indian Ocean, where Indian merchants had been very active, gradually declined in the 18th century. Meanwhile, trade expanded in the eastern Indian Ocean, where the British East India Company was involved . Then, in the first half of the 19th century, trade activities by both the British East India Company and British private merchants from Calcutta became prominent. The core of this commercial boom was the opium trade from Calcutta to Guangdong, in China.

This structural shift in Indian Ocean trade probably contributed to the rise of cholera pandemics. The sea route for cholera diffusion from Calcutta played a very important role in each of the six pandemics of the 19th century. We should also

note that the urbanization of Calcutta was another very important factor in promoting pandemics.

The diffusion route of cholera pandemics across the Indian Ocean from ports such as Bombay in west India to the Persian Gulf, the Arabian Peninsula or the Red Sea continued to be important. In the second of 19th century, major transportation innovations such as steamships influenced the diffusion routes. And we should also note that the Suez Canal was opened to traffic in 1869. Thus the likelihood of cholera diffusing through 'the Red Sea Route' to the Mediterranean Sea greatly increased. Concern that the Haji pilgrimage from South Asia could cause cholera epidemics deepened in the second half of the 19th century.

In the 19th century land routes were also important. For example, cholera was sometimes transmitted only through land routes to Europe during the 19th century. In fact, if we look at the list of the six cholera pandemics in the 19th century, we find that three pandemics occurred (in 1817-24, 1827-35 and 1839-56) before the transportation revolution fostered the diffusion of cholera. In particular, we should note the importance of overland routes through the central part of the Eurasian continent.

Even in the second half of the 19th century the fifth cholera pandemic (1881-1896) spread overland to Russia and Europe by way of Persia and Afghanistan in 1892 (see Map 5). In addition, the sixth cholera pandemic (1899-1923) was diffused to Russia by way of Central Asia and Persia.

3. How did cholera diffuse?: water and cholera

As already mentioned, cholera is not transmitted directly from person to person. Water is the medium which carries *Vibrio cholerae* from person to person. The most common way is the fecal-oral route, which means that a person drinks water contaminated with cholera-infected human waste. In the following discussion we focus on the water factor. The damage caused by cholera epidemics was different from one place to another, especially depending on the availability of water. We will take up two cases in Central Provinces and Bengal.

The first case is the 1868 cholera epidemic in Central Provinces. Here was the area of epidemic cholera. Cholera deaths were concentrated in the villages that were situated on 'the tops of rocky ridges', 'high open plateaus' or 'hard impermeable rock' in the trap formation. Water was not easily available in those villages because sub-soil water was non-existent and only the available surface water was often contaminated with sewage. Furthermore, the villages in the alluvial part of this region were also severely affected by cholera. Water resources from rivers, small streams or tanks were often polluted. On the other hand, the mortality rate of cholera was low in the metamorphic formation. (Townsend 1869)

Scarcity of water is a key factor in the intensification of cholera epidemics. Usually cholera epidemics reached their climaxes 'in May and the early part of June', the hot and dry season just before monsoon rain. This was a season of cholera epidemics. But in years when plentiful rain fell in the early months 'the progress of the epidemic was slow, and it was

confined within a comparatively narrow area.' (Townsend 1869) In epidemic areas of cholera in India, cholera in mostly semi-arid zone cholera was usually brought in from outside. The type of cholera was apt to be fulminant (explosive) in these areas. Epidemics occurred mostly in the period just before the south-west monsoon when water is most scarce and in the early monsoon period when human waste on the surface flowed into tanks or rivers and contaminated water.

The second case is the late 1870s of cholera epidemic in Bengal. (Bellew 1884) We try to do a temporal and spatial analysis on the cholera diffusion there by using the GIS approach.

In these areas it was difficult to dig deep wells because the land was waterlogged. Therefore people had to get drinking water from surface water sources such as tanks or rivers, and there was a high risk of drinking water contaminated with *Vibrio cholerae*. In these areas, cholera outbreaks usually occurred during the season from October to May. This was the dry season with low temperatures and low precipitation. On the other hand, severity of cholera outbreaks was small during the rainy season from June to September. Water contamination was mitigated by dilution with rainwater, leading to attenuation of cholera infection.

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Some historical places of the "Secret history of the Mongols" (by example of Buura steppe battle)

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Abstract: The Secret History of the Mongols is a history-chronicle retold in epic style and impregnated with steppe aroma. It says not only of the old genealogy of Mongol khans, of the life and deeds of Chingis Qahan as the founder of the Mongol State. It also gives a very vivid and truthful panorama of the nomadic mode of life of the Mongols and provides the richest material for understanding the different aspects of the Mongol society in the thirteenth-fourteenth centuries. The Secret history of the Mongols is the only immediate source of information about medieval mongolian life and self-consideration and also it is the invaluable treasure for historians, linguists, ethnographs and ethnologist engaged in the field of oriental studies. Therefore it is translated into 24 languages and had been printed over 250 times around the world.

In this research we're attempting to use Geographic Information System (GIS) to analyse the issue by the report, inquires first battle place where Chinggis Qahan took back Borte Ujin from Mergkits, and birthplace of Zuchi, his old son in 1179.

Keywords: Mongolia, The secret history of the Mongols, Chinggis

1. Introduction

The territorial position of the historic events has been distorting due to that names of the traditional lands and rivers has been revolving while human has been developing with a notable achievements at present, as well as geographical locations or modes are turned into.Mentioning an example about it: the cradleland of Chinggis Qahan, established the most powerful empire in the world, had been written in 6 different ways.

Therein:

1. Dadal soum, Khentii province
2. Bider soum, Khentii province
3. In the west of Onon river banking, located in the Southeast of the Chita, Russia
4. Dr. Erenjen Hara-Davan, Kalmyk accused the name 'Great island', and defined northern lat 50°, eastern long 132°
5. According to O.Jamiyan and Kh.Perlee, it'seastern latitude110° and northern longtitude 49°, close to Burkhan Khaldun mountain or ancentors' land.
6. In the north or in the border of Lake Baikal

And even, some Mongolian hystorians considers that Temuujin was Russian, Japanese and European. Hereto:

1. Temujin Chinggis Qahan (Mongolia)
2. Yoshitsune Chinggis Qahan (Japan)
3. Georgy Danilovich Chinggis Qahan (Russia)
4. John Prestory Chinggis Qahan (Europe)

In this regard, human is born in only one place. But the place's location and name was changed by historians and researchers as above mentioned. Like this, places of historical events have been written through many different names and positions. Thus, we're attempting to use Geographic Information System (GIS) to analyse the issue by the report, inquires first battle place where Chinggis Qahan took back Borte Ujin from Mergkits, and birthplace of Zuchi, his old son.

Establishing the routes of the historic events and wars basing on Geographical Information System is so core and give a chance to study history events within framework of geographic and historical science nowadays in particular, to pore over the historic events for geographic, to intensify some undiscovered activities, to consider the ground reliefs, geomorphological structures and locations of the rivers to conclude for space and so on. The utilization of the GIS is intensively developing in the world. A range of this is to raise itinerary of the historical event process by the way of rehabilitating geographical changes.

There are various international samples about it. For instance, there is a research which interlinks Christian biblical canon with GIS. It is considered that Christian Bible and Islamic Quran are the most widely published books in various languages. It is delighted to say that "Secret History of the Mongols", the historical source of Mongolia, is doubly qualified research comparing to any other countries' historical sources. It was proven that "Secret History of the Mongols" is not only Mongolian source but also the research of the whole world and about 400 types of it were published in more than 30 languages. Moreover, thousands of monographs and articles about it and the creation of independent research concept "Study of Secret History of the Mongols" demonstrate how deeply it has developed.

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As from the view of researchers , "Нигуча товчиян" or "Юань чао би ши" had been stored in the king's mint until the collapse of Yuani regime and after it was revealed during the period of king Hung U of Min state in 1380-139, the transcription, translation and presswork of the treatise were done first time.

Picture1 "Secret History of the Mongols" First interlinear translation in Chinese

"As mentioning about "Secret History of the Mongols", F.Klivez considered French edition of H.Yu, Klaproz in 1824 as the first European translation of it in the introduction of his edition written in English in 1928. However, most of the researchers believe that first

European edition is the publication of P.Kafarov (1817- 1878), Russian doctor, who has translated " Old myth about Chinggis Khaan" from Chinese into Russian in 1866 in his series of " Publications of Russian religious mission in Beijing".

In 1941, S.A.Kozin (1879-1956) translated "Secret History of the Mongols" into Russian. In 1970, N.Ts.Munkuev studied about Mongolian transcription pictography and Nangiad interlinear translation and he had been translating "Secret History of the Mongols" until his death. In 1982, V.Haissig simplified and wrote the epilogue of the version of E.Henish written in German in 1948. And M.Taube published several editions since 1989.

One of two editions published in 1917 by Tsend (1875-1932), ex

vice-minister of Foreign Affairs, adhering wooden stock source of Ye De Hui is in the library of the Institute of Oriental Studies of RUS, and other one is stored in the National Library of Mongolia. One possessed by J.Tseveen who subscribed the two editions is now in the Library of Saint Petersburg and a daughter of Tsend wrote background about it and published by photos.

Picture2 Some editions of "Secret History of the Mongols"

The fictional version written by Ts.Damdinsuren for the 700th anniversary of "Secret History of the Mongols" was published into series in "Science" journal in 1941-1942, into book in 1947, and also printed out about 30 times since 1957, 1976, and 1990.

Besides the scientist mentioned above, H.Perlee. T.Dashtseden, Sh.Gaadamba, D.Tserendsodnom, B.Sumyabaatar, Sh.Choimaa, Sh.Bira, T.Khorloo, A.Punsag, O.Bavuu, D.Purevdorj, G.Menes, M.Uuganbayar and many other scientists have made great effort and contribution to develop the study of Secret History of Mongolia and its transcription, translation, explanation and publicity of scientific articles and books. "Secret History of the Mongols" is the history of establishment of Mongolian state and the domination in the world. Furthermore, it is great treasury which offers chance to make more detailed research about Mongolian language, culture, tradition, legislation, economy, philosophy, stratagem, religion, horoscope, astrology, etc. We are presenting our speech, intending to elucidate the event happened in 1179 from this historical source.

Temuujin married Burte Ujin along with Mongolian traditional custom, being in the 12th to 13th century .

After a few months Temuujin brought her to own home, rivals of Merkits attacked them home suddenly. The mongols during this time period had a philosophy of the strong ruling over the weak with attacking and raiding each other being a common thing.

The unexpected foray was started by Merkits who were Toghta Beki of the Uduyit-Merkits, Dayir-usun of the Uwas- Merkits and Hatai-Darmala of the Hat-Merkits. As they heard of Temuujin staying in the bank of Sengur brooklet, these three Merkits, knowing that Mother Hoelun (Mother of Temuujin) had been abducted from Chiledu by Yesukhei, had now come to take revenge on Temuujin, sleeping.

Huagchin, the old woman who worked in the yurt of Mother Hoelun, rose up and said, the terrifying Tayichuuds coming. Then Temuujin, Hoelun Ujin, brother Khasar, Khachiun,

Temuge, Belgute, Boorhchi and Zelme as Temuujin's friends rode one horse respectively. Thus Lady Börte was without a horse. While it was still early, Temuujin and all the brothers rode off towards Burkhan Khaldun. The old woman Huagchin hid Borte in a black covered cart with a wooden frame harnessed to an ox with spots on its back to Tunkheleg brooklet. Then Sochigel, the second wife of Yesukhei stayed at home. When Huagchin was going to aiming place, some soldiers trotted past and then turned back. '*Who are you?*' the soldiers asked. The old woman Huagchin said, 'I am Temuujin's servant. I came to shear sheep in the great yurt I am now returning to my own yurt.' The soldiers then asked, 'Is Temüjin in his yurt? How far is his yurt?' The old woman Huagchin said, 'The yurt is not far away. I do not know if Temuujin is there so that I come from north yurt. Hearing these words, the soldiers trotted off.

The old woman Huagchin beat the ox with the spotted back. As she and Borte Ujin moved quickly off, the axle of the cart snapped. '*The axle is broken! Let us go into the forest on foot and run!*' they said to one another. Straight away, however, the Toghta Bekhi and his soldiers arrived at a trot with Sochigel mounted behind on one of the horses. As they approached, they said, 'What are you carrying in this cart?' The old woman Huagchin said, '*It is loaded with sheep wool.*' Toghta Bekhi said, '*You juniors and boys, dismount and take a look*.' Toghta Bekhi and boys dismounted. As soon as they removed the door of the closed cart, they found someone who seemed to be a young Ujin sitting there. They pulled the woman down from the cart, put both her and Huagchin behind them on their horses, and rode off with them.

In Burkhan-Khaldun mountain, the thick woods, and the dense forest, they were like glutted bears, unable to creep in. Toghta Bekhi with three hundred soldiers went three times round Burkhan-Khaldun in pursuit of Temuujin, but could not find him. Toghta, knowing that Mother Oelun had been abducted from Chiledu, had now come to take revenge. Toghta said, to avenge the abduction of Oelun, we will carry off their Ujin. We have taken our revenge. Then he said, '*let's go back*' and got back with all of the soldiers'.

Borte who was a pregnant, had been made a match to Chilger Bokh, brother of Chiledu, and Sochigel was a gamy of Hatai-Darmala.

It not only was a terrible abjection for Royal Blood that Borte Ujin was taken away by force, but also pothered in Mongolian Steppe. Temuujin had realised that he could not bring back by himself the fact that the Three Merkits was one of the most powerful tribal groups.

After that, all of Borjigon tribe had followed Temuujin because the irreverence of the Merkits was rankling for all of them, not only Temuujin. Then they leant on Tooril Khan, chum of father Yesukhei.

Temuujin with his brothers Khasar and Belguutei went to Tooril, the Van Khan of the Khereyits, who was staying in the Khar Forest beside the Tuul River and said

> In return for the black sable jacket
> I will bring together the people who abandoned you, before.

They told him: 'While we were still inexperienced in such things, the Three Merkits came and robbed my wife and my unborn son. We have come to ask you, Khan my father, whether you can restore my wife and son to me.' Tooril Khan replied: '*Did I not say as much to you last year? When you brought the sable jacket to me you said that, in your father's time, I and your father swore brotherhood together, and that I am therefore as a father to you. When you placed the coat on me, I spoke these words:*
Now I will stand by them.
In return for the sable jacket,
I will crush the Merkits and rescue Borte Ujin for you. Send a message to younger brother Jamukha, who is in the Khorkhunag Jibur. I will set out from here with twenty thousand men to form the right flank. Tell Jamukha to take twenty thousand to form the left flank. Let Jamukha decide the time and place of our meeting.' When Temuujin, Khasar, and Belguutei arrived at their yurt after visiting Tooril Khan, Temuujin told Khasar and Belguutei to take the following message to Jamukha. This was the message that he sent to his sworn brother Jamukha.

He also told Khasar and Belguutei to repeat to Jamukha the words of Tooril, the Khan of the Kereyits*: I will be a companion to you. With twenty thousand men, I will form the right flank and do battle. I will set out from here with twenty thousand men to form the right flank. Tell your younger brother Jamukha to take twenty thousand into battle. Let Jamukha decide the time and place of our meeting.*' After brothers come back home, Khasar and Bilguutei were sent to Jamukha.

When Tooril Khan's words had been conveyed to Jamukha, he said: Temuujin all these things. When my older brother Tooril Khan sets forth, he should make his way to my sworn brother Temuujin by the south side of Burkhan-Khaldun and follow the Onon River to its body at Botokhan-Boorji. Let us meet there. I will ascend the Onon River to where my sworn brother's people wait. The ten thousand men of my sworn brother's people and the ten thousand of my own men will constitute a force of twenty thousand. Following the Onon River to its body at Botokhan-Boorji, the appointed place, we shall join forces.' So saying, he dispatched this message.

Qasar and Belguutei returned and told Temuujin what Jamukha had said. Then sent the message on to Tooril Khan. On hearing these words of Jamukha, Tooril Khan set out at the head of twenty thousand men. 'When Tooril Khan sets out, he will come towards the Burgi bank of the Kherlen on the south side of Burkhan-Khaldun,' thought Temuujin, who was on the Burgi bank; 'and I am in his path.' So he yielded, and moved upstream along the Tunkheleg to the Tana Stream on the south side of Burkhan-Khaldun, where he set up camp.

From there, Temuujin and his army set out. The ten thousand men under Tooril Khan and the ten thousand under his younger brother, Jakha-Khambu, twenty thousand altogether, set up camp at Ayil-Khargana on the Khimurga Stream. At that point, Temuujin joined them and set up camp.

After joining forces, Temuujin, Tooril Khan and Jakha-Khambu moved towards the body of the Onon River at Botokhan-Boorji, where they found Jamukha, who had reached

the appointed place three days earlier. On seeing the armies of Temuujin, Tooril, Jakha-Khambu, and the others, Jamukha lined up his own army of twenty thousand men. After lining up their own armies, Temuujin, Tooril Khan, Jakha-Khambu, and the others went to acknowledge one another.

While they moved From Botokhan-Boorji to the Khilgo River, Toqto'a-beki was sleeping. Some fishermen, sabletrappers, hunters, and sentries had arrived from the Khilgo River. Throughout the night they had taken word that the enemy was on his way. When the message reached Toghtoa, he joined Dayir-Usun of the Uwas-Merkits and the two men went downstream along the Selenge to Bargujin territory. They escaped with just a few of their men.

The Merkit people fled at night in panic down the Selengge. Our soldiers, despite the darkness, followed closely on their heels, robbing and looting. Temuujin went among the panic-stricken, calling, 'Borte! Borte!' Borte Ujin, who was among those fleeing, heard and recognised Temuujin's voice. She got down from the cart and ran towards him. Both Borte and Huagchin recognized Temuujin's rein and tether. Then, Temuujin sent word to Tooril Khan and his sworn brother Jamukha to say: 'I have found what I sought. Let us not continue through the night but pitch camp here.'

In this time, the Three Merkits could not fight and had not combativity due to be not ready to fight eventhough the Three Merkits was so powerful.So, they committed robbery and gained a lot lucre without any threat.Eventually, Temuujin had takenback his Borte, as well as Tooril and Jamukha had accepted the lucre. After the batle, Temuujin had own army that included thralls of the Merkits and ten thousand men set out Temuujin's territory, given by Jamukha.When they went back to each other's territory, they caught Khatai-Darmalaa in Talkhun Island and enfettered him to outcast to Burkhan Khaldun.   It is named 'Buura Steppe Battle' where Temuujin's first victory on Three Merkits Battle in the history. Simultanously, the time was autumn in1179 that Zuchi was born, Temuujin's old son.

Temuujin named his son, Zuchi. However, some historians such as Jashid Ad Din, consider that Zuchi was not Temuujin's son the reason why Borte was a pregnant from Merkit. Then Temuujin named him Zochi (Zochin). Furthermore, many scientists argued and written that Zuchi was Merkit's descendant. For instance, according to Kim Jong Re, Korean historical proffesor, the Buura Steppe Battle started suddenly before Borte born Zuchi, Merkit's child… In Royal Bloop history, the son had been the main reason of   Mongolian empire fragmentation and inheriting the Crown. The case was remained as indelible6 smut in Mongolian history. But this argument is inveracity.

Thus, there is a question how long had Borte been taken by Merkits?

2. For Geographic Locations:

The places regarding the battle to destroy the Mergeds, the Battle of Buur Kheer, are as follows:

Burgi bank of Sengur stream – Erdene sum, Khentii aimag Lat 48°00', Long 108°00'

Burkhan Khaldun – Umnudelger sum, Khentii aimag Lat 48°46' N, Long 109°01' E

Black wood of Tuul – Tuv aimag, Khan-Uul district, Ulaanbaatar Lat 47°46' N, Long 106°40'E

Khorkhunag Jibur – Batshireet sum, Khentii aimag Lat 48°23' N, Long 110°20' E

Onon river source Botokhan boorji – Umnudelger sum, Khentii aimag Lat 48°06' N, Long 109°20' E

Khimurga stream, Ail khargana – Umnudelger sum, Khentii aimag Lat 48°14' N, Long 110°06' E
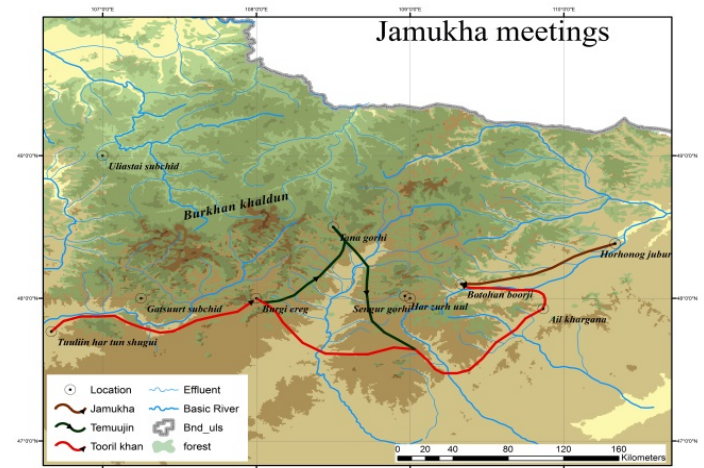
Tana stream – Mungunmorit sum, Tuv aimag Lat 48°30'N, Long 108°30' E

Picture 3: Route to Jamukha, Temuujin and Tooril khan's arranged place to meet.

Khilgo river – Ulan-Ude, Republic of Buryatia, Russia Lat 52°35'N, Long 111° 08' E

Buur kheer – Altanbulag sum, Selenge aimag Lat 50°18' N, Long 106°20'E

Talkhun island between Orkhon and Selenge – Sukhbaatar sum, Selenge aimag Lat 50°00' N, Long 106°00' E.

2.1 Route to Jamukha's appointed place: Temuujin and Tooril Khan traveled a total of 642 kilometers, and reached a place called Botokhan boorji.

As Tooril khan took off from the Black wood of the Tuul, Temuujin went off from Burgi ereg to Tana stream and caught up with Tooril khan. When they reached Botokhan boorji to meet with friend Jamukha, they were already 3 days late.

2.2 Route to Buur Kheer: It is 520 kilometers between Buur Kheer and Botokhan boorji, where Temuujin, Tooril khan and Jamukha arranged [appointed] to meet. Geographically, they will go through places such as present-day   mountains, Jargalant river, Eg river and Onon river. It is possible to use the route shown in Picture 4 and that would be a total of 496 kilometers.

Picture 4: Route from Botokhan boorji to buur kheer

Considering the distance between stations of the Mongol Empire, it is possible for a horseman to travel around 60-70 kilometers a day.

Therefore, Tooril khan traveled a total of 370 kilometers from the Black wood of the Tuul to Botokhan Boorji in 7 days. Temuujin traveled 200 kilometers from Burkhan Khaldun in 4 days and Jamukha traveled 192 kilometers from Khorkhunag Jibur. And all of them traveled 496 kilometers from Botokhan Boorji to Khilgo river in 9 days with all their soldiers.

2.3. Route back from Buur Kheer: As Tooril khan separated from Temuujin and Jamukha from Buura Steppe, he stopped by places called Uliastai subchid and Gatsuurt subchid, and finally reached Tuul's khar tun forest. On his way back, he spent approximately 7 days traveling 367 kilometers. Temuujin and Jamukha returned from Buura Steppe to Khorkhunag Jibur valley and had a great wedding celebration. They travelled around 1890 kilometers in about 40 days.

From this example, it is possible to estimate when the Buura Steppe battle took place. An assumption can be made that the battle took place from mid-June until beginning of August. After the battle, Temuujin had the opportunity to build his own army and that set to the beginning of becoming a Khan.
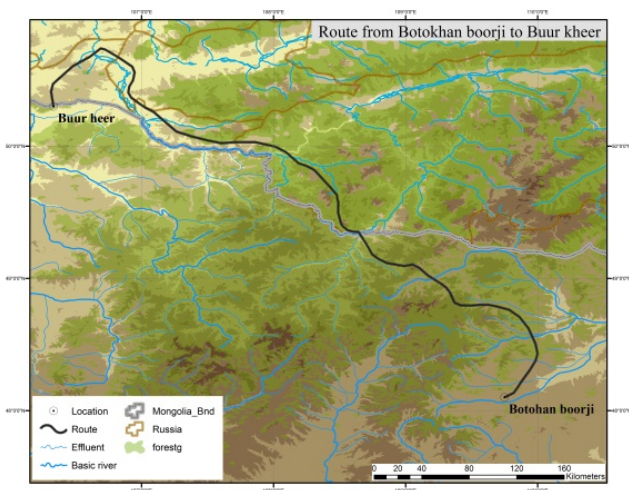
Picutre 5: Route back from Buura Steppe, where the battle took place

2.4. Temuujin was titled Khan: After separating from Jamukha, all the scattered Mongols came to Temuujin and Khorchi says:

"*My people are descended from the woman Holy Ancestor Bodonchir captured and took as his wife*
Because of this, we're such close kin to Jamukha that we're just like people who share the same mother's belly, like people who come from the waters of the same mother's womb.
We'd never have left Jamukha
But a sign from Heaven came to me in a dream and told me that Temuujin was meant to be our leader.
In this dream I saw a great cow enter our camp. First she circled Jamukha, then she charged at his tent, then charged at Jamukha himself, striking him with her head and breaking one of her horns.
'Bring me my horn!' she cried to him, bellowing at him as she stood there kicking up dustclouds with her hooves with one crooked horn on her head.
Then an ox with no horns at all pulled up the tent stake and harnessed himself to the car.
*He drew away Jamukha's cart until he came up to Temuujin.*
He stopped there and began bellowing, 'Heaven and Earth have agreed that Temuujin should be Lord of the Nation.
I've come to bring you the Nation."

After discussing, Temuujin was titled Chingis Khaan. (Meaning "Supreme ruler" or "Universal ruler")

Through the Battle of the Buura Steppe or the battle to destroy the Merkits, Temuujin, who had only few soldiers and army, destroyed the Merkits and captured the people and the weapons. After having his own army and people, he became the Khan of the Mongols. Ever since then, Temuujin started to rise. Today he is remembered for conquering many countries and taking over half of the world.

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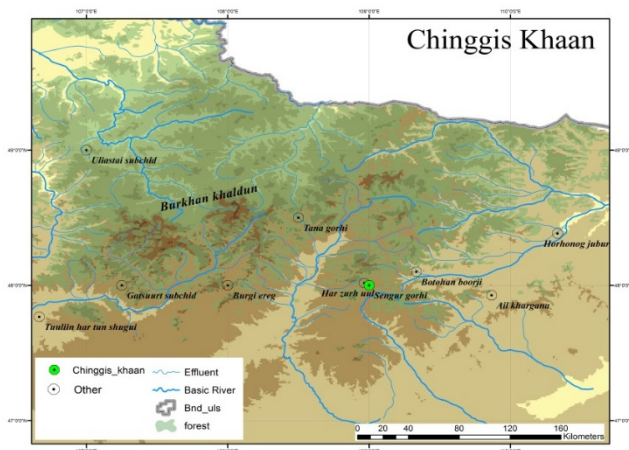
Picture 6: Map of where Temuujin was titled Chinggis Khan.

3. Conclusion:

Finally, the historic events in section 98-117 of "The Secret History of the Mongols" are analyzed below:

1. The eldest son of Temuujin (Chingis Khaan), Zuchi is not a rejectmenta of the Mergeds. In section 255 of "The Secret History of the Mongols", Chingis Khaan mentioned about Zuchi and says "Is he not the eldest of the brothers".

2. Temuujin was very aware of the situation at the time and as it was necessary for him to be under the influence of a reliable person, he reached out to Tooril khan and through Tooril khan he even united with Jamukha as well. His messages were the start of his diplomatic policy and he successfully implemented them.

3. The Battle of the Buura Steppe was not a battle of two sides preparing and facing each other, but a battle where one side made a sudden attack on the other. The battle destroyed the Merkits and ended their independence in history. The Merkits lost their indepence in history after their defeat at the battle.

4. Temuujin led his soldiers for the first time in this battle and was able to take back his wife Burte.

5. Temuujin not only united his friends but also he had his own army after the battle.

6. By leading his own troops in the battle, he was able to show that he is an outstanding leader and a heroic commander. Moreover, he gained the trusts of many Mongols and that was the beginning of numerous other events in the future.

7. Within a year and a half after the battle, 21 tribal groups followed Temuujin and later, the royal families of Khimurga stream7 came to Temuujin in groups. The fact that a total of 33 tribal groups, 13 thousand families came to Temuujin was far beyond Yesukhei's time.

8. Temuujin named his victory, which was against the Three

Merkits, the Battle of Buura Steppe and for the first based on the GIS, the map was created using geographical locations.

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Distribution and accuracy of place names in Thailand listed in a Japanese gazetteer during World War II

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Abstract: A series of gazetteers of Southeast Asia and the Pacific region, entitled Dai Nan'yo Chimei Jiten, was planned for publication in Japan during World War II. While not all volumes in the series were published, however, the fourth volume, which covered Thailand and French Indochina, was published in 1943.

Volume 4 lists about 3,000 place names in Thailand in Roman alphabetical order with not only their geographic coordinates but also, uniquely among gazetteers of the same period, a brief description of the surrounding landscape or landmarks. Some entries of the place in this volume also give place names in Japanese katakana script, which may show the conventional understanding in Japanese society at the time.

The geographic locations of these 3,000 entries are densely distributed along the coastlines, especially along the Gulf of Thailand, while entries for northern and northeastern Thailand are scarce and partial. This may vividly reflect the emergent requirements of wartime.

For my wider purpose of integrating these data into a digital gazetteer of Northeast Thailand with a diachronic aspect, I am presently analyzing locational accuracy. Here, I present some observations on locational accuracy, changes in place names, and common differences in Romanization of synonymous Thai place names. My study may contribute to smoother access to documents referring to Thai places in previously unstandardized Roman script, and identification of their locations.

Keywords: digital gazetteer, Dai Nan'yo Chimei Jiten, Thailand

Visualization of Trade of the Dutch East India Company in 18th Century: with GIS and Historical Statistics

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Abstract: This paper is about the study how to visualize historical phenomena using the statistical data and maps. This is a case study using Geographic Information System (GIS) with the statistics of the Dutch East India Company (VOC) during 18th century to think how to utilize GIS in historical study and share some challenges.

Keywords: GIS, VOC, Batavia, Trade, Asia

1. Introduction

It is well known that The Dutch East India Company (Vereenigde Oostindische Compagnie, VOC) built the international trade network among many cities and ports in Europe, Africa and Asia during the 17th and 18th century. Especially Batavia was the base of VOC and had acted as an important part as a world trade port city as well as the trade hub connecting cities in Europe and Asia. As VOC recorded statistics of trade among Dutch Republic, Batavia and other settlements where the trading posts were located, the transition of the total trade and goods in this area the change of the connection and the role of each place can be known through the data. However, if the one who read the data don't know the location of each VOC settlement, it is difficult to understand the dynamic history of VOC sailing across the world during that period. If the data including the transition of the trading in Asia can be visualized using maps, more people can know how the world in 18th century changed dynamically and see more things from maps which we cannot notice from the tables of statistics.

In this paper the author will share the maps using the data of trade among the VOC settlements collected by Jacobs (2006). The aim of this paper is to share the benefits and challenges of using GIS in historical research.

2. VOC, Settlements and Data

Historical documents and archives related to VOC have still remained. Especially we can get data on the VOC's trading activities and shipping routes, so we can know how Dutch developed their trading business in the world by sailing because many officers in the company wrote trade reports in each trading post and which route old ships took.

The sea lanes have been revealed by the project of Climatological Database for the World's Oceans 1750-1850 (http://pendientedemigracion.ucm.es/info/cliwoc/index.htm). This project collects logbooks from the ships engaged in military or government activities as well as the Spanish Postal Service and the quasi-governmental enterprises of British, Dutch and French trading companies to reveal the climatic information contained in ships' logbooks for the period 1750 to 1850. In the 18th and 19th century, officers on board sailing vessels maintained detailed log books of the ships' activities and management. Included within these records were observations of the current weather. The data also include latitude and longitude estimated by the logbook records of British, Dutch, French and Spanish ships. Figure 1 is the map plotting data of longitude and latitude from records of ships from ports in Dutch to Batavia and other cities in Asia with possible shipping routes between Dutch and Asian ports.
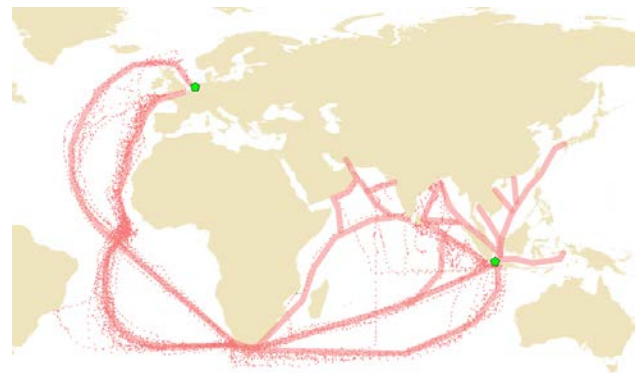

Fig.1.Estimated Points of the Shipping Routes and the Sea Lanes between Dutch and Asia and in 17th and 18th Century (Data source: CLIWOC)

Furthermore VOC recorded trade-related data among the VOC settlements by goods. This time the author uses the data compiled by Jacobs (2013). This data includes values of imports and exports of following 24 categories in 1711-13, 1730-32, 1751-53, 1771-1773 and 1789-90: Cinnamon, Cloves, Coffee, Fine Spices, Gold, Japanese copper, Mace, Mace-Nutmeg, Nutmeg, Opium, Pepper, Raw silk, Saltpeter, Silver Asian coins, Silver European coins, Silver Unminted, Sugar, Tea, Textiles, Tin, On freight, On recognizance, For company use and Other. The VOC was established in 1602 and expired at the end of the 18th century. So the data is important to understand the latter half of the VOC's activities.

Regarding to the VOC trading activities in Asia, her data covers 27 settlements existed in the 18th century (Table 1) to see trends of imports and exports between these places and Batavia. In the data some settlements refer to specific places, but some settlements are much bigger area such as regions. The trading data were already summarized in each settlement, but this data introduced the original VOC spelling. When we use this kind of modified data, it is important to understand the characteristics of the data before we use.

Table 1. VOC Settlements in 18th Century and Current Names of Countries

Settlement	Country	Settlement	Country
Amboina	Indonesia	Macassar	Indonesia
Banda	Indonesia	Malabar	India
Banjermasin	Indonesia	Malacca	Malaysia
Bantam	Indonesia	Mocha	Yemen
Batavia	Indonesia	Padang	Indonesia
Bengal	India/ Bangladesh	Palembang	Indonesia
Canton	China	Persia	Iran
Cape of Good Hope	South Africa	Pontianak	Indonesia
Ceylon	Sri Lanka	Semarang	Indonesia
Cheribon	Indonesia	Siam	Thailand
Cochin China	Vietnam	Surat	India
Coromandel	India	Ternate	Indonesia
Jambi	Indonesia	Timor	Timor-Leste
Japan	Japan		

(Data source: Jacobs 2013)

3. Visualize of historical data: its impact to share the information and knowledge

Is this easy to imagine the locations of the VOC settlements in Table 1? If you know all places and where these are in the world, it may not difficult. However, some settlements in the table 1 are spelled in the different way. As mentioned above, the names of the VOC settlements in the table 1 are the same as the original documents. It means, it is difficult to know without knowledge of old place names. The author added the present-day country names. This information helps readers to guess the locations of the settlements somehow. But our knowledge or memories on the locations in the world may be sometimes vague and inaccurate. Table 1 provides us the basic information on the VOC settlements to think of the global activities of VOC, but this is not enough to understand the dynamic activities of VOC spatially.

So the map will help us. Figure 2 shows the locations of the VOC settlements headquarters. This map helps us to understand how widely VOC expanded their trading activities in Asia.

Fig. 2. VOC Settlements in 18th Century

Triangles show the VOC settlements, and pentagons are VOC headquarter in Dutch and Batavia in Indonesia. From the map we can know many settlements were located in Indonesia, especially Java and Sumatra islands, especially facing Malacca strait and Java Sea. Also, some settlements in Indonesia were located in Maluku Islands known as the Spice Islands. In other areas, VOC balanced the distribution of settlements from Persia to Japan. We can read the map that VOC might strategically decide the locations of settlements in Arab, India, Mainland Southeast Asia and East Asia.

Since VOC has about 200-year history, the goods dealt by this company and major markets have been changed according to times. Not all of the settlements of VOC existed in the 18th century. For example, some were established in the 17th century, but closed in the middle of the 18th century. Of course we can know the facts on the settlements from books, research papers or documents, but we can also know the trends of the active or inactive trading posts or settlements from trading data and maps. To know the history of trading by VOC in Asia, the author visualized the data between settlements and Batavia in the 18th century. Here the textiles' trading data by Jacobs (2013) is taken for instance. The data include the settlements imported from Batavia and exported to Batavia and the value (Dutch Guilder) in each settlement in 1711-13, 1730-32, 1751-53, 1771-1773 and 1789-90 (Fig. 3). To see the trading activities only in Asia, the map excluded trading values between Batavia and Dutch. On the map, blue circles show exports to Batavia and pink circles indicate imports from Batavia.

We can know some settlements in India were leading the textile production in this century. Also the maps show some trading activities in China and Japan. In India, Coromandel in southeastern part of India was the largest textile export port until the map of 1771-73 (Fig. 3-d). But we also realize Surat in west India grew and find this settlement became bigger than Coromandel in the map of 1789-90 (Fig. 3-e).

Another remarkable point that we can see from these maps is changes of places imported textiles from Batavia. In the map of 1711-13 (Fig.3 –a), a large amount of textiles from India went to Ceylon via Batavia. The value of textiles to Ceylon was about 55% of all value of textiles exported from Batavia in Asia in these two years. Also the map indicates textiles were widely exported to ports in Asia. Imports of textiles in Ceylon once slowed down in 1730-32 and 1751-53, but rebounded in 1771-73 and 89-90 and took about 30 percent of the import value in Asia.

In 1730-32 and 1751-53, the export to Persia and Japan stood out. Especially Japan was the biggest settlement to get 1/3 of textiles exported from Batavia in Asia. In this century, Japan continuously imported textiles from Batavia. On the other hand, Persia was the biggest destination for export in 1751-53 but suddenly vanished in Fig. 3-d and Fig. 3-e. Why did Persia disappear from these maps? This sudden change was related to the settlement in Persia was closed in 1750s. The map sometimes gives us good questions to know many important things which we need to see other information sources besides maps.
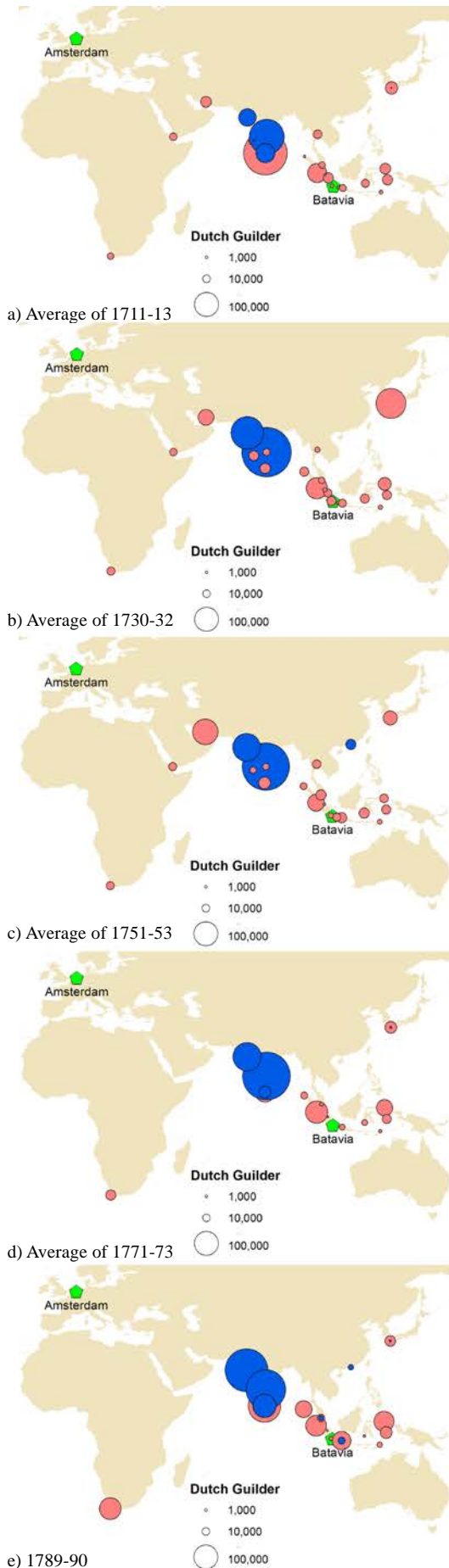
a) Average of 1711-13

Dutch Guilder
· 1,000
○ 10,000
○ 100,000

Batavia

Amsterdam

b) Average of 1730-32

Dutch Guilder
· 1,000
○ 10,000
○ 100,000

Batavia

Amsterdam

c) Average of 1751-53

Dutch Guilder
· 1,000
○ 10,000
○ 100,000

Batavia

Amsterdam

d) Average of 1771-73

Dutch Guilder
· 1,000
○ 10,000
○ 100,000

Batavia

Amsterdam

e) 1789-90

Dutch Guilder
· 1,000
○ 10,000
○ 100,000

Batavia

Fig. 3. Export of Textiles to Batavia in 18th Century
(Data source: Jacobs 2013)

In this century, Indonesia had been importing continuously textiles from Batavia. Settlements in Indonesia gradually increased their presence in textile export from Batavia. In 1711-13, settlements in Indonesia had 25 percent of textiles exported from Batavia. After then the settlements expanded the import of textiles. The import share in the settlements in Indonesia was 41 percent in 1730-32, 39 percent in 1751-53, 59 percent in 177-73 and 50％ in 1789-90. Then we can think why this change happened and try to find the answer by further research.

The maps can visually show the transition of textile markets between Batavia and the VOC settlements in Asia. These maps give not just trading data but also other information such as locations of settlements and distances between Batavia and other settlements and so on. And we can guess why this settlement imported more in this period from the map. It is sometimes difficult to know how large or small these numbers are without visual aid. Of course we can learn history from texts and data, but these maps help us know this area's history of the period spatially and find questions to understand more.

4. Challenges for using GIS in historical studies

There are three points of challenges in using GIS in historical research: data, knowledge and skills on GIS and map literacy.

To use GIS, geospatial data is necessary. This time the author used data of VOC which is comparatively easy to handle, but it was not so easy to use it in GIS. This is because the location specification from old place names was challenging. The first step of using data of VOC was creating data of base map on settlements with locational information. It is difficult to identify the locations of these settlements without historical knowledge. So it is important to check some historical sources. Once the base data were made, other map making processes are quite easy using GIS.

We can read the old books of travel with a lot of locational information. But we cannot imagine properly because we don't know "where". GIS can help to visualize an old world that we can never see. It would become more important to collect the knowledge about old place name data to see our history.

When we see the map, we can guess the distances among locations, movements of people or goods, relations of many places without reading texts. If we read historical texts with nicer maps, we can understand history more lively.

GIS is obviously a strong tool for historical study. The author thinks knowledge and skills on GIS is another challenge. We have unconsciously used GIS every day such as car navigation system or searching some locations on the website, but we hardly have a chance to learn GIS itself in our daily life. We cannot imagine what we can do using GIS without knowledge and skills. If historical researches using GIS are accumulated, more historians will be interested in using GIS in their researches and try to learn the basics and usage of GIS. At the same time, they will think of the importance of not only

historical education but also geography education to understand history more using maps and GIS.

The third point to utilize GIS in historical research is the map literacy. If we make maps using GIS but don't know the rules of cartography, the map becomes just a figure without any meanings. Even if we have historical knowledge but don't have the skills to read maps, we cannot connect a map with history and cannot yield any new findings when we see the map. The map is communication and visualization tool, but to understand this, we need to know the rules how to read the map and to train what we can read from them like learning languages. For historians, the map reading skill will become increasingly essential to understand history deeply and show effectively their findings to many people.

5. Conclusion

In this paper, the author tried to make maps from real historical data of VOC and discussed the benefits and challenges of using GIS for historical study. The visualization of old trade data of VOC using maps not only show us the transition of trading activities in Asia in the 18th century but also give us many questions such as why these changes happened. In other words, these maps bring us further understanding and imply other research possibilities.

In history field, maps as a tool show us the past and give information to understand people and society long time ago. There are some obstacles to extract geospatial data from old texts or old maps to use in GIS. However, we can get something more from the maps even if we struggle to learn GIS and make data for it. Acquiring map reading and making skills will become more important for historical education. It would be wonderful that GIS in historical study is introduced not only in higher education but also in elementary and secondary education.

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Theoretical analyses and field methods for the population density distribution in Mainland Southeast Asia

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Abstract: Mainland Southeast Asia is one of the most interesting regions from the view of the population density distribution and its motion. To analyze whole and hierarchical structures of it, the quantitative data analysis is needed. However, practical fieldwork analyses are suitable for the small scale structure because it is near to the scale of human lives, and theoretical analyses are suitable for the large scale structure because statistical data are essential in the large scale. In this paper, it is discussed that the connection of two methods, the theoretical analysis based on the "population density potential theory" inspired by dynamics, and the practical fieldwork analysis that uses the residence comparison of two big cities, Bangkok in Thailand and Hanoi in Vietnam, which are typical big economy and typical political center in Mainland Southeast Asia.

Keywords: Mainland Southeast Asia, Population Density, Numerical Simulation, Bangkok, Hanoi

1. Introduction

To understand variety of the Mainland Southeast Asia generally, it is important that inter-disciplinary picture of study is introduced, not only based on each specialty, e.g. sociology, anthropology, and so on. There are a lot of kinds of basic techniques to investigate such inter-disciplinary view in Mainland Southeast Asia. Here after, population density distribution, one of the geographical quantities, is employed as the standard to general study.

The population density distribution is just one of the geographical quantities, however it has a special position as the carrier, on which many other indicators or variables are distributed and modified riding. Because of such importance, there are some previous studies about population density distribution. For example, the spatial interaction models, such as gravity model (Ravenstein 1885), is one of the effective theoretically analytic methods in the starting period of this kind of study. It suggest mainly about transportation among points, e.g. cities, small areas, and so on. This method is effective for the motion of social objects from a point to another point and networks composed of such units.

However, the gravity theory is based on unclear assumption that individual social components such as a person or a unit of public transportation systems obey natural scientific theory for the gravity. To reinforce theoretical back ground of the gravity theory, extended models are considered. Modern models of spatial interaction models are based on the entropy maximizing model, which is built by extending the gravity model (e.g. Wilson 1967). They cannot be applied directly in this work because the spatial interaction model is accumulation of microscopic social phenomena. On the other hand, this work employs macroscopic view of whole region.

Previously, the direct analysis for population density distribution using informatical or numerical method quickly grows up because of public opened geographical data and social big data in general. However in some case, quantitative analysis for the fluctuation of population density distribution is technically difficult because the information about population is composed of complex geographical, social, and human data, which depend on regional particular properties. Additionally, nevertheless enough concrete data should be listed up to attempt writing a system based on the natural scientific description, data from social systems often cannot be built into such perfect shape because they are closed or naturally inadequate.

In social and human sciences, the data are just enough to make statistical estimation or to build model but to write the social fact or current exact situations in principle. From the interest for such quantitative analysis on the current facts or situations about population density distribution, some numerical methods are needed to investigate the distribution from inadequate data.

Previously, a theory about "population density potential" is newly introduced as the basics of whole scale analytical works (Umekawa 2009). This concept comes from physical potential in natural science. This theory is applied to the Mainland Southeast Asia and carried out to reveal the motion and distribution of basics about the social force for the population.

For the detailed scale, the other analytical method should be needed because individual human life or concrete social phenomena can be directly investigated in this picture. In such small scale, practical analysis through the fieldwork is important. To analyze on general view of hierarchical structure of the population density distribution and inter-disciplinary investigation, new methodology that connects population density potential analysis in whole scale and practical fieldwork analysis in detailed scale is needed.

In this paper, the hierarchical structure in this study is explained first. The theory of population density potential and the results of application are described next. The method practical analysis and its application based on the fieldwork in the city scale are also described in case of Hanoi, Vietnam. Finally conclusion and summary are discussed.

2. Hierarchical Structure

We consider the hierarchy of the population density distribution in this chapter. It should be considered as layered structure shown in Fig. 1. Generally, single method cannot be applied to every scale in some analytics because the relative scale to the

basic component is difficult by every scale.

For example in population density distribution, individual persons, who is the basic component of the population density distribution, is much smaller than the scale of whole region, e.g. Mainland Southeast Asia. In such stance, the macroscopic view of population density distribution can be regarded as natural scientific fluid like matter. Mathematical or numerical analyses to the model or statistical data are effective in this situation.

On the other hand, when detailed scale, such as internal city or district, is the target of analysis, individual people can see as the physical objects that can effectively give influences. In such situation, population density distribution can be no longer regarded as fluid like matter. So the mathematical method cannot be employed in detailed scale layer. Practical methods for investigation, for example data collection in fieldwork studies, are required in the detail scale.

Consequently, two or more analytical method which are correspond to each scales must be employed in the total work, at least mathematical or numerical study in whole region scale and practical method in detailed scale.
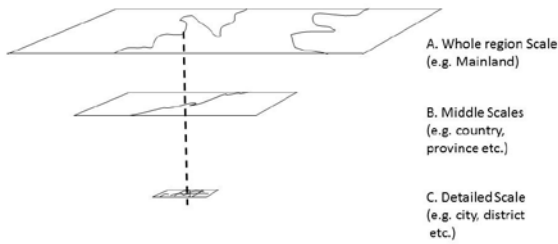
Fig. 1. Schematic image of the multi-scale study works for population density distribution.

In whole region scale, theoretical numerical works are employed and in detailed scale, practical fieldwork is employed to investigate population in each scale layer.

For the total analysis in hierarchical structure, the method how to connect the different schemes in different scales of the hierarchical structure is expected. Currently, we discuss about this important information in the last chapter how such problem should be solved.

3. Theoretical Method

3.1 Theory

To consider the distribution of population density projected on the population density field, the equation of motion for dynamical unit is determined as

$$F = m\boldsymbol{a}, \qquad (1)$$

where F, m, and $\boldsymbol{a}$ mean the socially based force that attracts units of population densities each other, the population number determined as the integral of population density units, and acceleration of population density units by the force F,

respectively. Bold face characters in equations means vector quantities. This equation comes from the dynamical theory. This basic equation for a socially based force that moves population describes force field in this theory.

The second assumption is that the population density distribution acts as like gravitational fluid. So it can be written by similar shape to the classical gravity equation:

$$\boldsymbol{F} = k\frac{Mm}{r^2}\frac{\boldsymbol{r}}{r}, \qquad (2)$$

where k, M, m, r, and $\boldsymbol{r}$ are a proportional constant, a population group which attracts another population whose number is m, population group who is attracted by another group whose number of population is M, the distance between m and M, and its position vector, respectively. Because of proportional constant k, equation (2) only means that the relation of F and m or M is relative. This assumption is common with the gravity theory.

From equations (1) and (2), the acceleration for population density groups on the population density field $\boldsymbol{a}$ is written as below:

$$\boldsymbol{a} = k\frac{M}{r^2}\frac{\boldsymbol{r}}{r}. \qquad (3)$$

$\boldsymbol{a}$, the acceleration of population density, is the determination of strength of population density field, which has the same reason in dynamics. On the assumption of similarity to the gravity force and field, equations above are consistent.

Based on such similarity with dynamical theory and its application to the population density distribution, a closed volume V is assumed, which is surrounded by surface S in the first step (Fig. 2). In volume V, population number M is equal to the integral of inhomogeneously distributed population density inside S, and the total N makes field of population density, whose field lines are drown as the distribution of vector quantity $\boldsymbol{a}$.
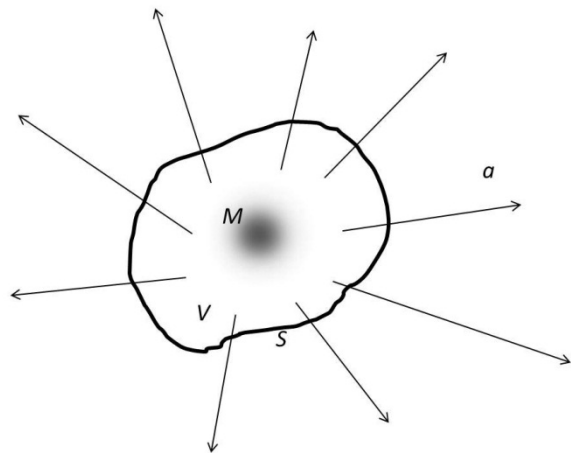

Fig. 2. Definition of volume V and surface S sarounding population whose number is M.

By vector field **a**, which comes from outer field and internal M in volume V, penetrate surface S of volume V. This vector field is seen as a kind of social force field created by the population density distribution. The force created by the population density distribution internal V and this social force penetrating surface S have a relation described by

$$\int \mathbf{a} \cdot d\mathbf{S} = \int a r^2 \, d\Omega , \qquad (4)$$

where Ω means solid angle. From equation (3), this equation suggests that the population field and population density are connected by simple relation. By using equation (3), (4), and Gauss's Law, new scalar quantity φ is derived as below:

$$\Delta \varphi = 4\pi k \rho , \qquad (5)$$

where ρ the population density is determined by

$$M = \int \rho \, dV . \qquad (6)$$

Newly introduced φ is population density potential that is determined by the relation $\mathbf{a} = \nabla \varphi$. Constant $4\pi k$ can be changed to the new constant b by $b = 4\pi k$. Finally, the Poisson equation,

$$\Delta \varphi = b \rho , \qquad (7)$$

is obtained.

From equation (7), the population density potential φ is uniquely derived by using population density distribution data. φ has some properties to write directly social force to be applied to population.

Because b is the arbitral constant, φ is determined as only in relative. It describes "height" of theoretical value of influences for attracting population units each other.

To make numerical analysis for the population density potential theory, additionally, techniques of numerical science must be employed. The numerical method in this work is ICCG scheme based on Meijerink and van der Vorst (1977) and van der Vorst (1981). Concrete used simulation code comes from modification of code in Umekawa (2000).

The mathematical part can be intuitively explained as a kind of theoretical height and its gradient (Fig. 3).
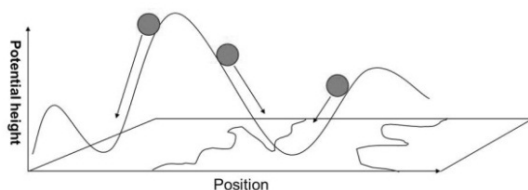
Fig. 3. Schematic image of the role of population density and its gradient.

Circles are symbols of unit of the population density and the curve vertically written against the bottom map means height of the potential.

3.2 Result of the Models in Whole Region Scale

3.2.1 Model
The example model parameters in the whole region scale are as below:

1. Region is including Indochina Peninsula
2. Grid size in longitude and latitude is 2.5"
3. Grid size (longitude $\times$ latitude) is 401×401

The global population density grid data in 2000 published from Socioeconomic Data Analysis Center (SEDAC 2000), are employed. The size of grid is 2.5' for the direction of both longitude and latitude.

For simplicity, two dimensional Cartesian coordinate is assumed in the numerical calculation. Boundary condition is zero fixed condition. Grids on sea are regarded as 0 number of population. In real fluctuation, these conditions are not exact, but under the assumption of equilibrium, they are acceptable because the time evolution is not supposed in this work.

In this paper the largest scale model is shown to investigate from the view of the whole region scale. More some models including Indochina Peninsula are calculated in a previous work (Umekawa 2010).

3.2.2 Result
Fig. 3 shows the numerical result of whole region scale model, including Indochina Peninsula.

The gray scale map layer, contour curves, and arrows mean the population density distribution, the population density potential, and the force vector field, respectively. Color white means population density distribution high, color black means population density low, and the value is 0 in the ocean. Numbers on the axes mean the grid number. Contour curves are drawn per every forty. Arrows in vector field are normalized as the length of forty grids is corresponding to the maximum value. These normalization rules are the same in results of other models in Umekawa (2010).

From Fig. 3, we can overview the result of whole region scale model.

In this scale, demographically massive cities such as Bangkok, Phnom Penh, Ho Chi Minh, and Hanoi, make clearly high density spot, and small troughs of potential distribution are shown by the curves of contours on each city. In addition, there is a low sloop of potential distribution whose direction is south east to northwest. The superposition of these two basic structures is the specification of potential structure in this region.

The population density is applied forces determined by the gradient of population density potential. Arrows show

information about the force. Population density have tendency to press from south east to north west weakly, and massive cities make small scale and strong spot of attraction.
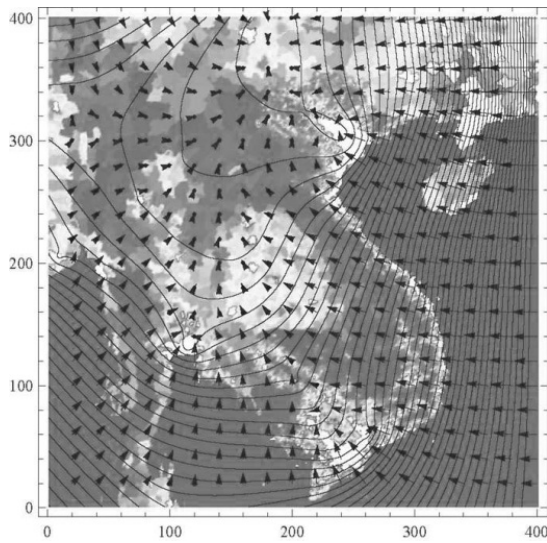

Fig. 4. The result of example model based on Umekawa (2010). Line contour and vector allows are numerical results. Back gray scale is population density that is numerical resource.

4. Practical Method

4.1 Scheme

Totally, this study is the comparison work for Hanoi city with Bangkok city. Both are categorized to the largest cities in Mainland Southeast Asia. Bangkok is one of the typical biggest economies, and Hanoi has also big scale and typical city that politically planed under socialist regime. The comparison of two cities about citizen's residence, structure of cities, transport, economy, and so on have possibilities to return some interesting results.

As written in chapter 1, to make the basics of such geographical analyses, we try to the practical work about residence in model cities as a carrier of some geographical quantities.

The shop-house style building is shown in cities in Southeast Asia (e.g. Fig. 5). Their first floor is shop office or any other kind of commercial space, and second floor or upper is living space. From the observation in this work, such shop-house style building has similar width near city center region. It can be determined as the typical style of the citizens and we can employ it as the unit of population.

By the average number assumption, population p_n for each one living space on the second floor or upper of shop-house style building is defined. On the other hand, the buildings in the model cities are categorized as below:

Type I: Standard shop-house (first floor is shop, second floor or upper are house)
Type II: Multiple shop-house (Some Type I merged building)
Type III: Park or field
Type IV: Detached office building
Type V: Detached housing

Type VI: Apartment house (Without shop floor)
Type VII: Office only building
Type VIII: Areas under construction

Type VII includes single office building without type IV.
From this modeling, type I including *n* floors has population number $p = (n-1)p_n$, type II *m* multiple merged buildings, its $p = m(n-1)p_n$, for type III, IV, VII, and VIII, $p = 0$, for type V, $p = k_V$ where k_V is determined from other data, and type VI including *n* floors has $p = np_n$.

Fig. 5. An image of shop-house style buildings in Hanoi.
It is composed of shop or office in first floor and houses second floor or upper.

To compare the two model cities, Hanoi and Bangkok, on the view of population density, observation for sample area in each city and counting number method is employed.
The method to observe is as below:

1 Make 1 km square region on both sides of main rivers in model two cities
2 Choose three regions on both sides of rivers in both cities randomly.
3 North or west sides of the primary or secondary main streets are chosen as the targets of the observation works.
4 Count the number of buildings and categorize them.
5 Calculate the reduced population number

There are twelve results of observation works, and here one result, a region on the west side of Red River in Hanoi, is shown as an example.

4.2 Result of the Analyses in Detailed Scale

4.2.1 Research Field

The research area is 1km square, west side of Red River and northwest near Lake Hoan Kiem in Hanoi. Position of the observed region and roads are shown in fig. 6. It is one of the six randomly chosen areas to count the number of building. Totally research areas are distributed randomly both side of Read River in Hanoi and also both sides of Chao Phraya River in Bangkok. Comparison works between cities and across the

rivers will be shown. An example result set at this area, named area 10 in this study, in Hanoi is shown in this chapter as an example.

Five roads with curves in fig. 6 mean targets which are the primary and secondary largest roads in area 10. The number of and total extension of roads are different values in every area. They are ranked in the first and second largest levels in area 10 determined by previous selection.
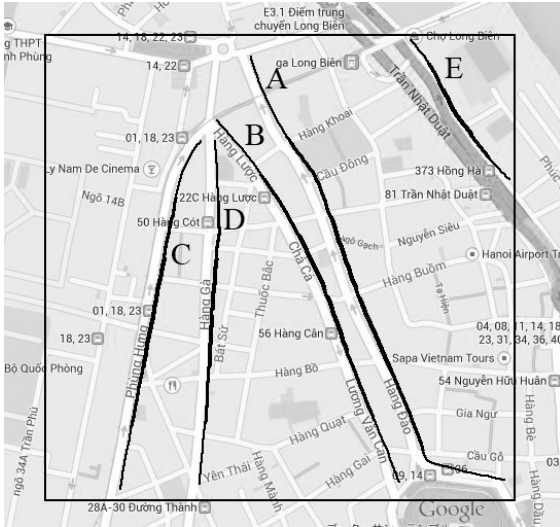

Fig. 6. Observed area the square solid line inside (area 10). This is one of the six target areas in Hanoi. Curves A to E mean chosen streets to count the numbers of buildings (Google 2014).

4.2.2 Result

The procedure of counting works is:

1 Waking really the target roads
2 Taking pictures and movies of north and east side of the target roads
3 Counting the number of buildings and their floors from the records

The result of counting buildings is shown in Table 1. Building types I to VIII determine the number of population p whose unit is p_n.

Table 1. Results in area 10, Hanoi

Road	# of Buildings by Type I to VIII	Total p
A	I:98 II:11 III:0 IV:1 V:0 VI:0 VII:17 VIII:2	$249p_n$
B	I:95 II:7 III:1 IV:5 V:1 VI:0 VII:6 VIII:1	$205p_n + k_1$
C	I:52 II:5 III:1 IV:7 V:0 VI:2 VII:8 VIII:0	$100p_n$
D	I:80 II:5 III:0 IV:1 V:0 VI:0 VII:14 VIII:1	$256p_n$
E	I:53 II:1 III:1 IV:1 V:1 VI:0 VII:9 VIII:1	$139p_n + k_2$
Total		$949p_n + k_1 + k_2$

p is population number along the target roads. k_1 and k_2 are

population numbers for type V buildings in road B and E respectively.

Buildings at corners are neglected in counting. In case of unclear in records, number of floors is conjectured from both neighbor buildings.

Counted results in all type of buildings are described in the table, however, type III, IV, VII, and VIII that are filled by shops or that are field, are defined that the population number is 0 in the same way.

From the results, population number can be estimated for north or west sides of five target roads in area 10. Valid value can be estimated as p_n from some statistics in Vietnam. For k_1 and k_2, other method to estimate is needed.

If total length of the target roads A to E is defined as L, $L \approx 3.94$km by actual survey. The value $R = p/L$ becomes typical index number to compare population density among regions relatively. In this model, area 10, the index number R is equal to:

$$R = \frac{949p_n + k_1 + k_2}{3.94}. \qquad (8)$$

from Table 1.

By assuming appropriate p_n, k_1, and k_2, R is fixed in a constant, which is population number per 1km. It is automatically a value per 1km^2, because the research area is in 1 km square.

Using this constant R, Comparison works among areas, e.g. both side of the river or Hanoi and Bangkok, can be studied quantitatively.

5. Summary and Discussion

The results of numerical works about whole region scale around Indochina Peninsula and practical fieldwork analysis in detailed scale for an area in Hanoi are carried out. They are shown as examples for multi-scale analysis for population density distribution.

From the explanation in the first chapter, there are appropriate schemes for each scale in the hierarchical structure of population density. So theory to connect analyses that are investigating different scheme in different level is needed clearly. This work suggests that quantitative information and covering practical method by it is an influential candidate of the method to connect analyses in such different scales.

Coefficient R defined in previous chapter comes from investigation in fieldwork. It is the value about population in a limited area. Using R, we can estimate typical line density of the population. "Line" here means chosen roads in model area, area 10. It makes common stage quantitatively between theoretical analysis in whole region scale and practical analysis in detailed scale for population density distribution.

Considering basic scheme and showing examples in each scale are described in this work. However, it is needed that more concrete models are investigated by using this theory from the view of hierarchical structure about population. Analysis for

more areas in Hanoi, Bangkok, and their comparison in continuous works are expected to carry out such concrete result.

p_n is put as a variable in this paper. It should be determined statistically. Every house floor in shop-house building is assumed the same area and the same number of living person. From the observations, the assumption is almost consistent because general view for the structure of shop-house style buildings is similar. It should be validate continuously for change of social phenomena.

To seek the conformed analytic method for middle scales in the hierarchy of population density distribution is an important purpose in future works. Although it should be possible that forcibly middle scales separate to categorize whole region scale or detailed scale, more accurate results are expected if especially adapted analysis for middle scales are discovered.

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The Occupational Structure and Patterns of Employment in the
Manila Districts
of Malate, Dilao, and Pandacan, 1878-1895

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Abstract: Urbanization is often described as a process by which the work force engaged in industries and services dominate the economies of urban areas. The exploration and analysis of the structure of employment as well as the spatial distribution of occupation may therefore contribute to understanding the historic and concurrent patterns of development of an urban core and its suburbs. Manila and its surrounding pueblos would be an interesting case-in-point, being the first primate city in Southeast Asia and in consideration of its significance in world economic history, from being an entrepot during the Galleon trade to developing an urban economy that exported domestic produce during the 19th century. An interesting aspect of this transformation is the emergence of a labor market that was composed of domestic jobs, employment in agriculture, and occupations that were related to the manufacturing of exported products such as tobacco and local and imported textiles.

This research seeks to investigate further the development of urban economies of 19th century Manila by describing occupational structure, diversity and specialization across the districts of Manila in the span of a decade and a half (i.e., 1878 to 1895). Age, gender, and the spatial distribution of occupations are the elements explored in this study through spatial visualization tools and descriptive statistical analysis.

Keywords: Manila, urbanization, occupational structure, unemployment, 19th century, GIS

1. Introduction

Occupational structure is a key concept in understanding the distribution of jobs and employment opportunities in a geographic domain as well as the development of the economic sectors such as agriculture, industries and services. The distribution of occupations is reflective of the economic and geographic differences among places. It is also influenced by proximity to urban centers due to the availability and diversity of the labor market in urban cores and their suburbs.

This paper explores the occupational structure of three pueblos in Manila to gain a deeper understanding on the characteristics of Manila as an economic center during the 19th century, when the urban market had shifted from an emporium of imported goods to exporting its native produce and mobilizing its local agricultural resources for the local population. The distribution of the work force in different industries and the concentration of specific types of jobs in certain pueblos may shed light on the economic roles and functions of the "second ring" of settlements outside of Intramuros, to further underscore the relevance of Extramuros in the urbanization of the capital city.

2. Objectives

This research describes the composition of the work force in three districts of Manila that were economically central to the development of the capital city, but politically and economically peripheral to Intramuros and, to a certain extent, to the districts north of the Pasig River. This study characterized these pueblos – San Fernando de Dilao, Malate, and Pandacan, based on the occupations supplied by their respective residents to the labor market of Manila through the combined performance of the Geographic Information Systems (GIS) and descriptive statistical summaries. The main data source from which all the information herein included are based is the Padrones General de Vecindario, a registry of men and women aged 18 or above that indicates the subject's name, age, profession, place of baptism, and civil status.

3. Methods

The Vecindario entries from San Fernando de Dilao, Malate and Pandacan were gathered from the National Archives in Manila and collated into a digital database using MS Excel. Inconsistencies in the data such as misspelled names or jobs, irregularities in place names, and abbreviated entries were evaluated and standardized. Reference was made to the National Statistical Coordination Board's Philippine Standard Geographic Codes (PSGC) for the standardization of place names, and to the 1994 Philippine Standard Industrial Classification (published by the same agency) for the classification of industry or occupation type. The procedure for creating the spatial data and layers was based from Lagman and Martinez, 2014.

Statistical summaries were all derived using MS Excel functions, while maps were generated using ArcGIS 10.1.

4. Settlements of the Extramuros: Dilao, Pandacan, and Malate

Outside of Intramuros, the outlying pueblos of San Fernando de Dilao, Pandacan and Malate developed as clusters of settlements at the "right" (south) side of the Pasig River. Malate is situated further south, adjacent to Ermita, and is distinctly characterized by the strip of settlements that are parallel to the coast of Manila Bay. On the other hand, Pandacan and Dilao have both developed compact settlements similar to but not as dense as those of the pueblos north of the Pasig River. Dilao, Ermita and Malate were incorporated into the Ayuntamiento of Manila in 1884 (Torres, 2010).

Gardner (2004) described the development of Dilao together with San Juan del Monte, Sampaloc, Santa Ana, and San Pedro de Macati as the "second ring of villages" forming an array of settlements adjacent to Santa Cruz, Binondo, Tondo, San Miguel, San Sebastian, and Quiapo (BISQS in the map, see Figure 1). Both Dilao and Pandacan are traversed by tributaries of the Pasig River, while Malate, like Ermita and Intramuros, is located east of the coastal waters of the Manila Bay. The centers of these three pueblos are more or less two kilometers away from Intramuros (see Figure 2).

Dilao was described as "marshy and flat" during the 1500s in the annals of the Franciscan priests. By the 1890s, Franciscan records indicate the presence of bamboo and wooden houses and households numbering to about 1,100 (RCAM, n.d.). The documented seven barrios under the Franciscan parish during this time, however, are only 23% of the number of cabecerias included in the vecindario records that were used in this study. One of the cultural features of Dilao is the Paco Cemetery, built in the early 1800s after the cholera epidemic (Torres, 2010, p. 22)

MALATE, DILAO AND PANDACAN

Figure 1. Location of Malate, Dilao, and Pandacan

Dilao was described as "marshy and flat" during the 1500s in the annals of the Franciscan priests (see Figure 2). By the 1890s, Franciscan records indicate the presence of bamboo and wooden houses and households numbering to about 1,100 (RCAM, n.d.). The documented seven barrios under the Franciscan parish during this time, however, are only 23% of the

number of cabecerias included in the vecindario records. One of the cultural features of Dilao is the Paco Cemetery, built in the early 1800s after a cholera epidemic (Torres, 2010 p. 22).

Figure 2. The "Second Ring" Up-close

Malate was a popular residential area for both the native elites during the Spanish colonization and the wealthy Americans during the early 20th century. Similar to Pasay and Ermita, its best asset in relation to site development was its proximity to the Manila Bay.

5. Occupational Structure of Dilao, Pandacan, and Malate

The 19th century was a social, political and economic milestone in world history. Often referred to as the phase of industrial capitalism, one of its key features is the rise of specialized workplaces such as factories, and that industries dominate the economic activities (Edgell, 2011, p. 7). Related structures such as warehouses, storehouses, and markets were also established. Diversification of jobs due to work specialization was one of the implications of this process.

The succeeding discussion describes the distribution of workers across industry types as well as the pattern of employment across three periods: 1878/1881, 1886/1887, and 1892/1895. One should note that the availability of the Vecindario data varied among the pueblos in question.

5.1 Distribution of Occupations across Pueblos

Based on the retrieved records from the Vecindario, there was in general a declining trend in the size of the workforce for all three districts of Manila. The magnitude of resident labor force in San Fernando de Dilao is highest among the three areas. An average annual percent change of -3% was experienced by Dilao within a decade, while in Malate the annual change is -2.4%. Pandacan's workforce expanded in 1887 but similar to the other two pueblos it experienced a reduction in size of about -20%. See illustration below.
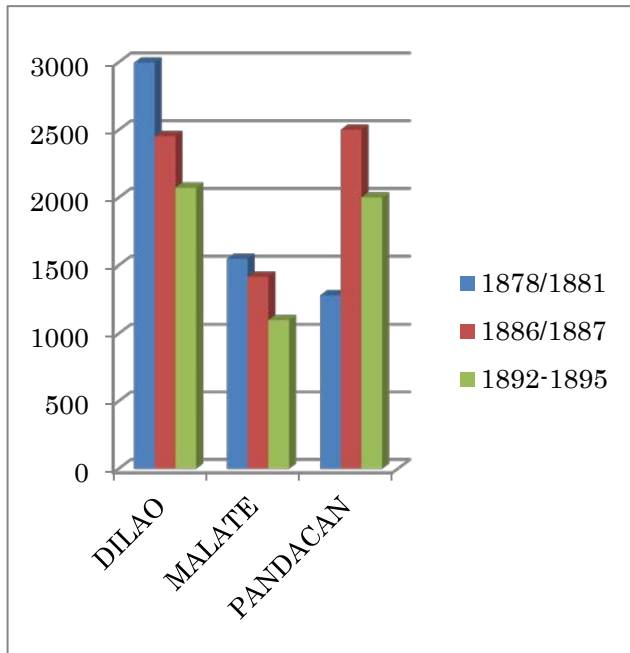
Figure 3. Number of Employed per Pueblo

5.1.1 Dilao

Manufacturing, which includes seamstresses, cigar makers, and stonecutters, along with construction (81% and 10% respectively) comprise the majority of the workforce in Dilao in 1878. The figures for the former declined in succeeding decades but were relatively stable at 55-58%, while those employed in jobs related to construction rose to 23%. On the other hand, administrative and support services' share varies between 4%-7% throughout the period under analysis, while the labor market for services related to accommodation and food, transportation, and information and communication is very limited. The job with the highest share of employment under the aforementioned category was clerical work. Men outnumber women in several industries except in wholesale and retail trade, where there are two women for every male worker, and in manufacturing, in which over 40% of all the employed work force in 1892 were women (see figure below).

5.1.2 Malate

Manufacturing is perhaps the most interesting industry in Malate because of its overwhelming proportion of workers (i.e., more than 50% of the workforce for both 1887 and 1893). This category primarily consists of cigar makers. Agriculture-related jobs are also unique to the pueblo – in terms of absolute number of workers or be it percentage share, Malate's primary sector's
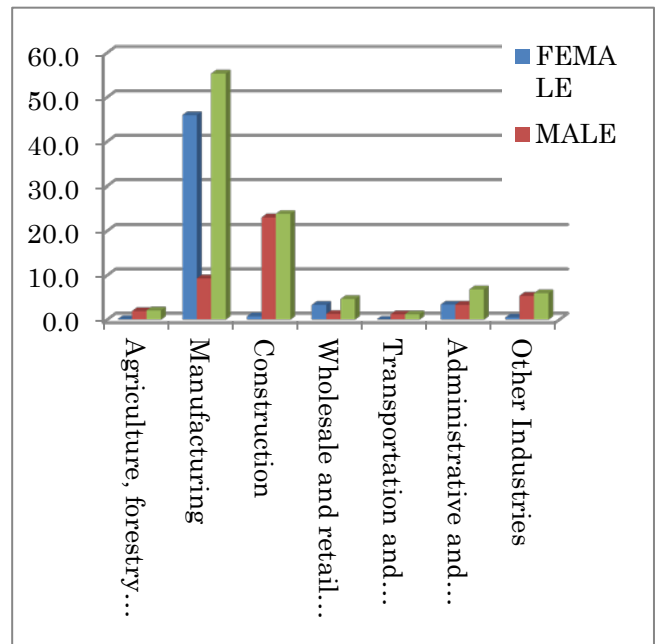
Figure 4. Industry and Gender of Workers in Dilao, 1892

employment share was always the highest of the three pueblos at 10%-20% (i.e., across the three periods). Some of the occupations with the highest number of employed workers are embroiderer, cigar maker, fisher folk, storekeeper, and laborer. Similar to the gender distribution of employment in Dilao, women also dominate the manufacturing industry in Malate, as well as wholesale and retail trade activities (see Figure 5). .
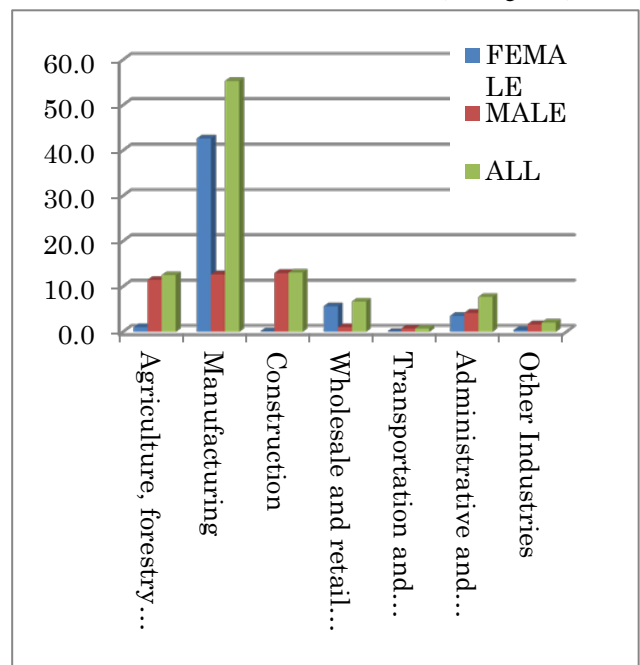
Figure 5. Industry and Gender of Workers in Malate, 1893

5.1.3. Pandacan

Workers in construction ventures outnumber those in other industries for all three periods as the majority of the workforce was engaged in providing labor for building structures especially for residential and institutional use. From 50.4% of

the workforce in 1878, employment in construction grew to 77% by 1886, but declined by mid-1890s to 69%. On the other hand, workers under manufacturing and primary activities combined comprise 34.2%, 15.2% and 20% of the gainful workers in 1878, 1886, and 1892 respectively. Interestingly, Pandacan's construction workers were significantly larger (in terms of share of employment) than the other two pueblos, at some point being almost four times as large as that of Dilao or Malate. Women had a significant share in employment in the construction industry at 33% in 1895, which makes the labor market of Pandacan unique from the other two districts (see Figure 6).
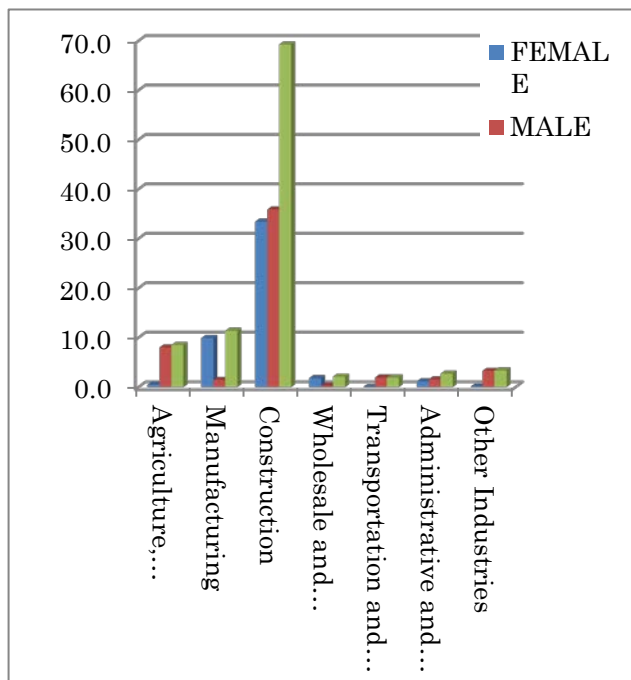
Figure 6. Industry and Gender of Workers in Pandacan, 1895

6. Unemployment

It is apparent from the data that unemployment was rampant during the early 1880s in Malate and in Pandacan, when almost 40% and 60%, respectively, of the resident work force had no occupation. This alarming situation improved in succeeding years as the rate of unemployment declined to 10% for Malate and 14% for Pandacan. By the next decade, however, save for Dilao whose unemployed work force remained at 11% of the total economically productive population, unemployment in Malate rose to 29% and 28% in Pandacan.

7. Variety of Occupations

From 41 different jobs in 1881, the variety of occupations in Dilao rose to 55 by 1886. Most of them are classified as manufacturing activities, such as embroidery, carpentry, brick layering and marble cutting. On the other hand, there were 40 types of occupations in Malate during the early 1880s. There was more or less the same variety of occupations in succeeding years, with the addition of employees working as cart pusher,

confectioner, hairdresser and midwife. Pandacan registered 35 kinds of occupations in 1878 which did not diversify or change significantly throughout the period being analyzed.

8. Age Distribution of the Workforce from Select Industries

Combining the data for all three districts provides a comprehensive view of the distribution of employment by age. The Vecindario data for the 3rd period (1892 to 1895) suggests that manufacturing employed the young members of the workforce. Sixty percent of workers in this industry were below 40 years of age. A steep decline in the share of workers aged 40 or above can be gleaned from the graph below. A similar pattern can be said of the workers in the administrative and support service industry, where 24% of the work force are between 30 and 34 years old. On the other hand, 40% of those engaged in wholesale and retail activities as well as in agriculture and fishing were aged 45 or above. In addition, all of the industries had shares of employees aged 55 or above to at most 11% only. See figure below.
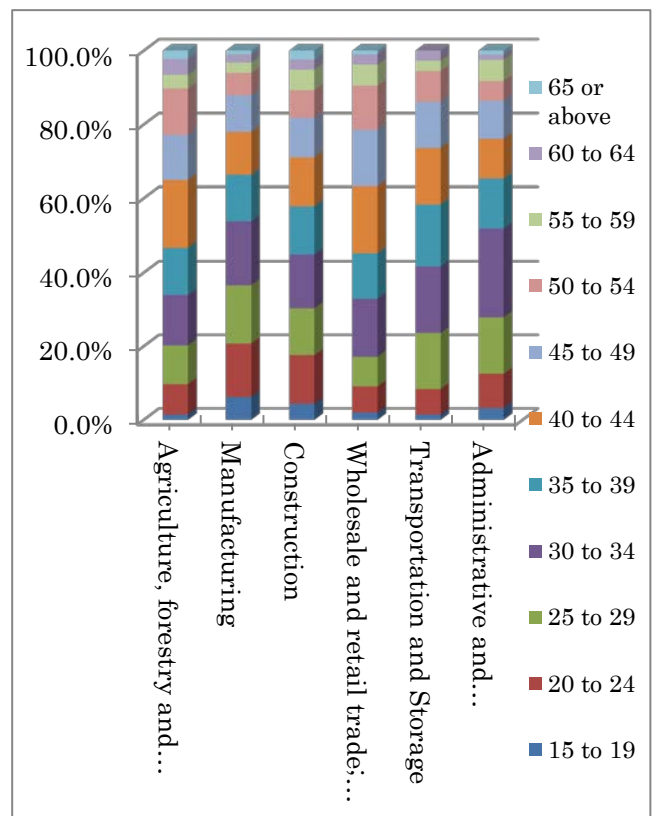
Figure 7. Employment per Industry by Age, 1892-1895

9. Spatial Distribution of the Workforce

Visualizing the distribution of employment per industry through a map facilitates a spatial approach to interpreting the pattern of employment across the three pueblos being analyzed in this study. The map below illustrates several interesting geographic patters about the distribution of the work force, such as:

a. The proximity of the three districts to the urban core and the minimal share of primary activities in the employment of the work force suggest that these settlements beyond the walled city are well integrated in the urbanization process

b. The significance of farming and fishing to settlements close to the Pasig River and Manila Bay is evident in the thriving primary activities in Malate and Pandacan

c. The decrease in the share of manufacturing and increase in the share of employment in construction is an apparent pattern as the settlement or district is placed further inland or further from the Pasig River
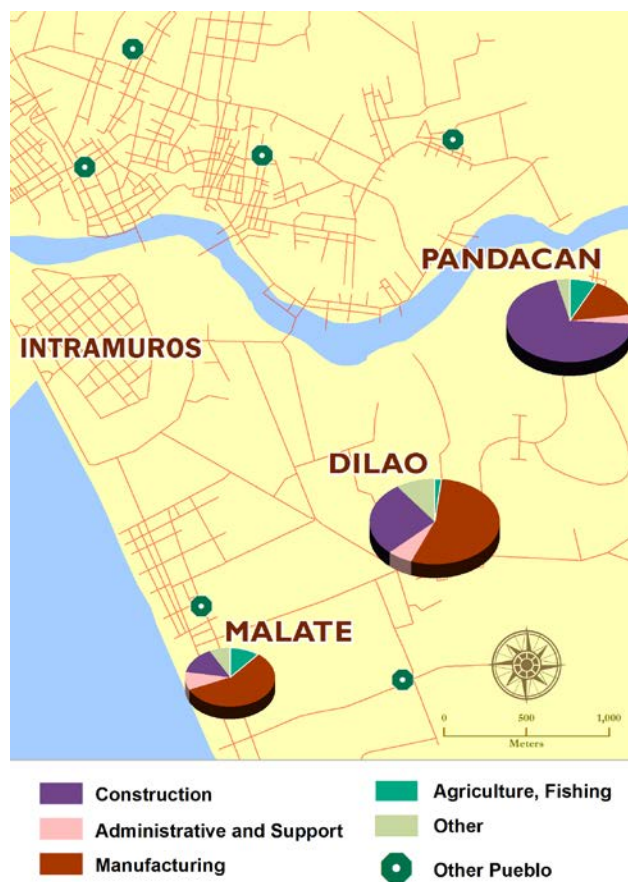
Figure 8. Employment by Industry in Malate, Dilao and Pandacan, 1892-1895

10. Observations

The results of this research presented the trends and patterns of employment that characterize the urban economies of Manila in the late 19th century, as well as the state of unemployment in each of the pueblos in question. The spatial distribution of occupation by industries may shed light to the predominance of specific activities in each pueblo, although more substantial literature would be necessary to derive more insights on the physical conditions and available resources that would have contributed to the pattern of concentration of economic activities in the said districts.

The age distribution across industries of occupied residents in the three districts further indicates that the predominant industries in the labor market favored workers in their 20s until mid-40s. One implication of this would be on migration towards Dilao and Pandacan, especially towards Dilao where the highest variety of jobs were concentrated.

While most industries are dominated by men, women had a very significant role in the urban economy of Manila with their predominance in the manufacturing industry and to some degree in trade and sales. An important aspect that needs further research is women participation in the construction industry, as indicated by the data from Pandacan.

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Expansion of the Dutch Colonial City: Spatial Analysis of Ethnicity and Land-use of Batavia, 1619-1930

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Abstract: In 1619 the Dutch East India Company (VOC) fixed Batavia, present-day Jakarta, to be its headquarters in Asia. Afterwards, this port city became a center for the global trade as well as for Dutch colonial governance in Asia, which continued until the mid-twentieth century.

Not only VOC's European and Asian employees lived in Batavia, but also this city had European and Asian free citizens and even Asian slaves. The population of Batavia grew up in the seventeenth and eighteenth centuries. For example, in the 1673 the population amounted to 27,000 and in the early nineteenth century it reached about 47,000. From the point of view of ethnicity, Europeans and Eurasians had political and economic power, but they were a minority group. Indeed, there share in total population was only 11 % in 1673 and 4 % in 1815. Asides from Europeans, there were several ethnic groups in the city, such as Chinese, Indian Muslims, Javanese and so on.

The missions for my research are as follows: The first is to reexamine ethnically divided districts in the urban area. It is often said that each ethnic group formed its own district. Based on a GIS-based analysis of population data, I will reexamine spatial ethnic distributions of citizens.

The second mission is concerned with the development of suburban areas. The suburban areas were developed for plantation agriculture to produce sugar canes for export since the seventeenth century. However, in the nineteenth century the sugar plantation was put to an end and it was transformed to rice field. Moreover, the urban area expanded along with the population growth in the course of time. In any case, my investigation will focus on changes in land-use in the suburban areas based on GIS-analysis.

Keywords: Batavia, population, ethnicity, land-use, GIS, plantation

Company, Industry and Network in "The Far East" in the 1930s: A Study of Directory Published in Hongkong

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Abstract: Before the World War II, "Intra-Asian" trade continued to make a steady and dynamic progress. But little attention has been given to the business development from the view point of the companies in this "Intra-Asian" trade. In order to analyze some aspects of the location and the business activities of the companies in "Intra-Asian" Trade, this study is intended as an investigation of "the Classified List of Trades covering China, Japan, Malaya, Borneo, Siam, the Philippines, Korea, Indo-China, Netherlands Indies,etc." and "List of Industries in "the Far East" compiled in *the Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc.* published by Hongkong Daily Press in Hongkong in 1941. It is certain that "The Far East" did not mean what "Intra-Asian" Trade was, but "The Far East" should be some part of it. Furthermore, "The Far East" seemed to be a certain regional trade area, not only the geographical scope of which the contemporary business persons there in those days might recognize and could "imagine", but also in which they conducted their actual business activities and strengthened their trade networks.

Keywords: Intra-Asian trade, The Far East, Company, Directory

1. Introduction

In the first half of the twentieth century, before the World War II, "Intra-Asian" trade continued to make a steady and dynamic progress. But little attention has been given to the business development from the view point of the companies in "Intra-Asian" trade. Certainly it is not easy to investigate the whole activities of the companies in this large business arena of "Intra-Asian" trade including in especially South Asia, Southeast Asia and East Asia, but, by using the classified business lists and industrial lists of the companies in "the Far East" reported in *the Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc.* published by Hongkong Daily Press in Hongkong, it is possible to analyze some aspects of the location and the business activities of the companies in "Intra-Asian" Trade.

Of course, "the Far East" did not mean what "Intra-Asian" Trade was, but should be some part of it. Furthermore, "the Far East" seemed to be a certain regional trade area, not only the geographical scope of which the contemporary business persons there in those days might recognize and could "imagine", but also in which they conducted their business and strengthened their trade networks.

This study is intended as an investigation of "the Classified List of Trades covering China, Japan, Malaya, Borneo, Siam, the Philippines, Korea, Indo-China, Netherlands Indies,etc." and "List of Industries in "the Far East" compiled in the directory published in Hongkong, 1941. In this study, there are three main research points as follows, (1) to examine comparatively what the classified lists of trades in 1940 reported, (2) to examine by comparing what the lists of industries in the Far East in 1940 reported, and (3) to analyze these kinds of companies data in the Far East compiled in Directory by using the GIS analytical method.

2. Directory published in Hogkong and "The Far East"

2.1 Directory published in Hongkong

Hongkong Daily Press published *the Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc.* since 1860s. This study examines *the Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc.* published by Hongkong Daily Press in 1941(see photo 1 and photo 2). This directory overviewed and complied the business persons, the companies and the industries in the major ports of "the Far East."
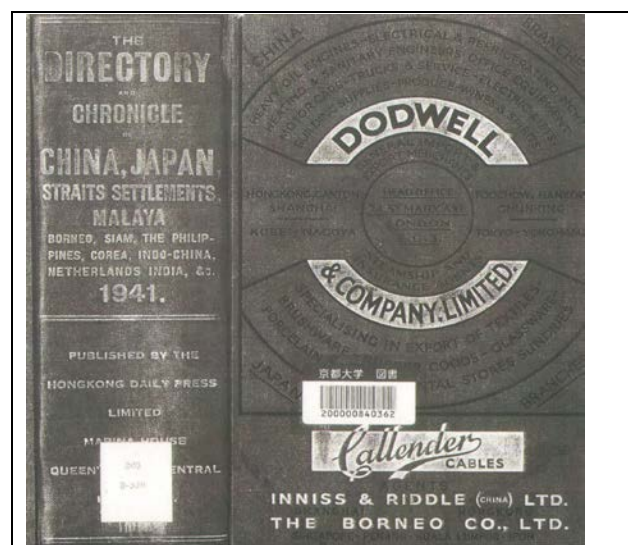
(Photo 1) A Cover of *the Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc. Hongkong Daily Press, 1941.*
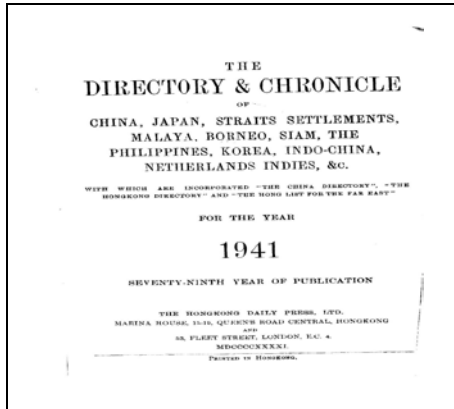
(Photo 2) Top page of *the Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc. Hongkong Daily Press, 1941.*

2.2 "The Far East"

The Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc published in Hongkong covered the directories of companies and foreign residents on the main cities in "the Far East" which was recognized as a kind of the regional trade area before World War II(see Map 1).
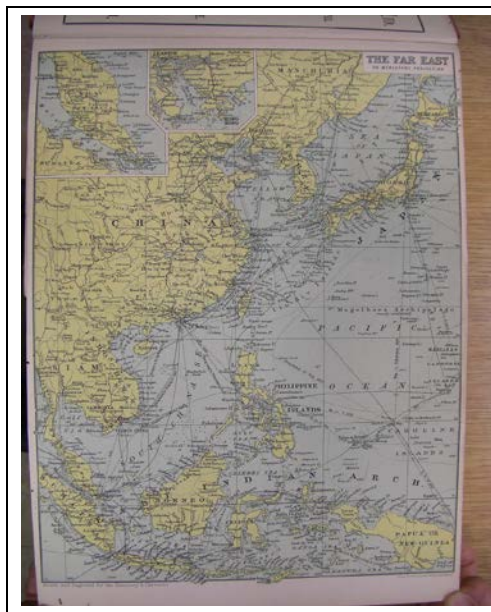
(Map1) "The Far East" in *the Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc. Hongkong Daily Press, 1925.*

3. The Classified List and the List of Industries in "the Far East"

The Directory and Chronicle for China, Japan, Straits Settlements, Malaya, Borneo, Siam, the Philippines etc published in Hongkong complied the important lists about companies, their professions and industries, which includes "The Classified List" and "The List of Industries" in "the Far East."

It is important to note that the directory published in 1941 included the companies' data in 1940. So the classified list of trade and the list of industries published in 1941 recorded the information in 1940.

3.1 The Classified List of Trade in "the Far East"

The classified list of trade reported totally 10,676 companies of the all 82 business classifications in 97 port cities in the Far East, such as Shanghai, Manila, Hongkong, Kobe and the others. This number of 10,676 companies are counted in nominal terms, but the number of the real companies were counted about 6,700. Because some companies carried on several business. So these companies were listed on several business categories.

The most common business profession in 97 cities of the Far East was General Merchants, 1,463 companies of the total 10,676 companies. The second was insurance (633). The third was shipping (458). The 4th was banks (410). The 5th was Machinery & Hardware Merchants (350). The 6th was Electrical Supplies (278). The 7th was Chemicals & Drugs (268). The 8th was Cotton & Textiles (267). The 9th was Motor Car Dealers (267). The 10th was Newspapers & Publications (251).

(Photo 3) The Sample Page of the Classified List in 1941

One main port city in 97 port cities in which the most companies were located was Shanghai (1,589 companies). The second port city was Manila (1,090). The third port city was Hongkong (977). The 4th was Kobe (801). The 5th was Singapore (685).

In Shanghai, the most common business profession was General Merchants, 199 companies, of the total 1,589 companies. The second business profession was Insurance (78). The third was Machinery & Hardware Merchants (67). The 4th was Chemicals & Drugs (59). The 5th was Cotton & Textiles (55). In Manila the most common business profession was General Merchants, 87 companies of the total 1,090 companies. The second business profession was Mining (76). The third was

Insurance (51). The 4th was Timber & Lumber Merchants (41). The 5th was Newspapers & Publications (37). In Hongkong, the most common business profession was General Merchants (151) of the total 977 companies. The second was Insurance (63). The third was Shipping (40). The 4th was Electrical Supplies (30). The 5th was Machinery & Hardware Merchants (28).

By analyzing "the Classified List" in "the Far East," it is possible to clarify the branch networks of the main companies in the Far East. For example, the first example of the companies which built the largest branches of business network was Hongkong & Shanghai Banking Corporation, which had 27 branches of port cities in "the Far East" not all over the world, such as Amoy, Canton, Dairen, Harbin, Shanghai, Swatow, Hanoi, Saigon, Kobe, Yokohama, Johore, Malacca, Penang, Perak, Bangkok, Iloilo, Manila and the others.

The second example of the main company was Mitsui Bussan Kaisha, Ltd. which built 27 branches of port cities, such as Amoy, Canton, Chefoo, Dairen, Hankow, Hongkong, Mukden, Newchwang, Peiping, Shanghai, Tientsin, Tsinan, Tsingtao, Kobe, Moji, Nagasaki, Nagoya, Osaka, Shidzuoka, Tokyo, Yokohama, Manila, Singapore, Batavia, Semarang, Sourabaya and Manila.

The third example of the main company was Jardine Matheson & Co., Ltd. which built 15 branches of port cities, such as Formosa, Kobe, Canton, Foochow, Hankow, Hongkong, Ichang, Kiukiang, Nanking, Shanghai, Swatow, Tientsin, Tsingtao and Wuhu.

(Photo 4) The Sample Page of the List of Industries in 1941

3.2 The List of Industries in "the Far East"

Number of Companies on The list of industries in "the Far East" was 1,879. But some companies carried on several industries. So these companies were counted at several times. Real number of companies was counted about 1,700 in 130 districts or cities such as Kowloon, Hong Kong, Shanghai, Perak, Binondo (Manila), Selangor, Singapore and the others. Then these companies were sorted into 115 industrial classifications.

Industries on "the List of Industries" is classified

into 115 categories. The most common industrial category was 161 companies of the total 1,879 companies. The second was Tin Mines (147). The third was Knitting (144). The 4th was General Engineers (104). The 5th was Electrical Engineers (93). The total 130 districts or cities were listed. The main district or city in which the most companies were counted was Kowloon, 602 companies of the total 1879 companies. The second was Hongkong (404). The third was Shanghai (134). The 4th was Perak (74). The 5th was Binondo, Manila (68).

In Kowloon, the most common industrial category was Knitting, 140 companies of the total 602 companies. The second common industrial category was Weaving (91). The third was Metal Wares (21). The 4th was Preserves (19). The 5th was Shirts & Garments (18). In Perak, the most common industrial category was Tin Mines, 56 companies of the total 74 companies. The second common industrial category was Mining Engineers (6). The third was Mechanical Engineers (4). The 4th was Consulting Engineers (3). The 5th was Civil Engineers (2).

At the country's level, the industrial categories of both Malaya and the Philippines are very unique. In Malaya, Tin Mines were the most common industrial category, 147 companies of the total 198 companies. Tin Mines accounted for about 74.2%. The second industrial category was Mining Engineers (11). The third was Civil Engineers (10). In the Philippines, Power Plants was the most common industrial category, 161 companies of the total 328 companies and accounted for 49.1%. Mining was the second category and accounted for 74 companies and 22.6% of the total companies. Sugar Central was the third category and accounted for 49companies and 14.9%. Contracting Engineers was the 4th category and accounted for only 9companies and 2.7%.

3.3 GIS framework and Companies in "the Far East"
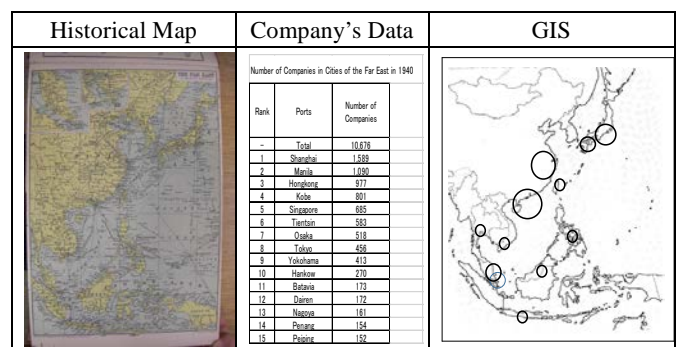
(Map2) Combination of the Historical Map and the Company's Data in "the Far East" by GIS

This study needs more to combine historical map and company's data by GIS analytical framework, method and techniques in order to define the historically dynamic process of the distribution of professions and industries and the location of companies in "the Far East."

4. Concluding Remarks

This study examines only the classified list of trade and the industry list published in 1941. So the more extensive research should be made as follows, (1) the dynamic change of location of the companies in the main districts, cities and countries in the 1930s, (2) the dynamic change of the business classification in the 1930s, (3)the change of the companies' branch networks in the 1930s by using the GIS analytical framework.

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Trade and Trade Centers in China during the "Long 19th Century" Working Hypothesis and Related Materials

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Abstract: The expansion of global trade during the "long 19th century," from the late 18th century to the eve of the World War I, has attracted much academic attention of late, especially in terms of the exports of raw materials and minerals from the Americas, Africa, and Asia to industrializing western Europe. To comprehend the long-term process of global economic integration, it is critical to identify that not only long-distance trade, but also intra-regional trade significantly increased. However, the conventional nation-basis trade statistics mask the key dynamics of the regional trade expansion centering on the newly developed trade centers. The trade statistics compiled by Chinese Maritime Customs (CMC) were unique, as they kept records on trade between domestic ports as well as the foreign trade. By applying GIS analyses to the port-basis trade statistics of China, this session takes the task to draw the changing landscape of trade during the "long 19th century."

Keywords: 19th century, Chinese Maritime Customs, Macro regions, Open ports, Postal atlas

1. Introduction

Although goods and bullion circulated globally from the 16th century, trade in the early 19th century marked a watershed in terms of volume, value, and the variety of commodities, and the speed with which they moved. The expansion of global trade during the "long 19th century," from the late 18th century to the eve of the World War I, has attracted much academic attention of late (Sugihara 2013). As for the causes for the breakthrough, the conventional understanding emphasizes the role of reduction of tariffs under the free trade regime, together with advances in transportation technology (O' Rourke and Willamson 2002). However, it has not been fully examined how those two key factors, one institutional and the other technological, worked at the ports newly integrated into the global web of trade, such as those in Asia.

One of the problems is that the usual nation-basis trade statistics mask the key dynamics of the regional trade expansion centering on the newly developed trade centers. Beyond the aggregated national data, we need to learn about the flow of goods with more specific information about the localities involved. The trade statistics compiled by Chinese Maritime Customs (CMC) were unique, as they kept records on trade between domestic ports as well as the foreign trade. By applying GIS analyses to the port-basis trade statistics of China, this session takes the task to draw the changing landscape of trade during the "long 19th century." As an introductory of the session, this paper overviews the background, the working hypothesis, related materials, and future research agenda of the project.

2. Commerce and markets before opening of the ports: G. William Skinner's analysis and its implications

In order to examine how trade routes and centers changed after the 19th century, we need have an idea about how the trade was like before opening of the ports. In terms of the traditional China's commerce and markets, G. William Skinner's "macro regions model" is one of the most influential. Skinner offered an analysis of the economic geography of late imperial China in terms of a set of eight macro regions, with regard to which the bulk of trade occurs internally rather than externally. Skinner argues that it is analytically fault to treat China as a single national market system in this period of time; rather, economic activity was largely confined within the separate macro regions. As he points out, the economic geography of traditional Chinese economy was largely governed by transport cost, and this meant that China's river systems largely defined the shape and scope of intra- and inter-regional markets.
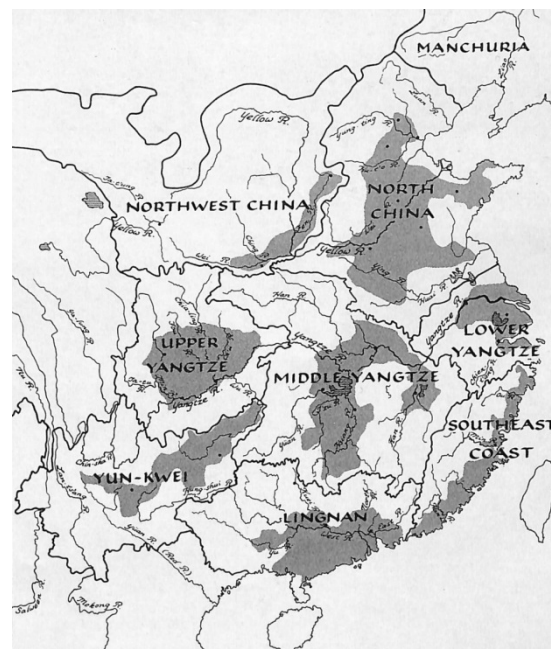

Figure 1 China's eight macro regions
Source: Skinner, G. William. 1977. "Regional Urbanization in Nineteenth-Century China." In *The City in Late Imperial China,* edited by G.W. Skinner. Stanford: Stanford University Press, p. 215.

3. Hypothesis: Open-port economic zones

The key questions about the modern Chinese economy are when and how the traditional pattern of trade such as the one illustrated by Skinner was transformed. Based upon macro analyses of CMC trade statistics, Yoshinori Kigoshi argues that after the openings of the treaty ports in the mid-19th century, the landscape of Chinese economy fundamentally changed. As European countries, and then from the United States and Japan demanded for China's primary goods from the late 19th century to the early 20th century, Chinese rural areas significantly increased exports via treaty ports. Consequently, the open-port economic zones emerged in which the rural areas were closely integrated with the treaty ports, while the traditional regional economies disappeared (Kigoshi 2012: 65-90). Kigoshi's view is echoed by Akinobu Kuroda, who argues that the circulation of currencies in the late 19th century Hubei province was critically influenced by the increasing exports from the newly opened treaty port, Hankou (Kuroda 1994: 150－187).

If the strong demand for primary goods from abroad as well as the improvement of transformation led to the urban-rural integration in terms of commodities and currencies, we have yet known in detail the spatial dimension of them. Keeping the open-port economic zone as a working hypothesis, we first apply the GIS analysis to the trade of each port. The results can be tested against the possible factors shaping those flows such as the port-hinterland relationships and the inland transportation.

4. Research agenda: Cartography and GIS

Our project first forms the data set out of the trade statistics compiled by CMC (see Kigoshi's paper for details). We apply the GIS-analysis to the data set to draw the flows of commodities between the port cities (see Shimanishi's paper for details). With this visualization of the long distance trade at hand, we can ask the two questions with the related maps, first how the hinterland of the port cities were integrated to those trade, and what kind of transportation contributed to the commodity flows.

(1) The map of inland trades with transit passes

The distribution of transit passes sheds light on the relationship between the port cities and their hinterlands. In order to finance the military expense to fight against the Taiping rebellion (1850-1864), the Qing government allowed the local governments to collect transit tax called *lijin*. *Lijin* remained the major financial source for the local governments even after the rebels were defeated. Foreign merchants complained about *lijin* as the unnecessary duplication of the import and export duties. As a result of several diplomatic negotiations, foreign merchants were allowed to pay one half of the import or export duty to the CMC at the treaty ports instead of the payment of *lijin*. Receiving the half duty, the CMC issued the certificate called transit pass which has the origins of exported goods or the destinations of imported goods. The records of transit passes show how the domestic trade linked the port-cities and the inland market towns.

Figure 2 Districts supplied with foreign goods, 1874
Source: China. Inspectorate general of customs. Statistical department. *Special series* 22.

(2) The postal atlas of China

It is not easy to learn about the transportation system in the past beyond major railways and river lines. The postal atlas of China, another publication by CMC, is the valuable geographical source showing the transportation of inland China. From 1867 to 1911, CMC managed China's postal system and left the related records including the postal maps.

Figure 3. The postal map of Jiangsu province in 1907
Source: Statistical Department of Inspectorate General of Customs, *China Postal Album: Post Offices and Postal Routes in Each Province*. Shanghai, 1907.

The hierarchy of the postal offices might reflect the market system. The map shows the networks of cities, counties, and villages connected by land road, river and canals, and railways. By putting together the commodity flows that we assess though GIS analysis and the postal map, we can

examine the landscape of domestic trade in terms of transportation and communication.

Conclusion

With his seminal work on the market system of the traditional China, G. William Skinner introduced the geographic analyses to the field of Chinese history. The recent development of GIS tools enables us to fully explore the key question, how the traditional system was transformed through the institutional changes and the technological advances in the 19th century. Examining formation of open-port economic zones, we apply GIS-analysis to CMC trade statistics to visualize the spatial dimension of trade expansion.   One of the most important feature of GIS is its capacity to compare different maps through overlapping technologies.   By way of combining cartography and GIS, our analysis of the long-distance trade can be tested in terms of the port-hinterland relations or the transportation system.

Using GIS for trade statistics is an explicitly exploratory exercise. GIS may not be meant to provide answers, but to raise new hypotheses to test, to urge us revisiting the primary sources with those new questions, thus to promote new research in turn.

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Visualizing Changes in the Routes and Scale of Trade in 19th-Century China

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Abstract: By visualizing with geographic information system (GIS) the value of trade at coastal and inland ports and trade routes in 19th-century China, this study examines how these two aspects of trade were related. In the process, it also explains the visualization methods and process that we have employed so far. Although research on trade in modern Asia has advanced rapidly, no attempt has yet been made to agglomerate or integrate scholars' profound knowledge and findings in their respective research fields to understand the 'big picture' of trade, including routes, volume/value, traders' activities, and changes therein. Thus, the current study will help deepen our understanding of the history of Asian trade by mapping together scattered and diverse pieces of information. We have started with China, given the wide availability of systematic trade statistics from the Chinese Maritime Customs, as a pilot study of our larger project that covers various regions and ports in Asia.

Keywords: Chinese Treaty Ports, Inland Trade Routes, Chinese Maritime Customs, Opium Trade

1. Introduction

In geographic information system (GIS)-based studies on the history of trade, many scholars have attempted to visualize trade routes (Shibayama 2012) [1]. Unlike its predecessors—most of which have focused largely on visual restorations of trade routes—our project attaches much importance on the relationship between trade routes and the actual flows of trade items. By visualizing the value of trade at coastal and inland ports and trade routes in 19th-century China, this study examines how these two aspects of trade were related. In the process, it also explains the GIS visualization methods and process that we employed.

This study is prompted by recent studies on the trans-Atlantic slave trade since the 15th century, in which both the trade routes and the volumes of trade have been successfully visualized (Eltis and Richardson 2010). Moreover, advances in GIS technology and its growing availability have encouraged the restoration and visualization of trading networks in various regions in the premodern and modern periods (Crespo Solana, ed. 2014). The majority of recent studies on trading networks address the Atlantic and the Indian Ocean areas. As a case study stemming from a larger project on the visualization of trading networks in modern Asia and the Pacific, this study takes up the case of China. Although research on trade in modern Asia has advanced rapidly, no attempt has yet been made to agglomerate or integrate scholars' profound knowledge and findings in their respective research fields to understand the 'big picture' of trade, including routes, volume/value, traders' activities, and changes therein. Thus, the current study will help deepen our understanding of the history of Asian trade by mapping together scattered and diverse pieces of information.

We launched a project in which we sought to visualize, through the use of GIS, the value of trade in major commodities in 19th-century Asia—namely, opium, rice, and cotton goods—and trade connections among various countries/regions; part of this project was presented at the 16th World Economic History Congress in 2012. [2] Based on the findings and problems stemming from that previous work, we are now visualizing inland trade routes and the flow of commodities among ports by using more detailed trade data. We have started with China, given the wide availability of systematic trade data from the *Chinese Maritime Customs Statistics*. [3]

2. Visualization of the Opium Trade with Spider Diagrams: Achievements and Limitations

Before examining China's inland trade, the achievements and limitations of our earlier work should be discussed. Among the several attempts made in 2012, we take up here the trade in opium during the 19th century, using spider diagrams as an example.

Figure 1 is a spider diagram that shows the volume of opium exported from Bombay and Calcutta, and the volume of opium imported into China and the Straits Settlements in 1890. As a reference, the diagram includes the volume of Turkish opium exported from the port of Izmir. We drew the figure with ArcGIS 10.0 and the Spider Diagram Tool for ArcGIS 10.0, which is available from the ArcGIS Resource Center. The figure shows that Bombay and Calcutta exported nearly the same volume of opium to China, while in the Straits Settlements the Patna and Benares varieties of opium, both of which were exported from Calcutta, dominated the market.
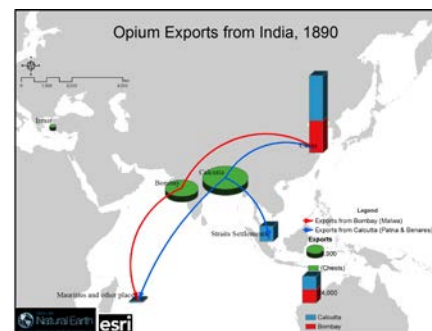

Figure 1. Opium Exports from India, 1890

Figure 2 shows the regional distribution of Indian opium varieties in China in 1886. Malwa opium was imported through ports mainly in Central and North China, while the ports in South China and Taiwan received the majority of Benares opium imported there. Hong Kong and Shanghai were the main opium-receiving ports, whereupon it was transported to other ports. Figure 3 demonstrates the volume of export from Hong Kong to various ports in China; the volume of re-export from Shanghai to other Chinese ports is illustrated in Figure 4. These figures clearly show that many ports in China imported Malwa opium through these two ports, rather than import it directly from the port of origin (i.e. Bombay). Hong Kong served as a distribution hub for the ports throughout the country, while Shanghai was a distribution centre for the ports northward from Shanghai. As these figures clearly show, one of the major advantages of GIS-based historical studies is that it allows us to immediately understand many different pieces of information on a map. In this case, clear regional differences in terms of opium trade and consumption are made visible. Because of our method—which, importantly, used trade statistics between ports in Asia, rather than those between countries—the various functions of each port, regional consumption differences, and diverse trading networks between Indian ports and Chinese ports emerge on the maps. Henceforth, we can start to analyse these points.
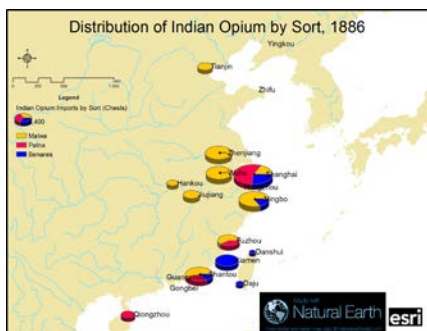
Figure 2. Distribution of Indian Opium by Sort, 1886

Figure 3. Malwa Opium Exports from Hong Kong by sort, 1879

Figure 4. Malwa Opium Re-exports from Shanghai by sort, 1879

This attempt, however, failed to generate a map that simultaneously depicts trade in several different goods, as too many symbols would appear on the map. Moreover, while we were able to successfully show trade relationships among ports through the use of spider diagrams, we needed further ingenuity to map the socioeconomic backgrounds underpinning those relationships.

3. Visualizing China's Internal Trade in the 19th Century, through Distributive Flow Lines

Figure 5 is a map that shows the annual value of foreign goods imported in 1871 into each port directly from foreign countries and by way of other Chinese ports. Clearly, the ports in coastal South China and Shanghai established direct trade connections with foreign countries, but the inland and northern ports received foreign goods from other ports. Figure 6 is the same map as Figure 5, but in 1920. After almost 50 years, more ports—especially in Southwest and North China—imported foreign goods directly from foreign countries, but the ports along the Yangtze and around Shanghai continued to import foreign goods from other Chinese ports. We prepared the same map for each year in the 1871–1931 period; the database used for this purpose was created by Yoshinori Kigoshi from *Chinese Maritime Customs Statistics* data. These maps illustrate chronological changes in trade and the characteristics of each port, which gives us the basic knowledge needed to examine the causes of changes and differences. However, we needed to add another 'twist' to illustrate more clearly the relationships among ports and how the value of trade increased as it developed.
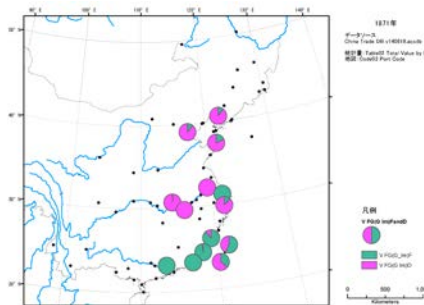
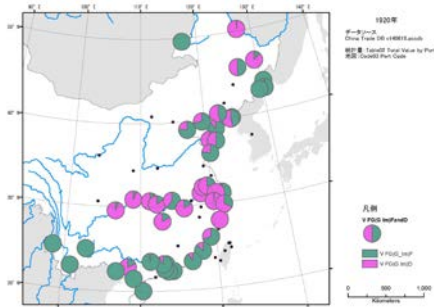Figure 5. Foreign Goods Imports into Chinese Ports by Value, 1871

Figure 6. Foreign Goods Imports into Chinese Ports by Value, 1920

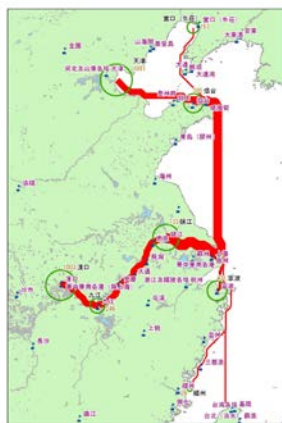Figure 7. Foreign Goods Re-exports from Shanghai by Value, 1871, on an Unprocessed Map

Figure 8. Foreign Goods Re-exports from Shanghai by Value, 1871, on a Processed Map

We chose to represent the relationships among ports and the value of trade with a line, by employing the Distribution Flow Lines GP Tool (DFLT), which is available from the ArcGIS website of Bob Gerlt. However, the line drawn by the DFLT is linear, as it has no function by which it can correctly recognize curvy coastlines and rivers, as shown Figure 7. We then used a small-scaled map downloaded from the website of

Natural Earth,[4] and 'erased' from the map a 10-kilometre buffer zone along the rivers. Figure 8, which is an erased-processed map, shows the value of re-export from Shanghai to other Chinese ports in 1871. The map clearly illustrates the trade routes between Shanghai and other ports, as well as the value of re-export. We drew the same map for each year in the database that we built (i.e. from 1871 to 1931), and through these maps, we were able to examine special and geographical patterns in China's internal trade, as well as changes therein during the study period.

4. Adding Relevant Information to the Maps

Although we have so far successfully visualized part of 19th-century trade in China by overcoming the problems we encountered in earlier research, we needed to undertake further study of the socioeconomic factors that can influence the scale of trade and trade routes; we also needed to visualize them through the use of the same types of maps, to understand chronological changes. Among the socioeconomic factors were population movements; the nature of port facilities and infrastructure, such as docks and warehouses; ecological or geographical conditions, including ocean currents and climate; consulates; and the offices of banks and firms. Here, we visualized population movements on the maps.

Shina Shobetsu Zenshi (the China Provincial Gazetteers), complied by the Japanese organization *Toa Dobunkai*, constitute the best available source of information on China's population in the 19th and early 20th centuries. Although some of the data are not completely reliable, this is the only systematic information to include the number of households and the population of villages and towns in each district. The population database we used here was also created by Yoshinori Kigoshi, using data from this source. Coordinate information was obtained from the website of the China Historical GIS, Harvard University. More precisely, we used point data with respect to provincial capitals, prefectural capitals, and towns and villages in the year 1911, which was combined with the population data. The results of this study are forthcoming.

5. Conclusion

Many scholars have repeatedly referred to the macro-region analysis proposed by G. W. Skinner to understand China's special patterns, as well as the relationship between geographical features and economic activities. It is, however, difficult to examine the impact of trade dynamics—such as the expansion of trade and infrastructure—on such geographical economic regions solely by using Skinner's approach. By utilizing a vast amount of data available from the *Chinese Maritime Customs Statistics* and *Shina Shobetsu Zenshi*, our project was able to touch upon these aspects. In future work, we will extend our study area from China to Japan, India, and Southeast Asia, and then visualize the volume/value of trade, as well as the changes therein, in modern Asia.

Notes

1 See also 'Old World Trade Routes Project' (http://www.ciolek.com/owtrad.html) by Matthew Ciolek.

2 Session organized by Tomoko Shiroyama, 'The Intra-Asian Trade during the "Long 19th Century": Formation and Dynamics of Regional Commodity Chains'.

3 Yoshinori Kigoshi will explain the details of the data in his paper.

4 http://www.naturalearthdata.com.

General Explanations for Chinese Trade Database in 19ᵗʰ Century

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Abstract: Our database uses the information from *the Annual Returns* compiled by Chinese maritime customs. They kept records on trade between domestic ports as well as the foreign trade. We input the total value of treaty ports with foreign country and native ports from 1867 to 1904. This data consist of 32 treaty ports and 22 foreign countries (including Hong Kong and Macao). The total number of items in our database is 151,323. The above data for keeping systematically are inputted and preserved by Microsoft's database application ACCESS 2013.

Keywords: Chinese maritime customs, Foreign Trade, Domestic Trade, Transit Trade, the Annual Returns, ACCESS 2013

1. Introduction

The statistics compiled by Chinese maritime customs (中國海關;1854-1949) are the most useful and reliable data sources for analysis of the modern china's trade. All statistical information in regard to China's trade through this customs had, been compiled in Shanghai at the Statistical Department of the Inspectorate General of Customs (総税務司) from the Statistical Copies of Customs declaration forms for Imports, Exports, etc., received from the treaty ports.

Figure 1. Chinese maritime customs at Shanghai, 1920's

Besides *the Daily Returns* published at Shanghai (1866-1932.3.31), which concerns that port alone, there are two sets of Returns of Trade published by the Inspectorate General of Customs: *the Quarterly Trade Returns*, which appears in *the Customs Gazette*, and *the Annual Returns of Trade*. The Annual Returns contains the most important statistics. They exhibit the trade of each treaty port, foreign and domestic. Our database uses the information from *the Annual Returns*.
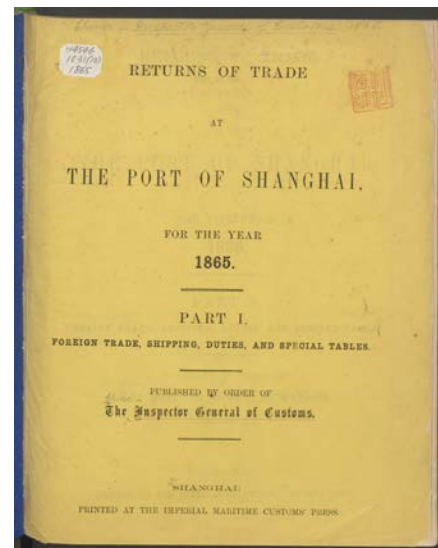
Figure 2. *the Annual Returns of Shanghai*, 1865

2. Classification and Definitions of Trade in Chinese Maritime Customs Statistics

The object of this statistics is to record the movements of the various articles of produce and manufactures which go to make up the commerce, both internal and external, of Modern China.

In Modern China, this commerce had two grand natural divisions, namely *Foreign Trade* and *Domestic Trade*. It is to be carefully in mind, however, that in this statistics only the trade carried on at the treaty ports, by vessels of foreign type and such native craft. Of the vast internal trade carried on by ordinary native craft (Junk) no statistics are kept, and with it we have nothing to do.

The Modern China's trade, with which the Chinese maritime customs had to deal, was classified as in the scheme below. *Foreign Trade* means the trade with foreign countries. *Domestic Trade* means the trade between the treaty ports. *Domestic Trade* is necessary to designate both the trade between the ports on the seacoast and that on the Yangtze River.

We have, besides, as an antecedent and sequel to these trades, the bringing of native goods from the interior and the conveyance of foreign goods to the interior, which, together, call

Transit Trade. The *Transit Trade* may be considered as a branch of the *Foreign Trade*, as it has to do only with foreign goods and native produce intended for foreign markets.

3. Chinese Trade Database in 19th Century

Accepting the above definitions, The Port Statistics in *the Annual Returns* consist of the three main tables: -

I.　Foreign Imports. This table gives the trade in foreign goods, both with foreign countries and native ports.

II. Native Imports. This table gives the imports trade in native goods, both with foreign countries and native ports.

III. Native Exports. This table gives the exports trade in native goods, both with foreign countries and native ports.

Figure 3. Table Foreign Imports, Port Tianjin (天津), 1881.

At the last column "Summary" of three tables, the figures are given to be the sum totals of foreign countries and native ports. For example, in the annual returns of Shanghai, the total value of exports and imports about Shanghai with each foreign country and Chinese treaty port is described (i.e. Great Britain Hk.Tls. 23,386,094 . . .).[1] We collect this total trade value of treaty ports with foreign country and native ports from 1867 to 1904.

Figure 4. Summary of Foreign Imports, Port Shanghai (上海), 1881.

The above data for keeping systematically are inputted and preserved by Microsoft's database application ACCESS 2013. In ACCESS 2013 File, This data is saved in five main Tables. "Table 01" is Total Value. "Table 02" is Value by Ports. "Table 03" is Value by Countries. "Table 04" is Value between Ports and Countries. "Table 05" is Value of inter ports.
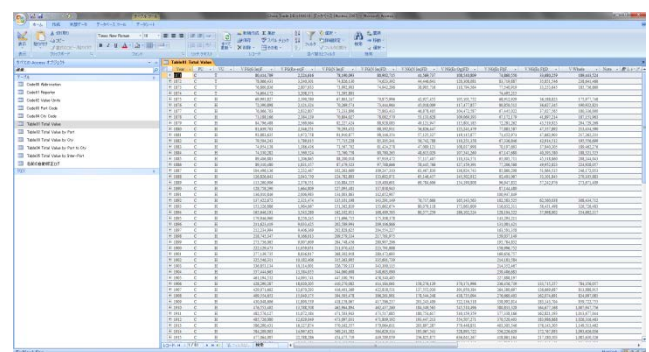

Figure 5. Open the Table 01 Total Value in ACCESS 2013.

Besides, these five tables are also kept by Relation-Ship Database Tool. At the first, we make codes about Value Unit, Ports and Countries. For example, Port Shanghai's Code number is 501, Nigpo is 602 (See Figure 6.). Finally five main tables are linked by these codes (See Figure 7.)

Figure 6. Open the Port Code Table in ACCESS 2013.
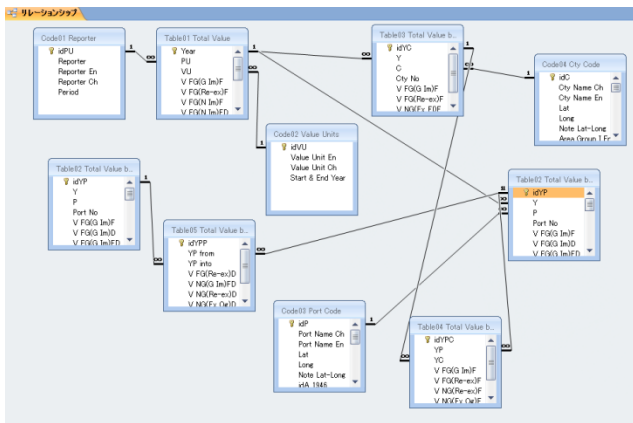
Figure 7. Open the Relation Ship Tools in ACCESS 2013.

This data consist of 32 treaty ports and 22 foreign countries (including Hong Kong and Macao). The total number of items in our database is 151,323; inter-native ports is 78,520 items, ports with foreign countries is 72,803 items.

Notes
1 HK.Tls.(Haikwan Tael) is the equivalent, in which the Customs Revenue and all Values are stated. 1 Haikwan Tael = pure silver 583.2g.

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CRMA Sessions

The Cultural Relationship Study of Mainland Southeast Asia Project
ANGIS and CRMA Bangkok Meeting 2015

Overview of CRMA project
From LARP to CRMA:
The Cultural Relationship Study of Mainland Southeast Asia Project

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Abstract: The Living Angkor Road Project, (LARP) was the collaboration research project between Khmer-Thai researchers started in 2005. The study was focus on the royal road from Angkor to Phimai, the infrastructures and cultures along this royal road were identified and studied in detail. After the study on the royal road from Angkor to Phimai had finished, we has been continuing to conduct the study on the ancient culture and society along the north-south and east-west cultural corridors in Thailand and neighboring countries. The purpose of selecting GMS and Malay Peninsula as the study area along the north-south and east-west cultural corridor is to be able to conduct the research in parallel tracks. The main objective of the project is to study the relationship of the local culture by integrating knowledge of various fields related for cultural study in the north-south and east-west cultural corridor from past to present. The integrated results of the study on each component of the research can be utilized to analyze the relationship of the local culture in the study area.

From our study, archaeological studies and the analysis of spatial data provide a broader picture of the relationship of regional scale in the north-south and east-west cultural corridor. The results of the study provide the broader picture of sharing and adaptation of culture in the past. The development of the transportation system, ancient industry had been revealed, which opens the new knowledge of the cultural material and evidence that had not been achieved previously.

For the current research named "The Cultural Relationship Study of Mainland Southeast Asia Project (CRMA)", the main objective will focus on the impacts affecting cultural change in order to visualize the relationship of culture at regional scale in the past to discover the relevance and coherence that impacted on society and culture as a whole, and cultural development until the present.

The purposes of this research are: 1) To study the impact and cultural change in Southeast Asia, and to trace evidence of linkage and cultural relations resulted from extending transport systems from the initial state to 17th century. 2) To study the process of cultural adaptation from evidence of cultural objects, which can indicate wisdom, production technology that continue until the present. 3) To develop information database to disseminate of research results. 4) To utilize the results of the research in various ways, such as for the education of young people in the region, and for enhancing the relationship between the countries.

The main topics of the study are: 1. The continuation of the study of royal roads from Angkor. 2. The study of ancient communication systems in Thailand, Myanmar, and Vietnam. 3. The study on the relationship of ancient culture and techniques across the region. 4. The development of geo-ontology technique for database development to fit wit the condition of the cultural data of the area.

Keywords: LARP, CRMA, Ancient Communication Systems, Cultural Relationship, Southeast Asia

Cultural Relationship in Southern and Central Thailand Through Archaeological Study

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Abstract: The presentation of Cultural Relationship in Southern and Central Thailand Through Archaeological Study will focus on the research during 2009-2011 by Fine Arts Department and the research project to study cultural inter-relationship of the countries in GMS and Malay Peninsula countries, supported by Thailand Research Fund (TRF). The research area in the upper Malay Peninsula covered mainly in 4 provinces of southern Thailand: Chumphon, Suratthani, Nakhon Si Thammarat and Pattalung, and the connected area in Ranong, Phangna and Krabi.

The data series of more than 200 archaeological sites throughout the research area were approached and were confirmed their locations as well as the specific attributes of artefacts were identified together with the number of newly identified sites. This presentation will also share newly models concern with the re-interpretation of cultural relationship of communities in southern Thailand and Central Thailand the cultural chronological understanding, which reflects intensive cultural activities involved with the international sea-trade from the first millennium C.E. that impacted to the emergence of the states in mainland Southeast Asia.

Regarding the development of sites, archaeological studies have found that there had been human settlements in the area of early period during Neolithic since approximately 4,000 years ago. The archaeological evidence found in both area was a number of skeletons buried in the same place, in the manner of proper burials. There were also jewelries and utensils buried along with the skeletons, for examples stone tools, pottery, bronze and iron tools, bronze jewellery, glass and stone beads, etc. This ancient settlements developed into a city community due to cultural influences from the outside, namely Dvaravati culture (7th-11th Century) and ancient Khmer culture (10th-13th Century). During the period when the area was under Dvaravati influence, ponds and city moats were dug in order to preserve water for use in drought season. Several religious buildings were also built. The main sites are: Wat Khlong, Julapratone, Klang Nok. The entire site are of Dvaravati style which reflects an influence from India. Both the architecture and the decorations, for example decorative stucco figures of dwarves, elephants, monkeys, Singhas, buffalos and the pattern of flowers and plants in the cave indicates that the craftsmen of Nakhon Prathom and Si Thep were highly skilled. Apart from the site itself, there have been discoveries of ancient objects, such as Buddha figures, Bodhisattva figures, and inscriptions.

Archaeometallurgy Information Implying Relationship of Ancient Cultures
in Mainland Southeast Asia

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Abstract: Archaeometallurgical studies conducted in Thailand since the past few decades up to the present by various research projects, which also include 3 recently operated projects supported by the Thailand Research Fund (TRF); namely, the Living Angkor Road Project, Research Project for Developing Database on the Past to Present Cultures and Civilizations in the Greater Mekhong Sub-region and Malay Peninsular, and Cultural Relationship in Mainland Southeast Asia Project, have provided much information and knowledge about ancient metal production process in Thailand. Besides, basing on the information derived from comparison of some characteristically special metal artefacts and from analyses of some archaeological finds related to archaeometallurgy obtained through the researches, cultural relationship of ancient communities in mainland Southeast Asia can also be substantially delineated.

Keywords: Archaeometallurgical study, LARP, CRMA, Southeast Asia

VIMAYAPURA, YASODHARAPURA AND VIJAYA

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Abstract: This paper presents a preliminary study of a visual aspect of cultural relations among three outstanding centres of cultural and political eminence of Southeast Asia during the 12th century. Vimayapura in presentday Northeastern Thailand may have shared a political and cultural history with Cambodia since an ancient time. The powers of Yasodharapura (Angkor) in its heyday extended over a great part of present-day Thailand and Laos, and also to the east into the Cham territories in present-day Vietnam including Vijaya (binh-dinh) on the eastern coast. Material remains and inscriptions retain reflections of such relations. Many grand temples in Northeastern Thailand, Laos and Vietnam bear evidence of the art styles of Cambodia, which had gone through many centuries of impressive steps of evolution, to become the most compelling centre of artistic forces to its neighbours. In the region of Vimayapura in Northeastern Thailand, many major temples, e.g. Phimai, Phnom Wan and Phnom Rung bear unmistakaeble evidence of the overwhelming influences of the artistic tradition of Yasodharapura , comparable to features observed at the 12th century royal temples at Yasodharapura (Angkor) , e.g. Banteay Samre, Thommanon and Angkor Wat. Stone were used as main building material in Northeastern Thailand and Cambodia. The lotus-bud silhouette of the tower roof of their sanctum sanctorum, and figurative as well as and decorative sculptures of the temples revealed features assignable to the Cambodian Angkor Wat style. Such designs and decorative elements were also noticeable at a number of tower temples built in the region of Vijaya (Binh Dinh), the post-classical capital of the Cham civilization, especially at the group known as Ivory Towers at Duong Long and a few others. These Cham temples, nevertheless, were raised in bricks – the traditional native material of Champa and their decorations were also cerved in bricks. Nevertheless, stone base- mouldings built up and carved in typically Cambodian style, together with many iconic images, stylistically and icongraphically comparable to those found at Vimayapura and Yasodharapura, remain preserved at these Cham temples, even when most of the decorative sculptures faithfully followed the traditional Cham styles.

A Transregional Ritual Complex –
Dvāravatī and Zhenla in the Seventh-Eighth Centuries

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1. Introduction

The paradigm that Dvāravatī was predominantly "Buddhist" and the entity known as Zhenla "Brahmanical" has long remained uncontested. 1 In the past, the "Dvāravatī realm" has largely been described and associated with settlements in today's central Thailand where "Buddhism" was significantly and increasingly practiced during the second half of the first-millennium CE.2 Based on this literature, Dvāravatī has long been assumed by scholars and archaeologists as almost exclusively a Buddhist domain (e.g. Phasook 2004) although there has been a hesitant shift in recent years to argue for Brahmanism alongside Buddhism (e.g. Brown 1996; Saritphong 2556). In contrast, "Brahmanism" has often been perceived to operate primarily in the eastern margins of this territory, closer to Khmer counterparts in Zhenla where there were presumably followers of Śiva and Viṣṇu as well as Harihara, a combination of both gods (Sanderson 2003-04; Lavy 2003).

In this reappraisal, however, I challenge this basic religious dichotomy. My reassessment of the material culture and inscriptions from these two neighbouring regions tempers and questions the compartmentalization of such doctrinal categories as either "Buddhist" or "Brahmanical" and instead emphasizes the complex nature of the religion of that age through the lens of the ideology of merit (Skt, *puṇya*; P., *puñña*). 3 In this paper, I also examine the religious affiliation of certain small-scale artifacts, such as medallions, and inscriptions that are clearly related to this ideology. In doing so, I attempt to consider mainly material finds from Dvāravatī – without a Buddhist bias – by comparing these with other evidence found in the neighbouring culture of Zhenla and, even further afield , with those prevailing at the time in ancient India.

2. Numismatic and Archaeological Evidence

Several important discoveries of inscribed medallions4 in pure silver have been made in Thailand over the past decades. The first medallions were found in a small earthen jar beneath a ruined *stūpa* at Noen Hin in Nakhon Pathom and carry an identical legend in Sanskrit language and characters paleographically datable to the seventh century. The reverse reads *śrīdvāravatīśvarapuṇya*, the "meritorious work of the

lord of Śrī [i.e. glorious] Dvāravatī" (Cœdès 1963: 290) or, perhaps more accurately, "merit of the glorious lord of Dvāravatī" (Skilling 2003: 95 n. 9).

Other similar inscribed medallions have since been found in the Thai provinces of Nakhon Pathom, Ratchaburi, Suphan Buri, Sing Buri, Lop Buri, and Chai Nat (Skilling 2003: 95).5 As important as these artifacts are for the history of the region, and for clearly establishing the presence and location of the elusive Dvāravatī entity somewhere in present-day central Thailand, their religious character is also prominently determined because of the likely participation of this "lord of Dvāravatī" in installation rituals (*pratiṣṭhā*). This "work of merit" or pious foundation, however, does not confirm that the religious context was Buddhist. These medallions, in fact, seem to question the very idea that this "lord" would necessarily be a Buddhist ruler or that his meritorious actions were only produced as part of Buddhist foundations. Indeed, the notion of merit-making is not exclusive to Buddhism since Brahmanism is steeped in the same ideology.6 There are indeed several inscriptions in mainland Southeast Asia where the Sanskrit word *puṇya* is found in an apparently Brahmanical milieu, including one of the oldest stone inscriptions in Sanskrit from Thailand discovered at Si Thep (K. 499), Phetchabun province (FAD 2529a: 135-138).7

In 1997, three additional inscribed medallions were excavated in an archaeological context at Khok Chang Din, monument 7, near U Thong, inside a jar containing several other medallions stuck together along with chopped silver ingots (Skilling 2003: 93-95). This archaeological site, however, has only yielded Brahmanical remains, including a rare stone *ekamukhaliṅga* (Somsak 2510: 79, 83, fig. 7).8 It may be possible, therefore, that this Dvāravatī lord consciously erected a Śiva *liṅga* to indicate his presence and authority over the area. While, the Dvāravatī medallions display on the obverse various auspicious symbols of fertility and prosperity that are both representative of Buddhism and Brahmanism such as the "cow with its calf", these symbols do not give *sensu stricto* a clue to the religious affiliation of our local *īśvara* or lord of Dvāravatī and are open to multiple readings. However, a unique gold medallion recently discovered in 2012 in the region of Angkor Borei, Cambodia, is far less ambiguous in this regard (Cribb 2013; Epinal 2013). The medallion bears an inscription

on both sides which Arlo Griffiths (2014: 56) reads as *īśānavarmma*[*ṇaḥ*] on the obverse, and *īśānapu*[*ra*] on the reverse, meaning "of Īśānavarman", and "Īśānapura [Sambor Prei Kuk]". Because of this inscription, the medallion can be identified as the production of this king of Zhenla. The obverse shows a reclining bull which appears to be a clear reference to god Śiva, from whom the ruler took his official name.9 The king also named the city he founded after the god.

We also know from other inscriptions that Khmer royalty and elite of the pre-Angkorian period were customarily associated with either Śiva, Viṣṇu, or even perhaps a combination of both gods, that is Harihara (Lavy 2003: 32-37). This Indic practice of naming or identifying oneself with the Brahmanical gods, mostly Śiva in the form of a *liṅga*, presumably enhanced the legitimacy of the rulers (Sanderson 2009: 274ff), facilitated the establishment or restoration of deities temples, and even created what Alexis Sanderson has coined a "Śaivization of the land" (2003-04: 403-409). In ancient Cambodia, these "elite-sponsored religious foundations", as Paul Lavy makes clear (2003: 37), were likely important means for the local rulers to exert control over a certain area and were liable to be instrumental in the development of early political entities.

Based on the above numismatic evidence, a case can be made that the Dvāravatī entity experienced the same phenomenon and was largely associated with settlements where Brahmanism was significantly practiced along with Buddhism. Adding to this reasonable statement, Claude Jacques (2009: 27-29) recently suggested that Dvāravatī could be identified with the ancient city of Si Thep, partly because of its well-known acquaintance with the early cult of Viṣṇu or rather its human manifestation as Kṛṣṇa, which in Indian mythology is clearly related to the foundation of the city of Dvārakā or Dvāravatī. Whatever the case, these fresh ideas are rather challenging since Dvāravatī has often been perceived as almost exclusively a Buddhist stronghold. This supposition probably echo the assertion of the seventh century-Chinese travelling monk Yijing who recorded the fleeing of numerous Buddhists from "the country of Banan", formerly known as Funan (i.e. Zhenla?), where a "wicked king" is said to have seized power and persecuted all Buddhists during his days (Li Rongxi 2000: 13).

3. Inscriptional Evidence

It is an undeniable fact that Buddhist sculpture started to appear widely in central Thailand during *circa* the seventh century CE and that Buddhism grew powerful in the following centuries. However, was Buddhist art the fruit of a vast religious feeling? Perhaps the flourishing of Buddhist sculpture in Dvāravatī was not so much the "result" of Buddhist expansion, but one of the "means" through which Buddhism expanded, that is, a strong visual propaganda, based on powerful economic lay or

royal support, that gradually transformed the religious landscape of the region. But given the abovementioned archaeological evidence for the concomitant worship of Brahmanical gods in pre-modern Thailand, it is not too far-fetched to conceive that the elite or so-called lords or "kings" of Dvāravatī might initially have been Śiva followers, similar to their Khmer counterparts in Zhenla. At this stage, we should recall that all the above medallions are inscribed in Sanskrit, that is, as Sheldon Pollock has magnificently illustrated (2006), the language of the gods and royal elite in first-millennium South and Southeast Asia.

A unique example from central Thailand is seen in the inscribed panegyric (*praśasti*) copper plate from U Thong (K. 964). The inscription is paleographically datable to the seventh century10 and reports on the dedications of gifts to two *liṅga*s by Harṣavarman, "grandson of king [*rājan*] Īśānavarman" (Cœdès 1958: 130). The possible identity of the latter with the king of the same name ruling over Īśānapura (r. ca mid-610s-635?), that is Sambor Prei Kuk in Cambodia, is becoming increasingly accepted among scholars despite some initial doubts. The issue at stake is whether the Harṣavarman of the U Thong copper plate represents a local offspring of Khmer royalty. To be sure, we cannot exclude with Claude Jacques (1986: 84-85) that the U Thong plate had possibly been move there from elsewhere (Zhenla?), so that it may be irrelevant for local questions. Yet the evidence from ancient Thailand and Cambodia, both archaeological and epigraphic, amply demonstrates the close relationship between these local rulers and the erection and worship of Śiva *liṅga*s.11

But what about their entourage and consorts at the court? In India, local sovereigns often ruled according to Brahmanical principles while support for the Buddhist community and temples generally came from their wives and ministers as well as from the laity. The division of ritual tasks between the male and female representatives of a dynasty was thus traditional in ancient India. In general, the king was a self-declared Śaiva or Vaiṣṇava, while one of his queen (or his sister or mother) would represent the Buddhists. An early example is that of the Ikṣvāku rulers of Nāgārjunakoṇḍa, probably all Śaivas. There, it is to Cāṃtasiri, sister of King Cāṃtamūla I (r. ca 229-260 CE) that the patronage of the *mahācetiya* was due (Vogel 1929-30: 4, 16-17).

In this light, it may be significant that two additional silver medallions from Thailand are reported to refer to a similar "meritorious work of the queen of the glorious lord of Dvāravatī" (*śrīdvāravatīśvaradevīpuṇya*). Unfortunately, no context or clear provenance is given (Phuthon 2530: 23). Coincidentally, however, a seventh century Sanskrit fragmentary stone inscription found on the base of a circular pedestal at Wat Chan Thuek, Nakhon Ratchasima province, also refers to a certain *devī* of the ruler of Dvāravatī and relates closely to the installation of a Buddhist image. It was first deciphered and translated as: *sutā(ṃ) dvāravatipateḥ mūrttim*

asthāpayad devī…īn tāthāgatīm imām, "the queen of the King of Dvāravatī had the daughter installed this image of the Tathāgata (The Buddha)" (Kannika & Chirapat 1999: 390, 394). Not only would this be the first time that a reference to a certain ruler12 (and queen) of Dvāravatī is found on a stone inscription, but it would also be a rare example that an image of the Buddha is given as *mūrti*, a term widely used for the Brahmanical triad or *trimūrti* composed of Brahmā, Viṣṇu, and Śiva. Acknowledging the fragmentary nature of the inscription, however, Peter Skilling has proposed a slightly different transliteration:

Fragment A: unreadable
Fragment B: xxxxxx -*tava | sutā dvāravatīpateḥ |*
Fragment C: *mūrttim asthāpayad devī |* x-*īn tāthāgatīm imām ||*

and proposed a more cautious translation: "… daughter of the Lord of Dvāravatī … the queen set up the image … this of the Tathāgata" (2003: 97). According to this translation, the queen and the daughter would be one and the same person and not two distinct people. But Jacques, who first deciphered fragment C (K. 1009), read: *mūrttim asthāpayad devī-*[*śr*]*īn tāthāgatīm imām* and tentatively translated it as "the princess established this image of Śrī, who is a follower of the Tāthāgata" (1969: 69). Whether or not the name Śrī was intended here, Jacques argued that the image should have been commemorating a "female deity", not the Tāthāgata referred to in the inscription. But whatever the real identity of this *mūrti*, it is unlikely that the members of the Dvāravatī court regarded the worship of these religious icons as exclusively as we do today.

Other examples from the same region of Nakhon Ratchasima perhaps indicate an even more complex religious landscape at that age. The first example is drawn from a Sanskrit inscription (K. 1155) dated from the eighth century *śaka* found at Ban Phan Dung (Cha-em 2530; Estève 2009: 308ff, Appendix 4, 518-519). It begins with a salutation to Śiva and records chronologically the installation of a Harihara13 and a Viṣṇu image by a certain Śrīvatsa *circa* 718 *śaka* (796 CE) along with an offering of gifts. Later, in 747 *śaka* (825 CE), possibly the same donor established a hermitage (*āśrama*) as well as installing a "Buddha" (*sugata*) image. The second example, which should be read in conjunction with the first, is based on the nearby Mueang Sema inscription (K. 1141), dated 892 *śaka* or 970 CE (FAD 2529b: 105-117; Estève 2009: 309ff, Appendix 4, 520-523). It recalls in Sanskrit verses the degradation of the aforementioned Harihara image, previously installed there in around 718 *śaka* by the same sage Śrīvatsa and various other installations, basically keeping to the same narrative sequence as in the Ban Phan Dung inscription. These installations were as follows: first, in 747 *śaka*, a Buddha (*munīndra*, *sugata*), possibly replacing a Śiva (*śaṅkara*); replaced shortly

afterwards by a Devī installed by the Brahmin Śrī Śikharasvāmi; and finally the erection of a great Śiva *liṅga*, replacing the Devī, by a certain king in 761 *śaka* (839 CE). 14 This royal *liṅga* would eventually be reconsecrated later by Śrī Dṛḍhabhaktisiṅhavarman, a provincial governor during the time of Jayavarman V (r. ca 968-1001), along with an image of the Tathāgata, through the "eye opening" ceremony (Estève 2009: 320-322). This devout royal act, indeed, was the *raison d'être* of the Mueang Sema inscription commemorating more than two hundred years of religious activity at the site. 15 In these two related epigraphic examples (K. 1141 and K. 1155), Brahmanical gods are installed before and after a Buddha, but there is no indication that the latter was regarded as superior or inferior to the former gods. 16 It could be argued that the presence of a Sugata image here was necessary in order to cater to the needs of a Buddhist population who frequented the site. In later Vaiṣṇavism, however, the Buddha/Sugata is traditionally viewed as the last historical incarnation or "descent" (*avatāra*) of Viṣṇu from heaven to earth in human form to establish "true Dharma" (*saddharma*) and protect worshippers from "heretics" (Geo-lyong Lee 2002; Holt 2008). In doing so, the "Hindu Buddha" teaches heresy in order to delude the "demons" and destroy evil (*adharma*). If this religious atmosphere also applies to mainland Southeast Asia as it did in South Asia, 17 it follows that the worship of a Buddha image does not necessarily indicate the adherence to the Buddhist teaching and *vice versa*, the dedication of a Brahmanical image in a given shrine does not automatically entail personal devotion towards that deity.

4. Merit-Making: Who Holds the Monopoly?

In concluding this paper, I am entirely conscious of having posed more complications to the issue of religious affiliations and practices in pre-modern Southeast Asia. Indeed, the above studied artifacts and selected inscriptions from the Dvāravatī and Zhenla's spheres of influence seem to interweave doctrinal categories that have been typically compartmentalized by modern scholars as either "Buddhist" or "Brahmanical". We should be cautious, however, about imposing discrete models based on our backgrounds and expectations. To be sure, the basic religious concepts of these two common belief systems certainly coexisted in pre-modern Southeast Asia, but sharp, self-conscious distinctions in ideology were probably not adopted until a much later date. Even today, there are many examples in Thailand, Cambodia, Laos, etc. of Brahmanical images in worship in Buddhist cultural contexts and/or by people who consider themselves Buddhists and not Hindus. The early archaeological and epigraphic evidence, when confronted or studied in its own context, often speaks for itself.

In a broader sense, the evidence presented here helps to highlight the different ways in which the religious works of art were conceptualized and understood. These

inscriptions and artifacts, even in fragmentary form, surely preserve something of the manner in which sacred spaces and objects were perceived, created, and maintained in pre-modern Southeast Asia, through a certain liturgy and ideology. To relate the religious artifacts and practices therefore seems essential. A major reason for excavating or studying material remains, indeed perhaps the principal reason, is to illuminate practices to provide us with a glimpse of the mentalities and society during the period under study. Unfortunately, many of these objects and inscriptions are often deprived of their own history and original contexts, and hence their mystery and our futility. More research, more inscriptions, and more material evidence are therefore needed before our picture of first-millennium religious practices will become clearer. Further studies should work hard at restoring the religious artifacts and inscriptions under consideration – today mostly scattered in various museums or private collections – to their original contexts and study them as ritual fragments, objects of veneration and, as we have seen, products of the ideology of merit.

In this vein, it is perhaps not surprising that categories such as "merit" seem to be understood, including within the Dvāravatī and Zhenla cultures, as both ecumenical and transreligious. As Prapod states in his study of kingship and religion in mainland Southeast Asia, "the much-debated issue of whether this or that king was Brahmanical or Buddhist should be dropped" (2010: 146). In actual fact, it is likely that the various rulers and kings resorted to a balanced policy and supported both ideologies so long as these brought them merit, power, and blessings for their good deeds. However, the idea that strong economic and lay support, in addition to royal protection, was possibly behind the diffusion of this common ideology provides new avenues for interpretation of the social and cultural aspects linked to this religious development. As a result, it appears necessary to envision Dvāravatī and Zhenla anew as a transregional ritual complex, that is, a truly tolerant place for the practice of *śāsana*/*dharma* or "religion" in ancient time. Whether these practices leaned more towards Buddhism or Brahmanism cannot totally be determined, but, surely, they were not exclusive.

Acknowledgements

Notes

1 In this paper, "Dvāravatī" refers to both an archaeological typology and a historical polity vaguely located in western-central Thailand from *circa* the seventh-eighth centuries. Likewise, I use "Zhenla" merely as a temporal and areal reference to designate "Cambodia more or less within its modern borders during the 7th and 8th centuries" as Michael Vickery does (1998: 43), with some possible extensions in the southern regions of Laos and the Mun and Chi river basins of northeast Thailand (Lorrillard 2014). Of note, the name "Dvāravatī" is also found in two donative inscriptions (K. 89, K. 165) from the tenth-eleventh centuries in ancient Cambodia (Cœdès 1951: 164-169 and 1954: 132-139). K. 165 records the installation of a [Viṣṇu] Cāmpeśvara in Dvāravatī.

2 Along these lines, the recent Dvāravatī exhibition held in the Musée Guimet, Paris, was called "*aux sources du bouddhisme en Thaïlande*" (Baptiste & Zéphir 2009). See also the Fine Arts Department's catalogue entitled "Dvāravatī Art: The Early Buddhist Art of Thailand" (FAD 2552).

3 For an earlier treatment of the ideology of merit in Dvāravatī Buddhism, see Skilling 2009 and Revire 2014.

4 The primary reason Cœdès (1963: 290) used the term "medallions" lies in their ritual function since these pieces were found in foundation deposits. It is therefore unlikely that these inscribed coinages served as currency.

5 The majority of these discoveries are chance finds and their exact provenances are unknown. Many medallions now circulate in private collections (e.g. Ronachai & Mihailovs 2012: 49-50). Recently, fakes have also been noticed.

6 For a thorough study of the cultivation of merit back into the Vedic period, see Gonda 1966.

7 For the occurrences of *puṇya* in Old Khmer inscriptions, see Vickery 1998: 158-163.

8 For another *ekamukhaliṅga* from U Thong, see FAD 2552: cat. 13, 137. Lucien Fournereau also reported a *liṅga* and a huge channel or water receptacle (*somasūtra*) during his visit at the Phra Pathom Chedi in Nakhon Pathom (Hennequin 2009: 138-141, fig. 5). Recent excavations at Wat Thammasala, Nakhon Pathom, also revealed a *yonī* in situ. See also Saritphong 2556.

9 Īśānavarman means "protected by Īśāna" = Lord, here an honorific name of Śiva.

10 An incongruity surrounds the letter *ka* which shows a very short medial vertical. This shape of the *akṣara* type is often conveniently used as an indicator of so-called "post-Pallava" scripts, usually deemed later than the "seventh-eighth century". We should be cautious, however, to draw from this sole palaeographic feature any particular chronological implication since it could well just be a matter of regional variety. A few dated seventh century-inscriptions showing the same "late" pattern for the letter *ka* are known in southern Cambodia (e.g. K. 154 from Kandal province, dated 606 *śaka* = 684 CE; Cœdès 1942: 123-125).

11 One cannot help thinking of Citrasena-Mahendravarman (ca 550-611?) who is recorded in the inscriptions to have erected Śiva *liṅga*s and the bull as the symbol of his conquest over the entire territory (Chirapat 2010: 45-46). See also Lorrillard 2014: 197-198 for an up-to-date account of the epigraphic record of this prince/king discovered in Thailand, Laos, and Cambodia.

12 Verse composition often influence choice of words, hence the Sanskrit title *pati* found here would likely equal *īśvara*. But could this ruler (*pati*) of Dvāravatī actually be a son or a vassal of an overlord (*īśvara*) of the same realm? One Lop Buri inscription (K. 577) refers to a certain *adhipati* Ārjava of the Taṅgur people, son of the *īśvara* of Śāmbūka, presumably in central Thailand. Brown (1996: 64, 112-113) had speculated with good reason that these various regional polities were probably related through intermarriage, family ties, or vassalage.

13 This is the first time that Harihara is mentioned in the corpus of inscriptions from Thailand. Paul Lavy (2003) has argued that, during the seventh and eighth centuries, efforts to consolidate political authority by Khmer rulers led to the deployment of this composite deity in neighbouring Cambodia, although this hypothesis has been contested by

Julia Estève (2009: 256-257, 291-295).

14 The identity of this local king is not known, but, in Angkor, Jayavarman III ruled at that time (ca 835-877).

15 Estève (2009: 319, 325-326) conjectures, with good reason, that the two inscriptions should refer to one and the same "holy site" named Damraṅ in the Khmer portion of the Mueang Sema inscription (l. 13).

16 For more on the question of the so-called religious "synthesis" or "syncretism" between Brahmanism and Buddhism in ancient Cambodia, see Kamaleswar Bhattacharya 1961: 29-30, 32, 34-39; for a recent reassessment of the notion, see Estève 2009.

17 In India, the Buddhāvatāra appears first in the *Viṣṇupurāṇa* where it is already established in full detail. It is also mentioned in a seventh-century Pallava inscription as well as on an eighth-century Tamil inscription (Doniger 1976: 187-189).

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MAKARA IN TEMPLES OF OLD CLASSICAL ERA OF INDONESIA

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1. INTRODUCTION

Candi or temple is derived from the word *Candika*, which is one of Durga incarnations. In Indonesia, the term *'candi'* is known as an ancient building from Hindu-Buddha period. *Makara*, in the form of two dimensional *(relief)* or three dimensional full figured is one of the ornaments on Hindu-Buddha temples. *Makara* is found in various places in Southeast Asia which got influenced by Hindu-Buddha and Indian culture. In Indonesia, the period in which Hindu-Buddha and Indian culture had been developed is named as the Classic period. It is called the Classic period due to the result of culture in that period which is still known and be a reference for a society development nowadays. One area that has many archaeological heritages from Hindu-Buddha or the Classic period is Java. Based on archaeological evidences, such as inscription and temple, the Classic period in Java occurred around the eight to fifteenth B.C. The Classic period was then divided into two, which are Old Classic (8th – 10th B.C.) and Young Classic (11th – 15th B.C.). The Old Classic period developed in Central of Java simultaneously with the development of The Ancient Mataram kingdom (Munandar 2011: 2). According to Soekmono, temple in Java has two *langgam* which are Central Java and East Java. One of the figureistics of *langgam* in Central Java is *Kala-Makara 1* ornament. Similarly, *langgam* East Java also has *Kala* ornament but the ornament of *Makara* is replaced using another figure (Soekmono 1997:86). Therefore, the scope of this research is *Makara* on temples in the Old Classic period which located in the Central of Java, whether on Hindu or Buddha temples.

The enshrinement of Hindu-Buddha in the period of Old Classic, *makara* was usually carved on (a) the tip of banister (b) the tip frame of the *Kala-Makara* entrance (c) the tip of *Kala-Makara* frame on *relung (parswadewata)* (d) as *jaladwara* (fountain). The complete meanings are found in the tip of banister which is in the shape of three dimensional. Furthermore, it would be analyzed to get the components of the depiction of *makara*.

In Sansekerta, the term '*makara*' means a sea dragon or a sea giant creature (Monier-Williams 2008: 805). In the early Indian arts, *makara* or *ikan gajah* (*gajamania*) is a mythical creature which was evolved from an animal resembles a crocodile (Fontein 1990: 235). The shape of *Makara* is keep developing into a more complex form, which is a combination of six or seven animals, such as elephant's trunk, crocodile's jaws, rats' or apes' ears, wild pig's fangs, peacock's tail feathers, and lion's feet (Clough, B 1997: 163). Although *makara* is often found in various areas which have interfered with Indian culture, it still has different arts style. The uniqueness and

fineness of ancient Java carver is obviously different with *Makara* in India and other places in Southeast Asia which have influenced by Indian culture also.

2. METHOD

This research uses literature study before doing the observation of *Makara* in the location. In this case, the primary data used in this research is *Makara* on temples in the North and South of Central Java which still have *Makara* on its tip of banister, while the secondary data is gained from literature data, such as pictures from books and related institutions.

Furthermore, this research uses descriptive-comparative methods. *Makara* on those temples is described and compared to one another. Moreover, the similarities and differences are recorded, then being analyzed before coming into the conclusion.

3. DISCUSSION

Object of this research is *Makara* on twenty three temples in the North and South areas of Central Java. Those *makara* are placed in the lower tip of banister in the shape of three dimensional full figured. On the upper tip of banister, there is *Kala* with an opened mouth. *Kala* and *Makara* in the lower side are connected with curved lines. Viewing from its side, the curved lines seem like a dangled tongue of *Kala*. The ornament of *makara* cannot be separated from *Kala*. The ornament of Kala-*Makara* in the tip of banister symbolizes rainbow, a bridge to the god's world. In Hindu tradition, it symbolizes the relationship between human and the gods. (Tjandrasasmita 1975: 41). The placement of Kala-*Makara* in *relung* arca is a protector of purity sign which has a superstitious power (Bosch 1931: 473-494). Meanwhile, water from *jaladwara makara* is believed has ability to purify sins2.

In Indonesia, the ornament of *makara* is not only found in the enshrinement. However, it is also found in gold jewelleries which shaped like a dolfijn, a kind of dolphin. In addition, the ornament of *makara* also found in the gold genitals covers (*badong*) in the shape of fish-elephant (*gajamina*). A bronze light in the shape of *makara*, which is a fish that has elephant's trunk which shapes like a tendril (Van der Hoop 1949: 162-165).

The depiction of *makara* on Hindu-Budha temples in the Old Classic period, especially the tip of banister, is more than a combination of fish and elephant shapes. Moreover, that *makara* is shaped by a combination of land, water, and air animals. The following discussion would explain on the components of *makara* in the

banister.

On Hindu-Budha temples, *makara* on banister is represented with a wide opened mouth. The upper lip is thicker than the lower. At first, the wide opened mouth is considered as a mouth shape or elephant's jaws. However, a further observation indicated that it seems more likely to hippopotamus' mouth due to the lower and upper lip that have the similar length and width. Meanwhile in the elephant, the lower lip is shorter. The shape of elephant's mouth is found on Sumatran *makara*. Then *makara*s on the Old Classic temples in Central Java looks more likely to hippopotamus' mouth.

Although hippopotamus is not a mythical animal, it was highly populated in Java. Fossil of hippopotamus is mainly found in Bengawan Solo, Central Java. Leptobos (ancient ox) ancient elephant, hippopotamus, epimachairodus, (a kind of tiger) found in Jetis and Trinil, is called fauna "siva malaya" because it shows similarities with sivalic fauna in India. These fauna came to Indonesia through the west. This Hippopotamus had similarities with Hipopotamus Namadicus and Hipopotamus Palaeoindicus of India. This fauna were found at Ngandong site, near Solo river (Soejono 2008: 63)

Besides that, hippopotamus is a kind of water horse, which is one of wild dreaded animals in water. Probably, the ancient Java carver took the shape of hippopotamus' mouth as a wild animal in water to represent the mouth of *makara* which is ready to grip or bite until helpless and die for whoever disturbs the purity of temple.

There is a depiction of elephant's trunk which is an extension of *makara*'s upper lip. The tip of trunk shapes *ukel*. The direction of *ukel* is varied. There is *ukel* which side on the outer, inner, front, and back. *Ukel* in the elephant's trunk is depicted holding *padma* which has a stem of stamens. The tip of stamens is sometimes depicted with or without flowers. In the top of trunk, there is an addition of tendril depiction and or *padma*.

In addition, the depiction of elephant's trunk is sometimes replaced by a head of snake and or a head of lion with curved horns. The figure of snake is depicted with an opened mouth showing the upper and lower teeth. The shape of the snakes is also varied, with or without *padma*. In the mouth of snakes and the head of lion, there is *padma* with stamens which dangle with a flower in the edge or flower with stamens only.

It also can see the depiction of tongue and series of upper and lower teeth3, which are the front teeth, molars, and fangs. The shape of tongue looks like an elephant's tongue. Fangs is at the hip of tongue and at the tip of upper teeth. Fangs at the hip of tongue is shorter than others at the tip of upper teeth, and its shape seems like lion fangs. Meanwhile, fangs at the tip of upper teeth are sharp-pointed, like the shape of a boar. Sukowati Susetyo named these fangs as horns (Susetyo 2014: 4). The shape of front teeth and molars in *makara* seems similar with the teeth of elephant. However, *makara* in Siva, Wisnu, and Brahma Prambanan temples depicts sharp-pointed series of upper and lower teeth.

On the palate of *makara*, there are horizontal lines which represent scales of a snake. However, those horizontal lines might be seen as a real depiction of a hippopotamus' palate. On the mouth of *makara*, there are different figures, which are lion, crested cockatoo, owl, human, *padma*, and human with four snakes. Those figures are placed over the tongue, especially *padma* which is not placed over the tongue. This figure is a tip lower part of

stamen which dangles deep in the mouth of *makara* (main temple *Lumbung*). For the human with four snakes is only found in Gana temple.

In general, the eyes of *makara* are portrayed slanted with a variety of visible or invisible eyeball. The shape of *makara*'s eyes looks like the eyes of elephant. From the eyes of *makara*, there is a curved horn with a sharp-edged. The horn seems like the horns of tup. The horn of tup seems clear in Borobudur's and Wisnu Prambanan's temples. The brow of *makara* is depicted vague or often united with the tendril which located in the back of *makara*. The shape of ears looks like ears of a deer that shaped like a tendril. The earlobe is mainly pointing upward. It is only in Arjuna Dieng's temple that the earlobe is downward.

There is a gill behind ears and horns. Fish tail is portrayed like a tendril. There is a depiction of tendril like a robe in the back of *makara* which represents peacock's feathers. On Mendut' and Ngawen's temples, the tendril in the back of *makara* is portrayed inside a round shape which placed above the eyes. This shape is probably a tendril that is intended to be rolled in order to have a round shape. The depiction of eyes, brows, and tendril in the back of *makara* seem like a peacock that does not flapping. The shape of peacock seems clear on the *makara* of Merak's temple. As for the temples that have the depiction of *makara* as what has been discussed above, can be seen in Tabel 2. The component of *makara* banister on Old Classic temple.

4. CONSLUSION

As a mythical creature, the shape of this *Makara* is a combination of nine animals that live in land and water, which are elephant, fish, hippopotamus, snakes, lion, tup, boar, deer, and peacock. The figure of elephant is found in molars, tongue, eyes, and trunk. The figure of fish is represented by a tail that is shaped like a tendril and gill. The figure of hippopotamus is found on the mouth shape. The figure of snakes is represented with horizontal lines in the upper jaws, or can be in a form of head snakes which replace the elephant. Lion is also represented by replacing the elephant's trunk or can be placed in the mouth of *Makara*. The figure of tup is only placed in the depiction of horns which comes out from the eyes. The figure of boar is found on the fangs in the upper teeth, while the figure of deer is represented with ears that almost shaped like tendril. Last, the figure of peacock is found in the back of *Makara*.

The back of *Makara* which shapes like a peacock along with its feathers which is not flapping is united with the depiction of brow and eyes of *makara*. In addition, there are figures of cockatoo and owl. However, those figures are only placed in the mouth of *Makara*. Another characteristic of *makara* on banister in Central Java temples is *padma*. The *padma* has a stem that come out of the elephant's trunk or the mouth of snakes and lions. In addition, the *padma* excretes stamens that dangle and has flower at the edge.

Makara as well as Kala which functioned as a building guard and a danger barricade, is also related with water as a sin purifier, fertility, and prosperity4. Animals that appear on *Makara* have certain meanings. In the period before the entrance of Hindu Budha in Indonesia, human depiction was not only functioned as fineness but also had a sacred power as a danger barricade (Van der Hoop 1949: 92-93). Besides human

figure, another thing that was depicted in the mouth of *Makara* is animal, such as lion. However, lion never lives in Indonesia. The ornament of lion appeared simultaneously with the entrance of Indian culture. Lion is believed as a temple guard which can be meant as a danger barricade (op. cit, pages. 150-155). In terms of implying meanings, animals might be related with the gods, such as elephant with Ganesa, lion with Durga, snakes with Siva, fish with Wishnu, and peacock with Kartikeya. In addition, it needs further research to reveal all these meanings.

Notes

1 Ornament of Kala-Makara is framing the entrance of the temple and also deity statue niches. Kala is placed on top, and symbolizing the sun and light. Makara is placed at the bottom, associated with darkness and water (Fontein 1990: 235).

2 The water of the Gangga river is believed to cleanse the sins. It is because makara is live in it, and makara is also used as vehicle of gangga goddes.

3 There is also makara that are not represented by a row of lower teeth as found in Pawon and Lumbung temple. At the lumbung temple , the mandibular canines are only located near the base of the tongue.
4 In India, Lakshmi statue depicted seated on padmasana, holding half elephant trunk and half fish.

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Makara in Sojiwan temple. Canine at the end of the upper teeth are shaped like male wild boar tusks.
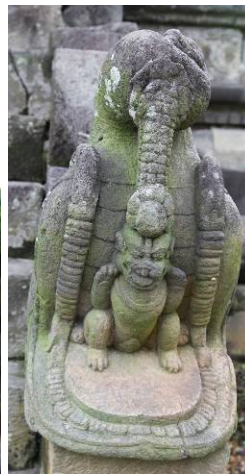
The shape of the hipopotamus and the state of his palate. The Palate of makara looklike horizontal stripes resembling Cobra scales.

Elephant molar teeth.   Stegodons fosil.   Mouth and tongue of elephant.   Makara from Soloksipin
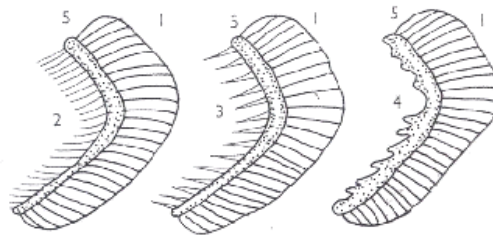
Sheep   Makara of Borobudur temple, Horns like a ram's horn.

Deer, makara of Borobudur temple and dukuh temple. Ear, resemble deer's ear, stylized as ropes.

Makara of sojiwan temple, fsih gills

Peacock, makara in merak temple and siva prambanan temple. The body of merak temple located at the

Back of makara,

t

Makara candi Ngawen. Suluran di punggung makara (di atas mata) digulung menjadi bentuk lingkaran.
Makara of temple. Ropes at the back makara (above the eyes) rolled into a circular shape.

A Research on the Forts during the Europeans Period especially in North Sri Lanka

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Abstract: This research attempts to have a purpose to investigate about the forts during the Europeans period, historical background of their construction, heritage, importance, archaeological and architectural value and the advantages of forts in tourism.

According to the current administrative structure, north Sri Lanka is indicated as north province in Sri Lanka. This area, which has a very long historical tradition, contains eight forts as the result of European domination for four centuries. These eight forts consist various unique features. Archaeological evidences are obvious to carry the history of this area in backward trend.

Presently the particular research area is traveling towards the development from the condition of destruction due to the thirty years civil war. As the result of this civil conflict and as used as the residence of military force, the forts situated in the central parts are still remaining with major destructions. Also the archaeological activities were not carried out since 2010, so that the forts are being destroyed by natural disasters. Thus there is a need for a discussion regarding the security planning and reconstruction.

Tourism contributes much in the development of Sri Lanka as well as the developing countries. It is necessary to protect the traditional monuments to expand tourism in developing the research area. Also it is portrayed through this research how the tourism can be improved, by reconstructing the forts in the traditional monumental area.

As the result of this research the uniqueness of the Europeans forts in Sri Lanka, historical tradition according to the present archaeological research conclusions, necessity of reconstruction, and necessary activities to expand tourism are expressed obviously.

Keywords: Fort, Heritage, Tourism, Archaeology

Regional Communication Networks

Surat Lertlum[1] and Khien Chan[2]

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Abstract: This presentation will be centered on the cross-border multi-disciplinary research on ancient roads that aimed, firstly, to identify all the remaining portions of ancient roads radiating from the Angkor capital to different provinces of the ancient Khmer Empire.

Then, we will explore ancient roads and paths in the region including the ancient roads and trails connecting ancient cities as well as roads within cities. These studies contributed physical evidence illustrate linkage of cultures through a complex range of different types of communications systems. The identification from ground survey and analysis of various ancient roads in the region suggested the following classification of roads:

1. Ancient roads linking ancient cities
2. Ancient roads within city limits
3. Ancient road links between strategic places and the main water ways.

From our study, the topography and environment along the ancient road influenced the building of roads, particularly the slope of the area and the water resource. There are some areas for example, in which the roads are raised ridges. In some areas, the topography was not favorable to the construction of raised ridges.

At the same time, agriculture expansion has caused the loss of many ancient roads especially in Thailand and increasingly in neighboring regions. Therefore, it is important to study the characteristics of the ancient road in areas where it still exists to extrapolate to areas where the ancient road has been lost.

Keywords: ancient road, royal roads from Angkor , ancient communication

Eagle-wood and Jar: Reconstructing upland and lowland exchange network in Central Vietnam

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Abstract: This is a paper of a work on progress. The paper is based on the joined research with a Vietnamese art historian, an archaeologist, an ethnologist and a Japanese anthropologist to trace back the ancient system of lowland and upland exchange network. The Central Vietnam is known as a region where a maritime kingdom called Champa existed. Champa became prosperous for providing relay ports from Southeast Asia to Indian Sub-Continental and China and provided luxury forest export items such as eagle woods, cinnamon, ivory, rhinoceros horn, so on. Most of the export items that Champa offered came from the central highlands where various ethnic minority peoples were living.

By applying the idea of Bennett Bronson's riverine exchange network, the paper attempts to detail the lowland-upland exchange system existing in the central Vietnam. It also explains the findings of the Champa's historical vestige along the exchange network and argues that the existing lowland-upland exchange system in the Central Vietnam is based on the ancient Champa's lowland-upland exchange network. These exchange networks extended to those of Northeast Cambodia and Southern Laos as well.

The paper also explains relationship and economic dependency between majority Kinh (Vietnamese speakers) and ethnic minority people living in the central highlands although it is commonly perceived that the majority and the ethnic minority people who live in different localities do not interact with each other. The research has been as a contribution into the Cultural Relationship in Mainland Southeast Asia Project (CRMA).

Keywords: Riverine exchange network, Lowland-upland exchange, Central highlands of Vietnam, Ethnic minority people, Champa

A Research on Ancient Passengers Residences and (along with) Monuments

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Abstract: This research paper deals with the passengers residences along with buildings and monuments located near the ancient trade routes which were found out in Jaffna peninsula.

Jaffna peninsula consists a long historical tradition. As the result of the present archaeological researches the history, which was founded in the palm leaf manuscripts has gone back many centuries. The location of the area, geographical condition, natural harbours, and density of trade things are the causes of effective local and foreign trade. Particularly, the archaeological monuments express the trade with India, China, Rome, Greek and South Asian countries.

In order to expand the trade, and for the convenience of traders, such as staying safely along the trade routes, looking after their cattle which were supportive to their journey, 'madangal', 'sumaithaangihal', 'Aavuranjihal', and keanihal have been built. Most of these monuments are being destructed due to the poor maintenance, civil conflict, non-awareness of citizens, government and non government organizations.

As the result of this research, Jaffna peninsula was being an important trade center for many centuries, and effective technological ability of the citizens in Jaffna are brought out obviously. Also it is necessary to create an awareness among the civilians, government and non government organizations to protect these monuments from destruction by implementing security arrangements and reconstruction. It is able to understand the expansion of trades while doing the research in these centers.

Keywords: Jaffna, Monument, Ancient, Trade

Ancient sites in Myanmar from the Williams-Hunt Collection

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Abstract: The presentation summarizes the history and development of the World War II archive of aerial photographs named in honour of Peter Williams-Hunt. The collection, housed at SOAS, was digitized and put online with a further phase of development focusing on the ancient sites in Myanmar seen on the photographs underway with an updated online provision by the authors.

Keywords: ANGIS, Aerial photographs, World War II, ancient sites, Myanmar

1. Introduction: background

The collection had completed by Peter Williams-Hunt, an aerial photographic interpreter, who gathered them during and after the World War II. After his death in Malaysia in the early 1950's, Williams-Hunt's pictures were sent to his colleague John Bradford and housed at the Pitt Rivers. The Pitt Rivers agreed for the photos to be transferred to the University of London, where thanks to encouragement from Prof. Ralph Smith, then Chair of the Centre for South East Asia (SOAS CSEAS) grants from the South East Asia Committee of the British Academy, the collection was digitized to produce a set of full-size negatives. After that, a database inventory had prepared by E. Moore in 1982 as part of her doctoral research at University College London (UCL, Institute of Archaeology) and the inventory and copies of the prints were acquired by the Royal Angkor Foundation (Budapest), the Center of Southeast Asia Studies (Kyoto University), the National Archives of Malaysia, the Singapore National Archives, the National Archives of Thailand, and some donated by E. Moore to the National Archives of Myanmar.

During his brief lifetime (1919-1953), Williams-Hunt made significant contributions to our understanding of how aerial photography can help interpret manmade alterations to the ancient and recent cultural landscapes of Southeast Asia. His analysis of the varied patterns of ancient water management in Northeast Thailand, for example, showed the antiquity of human interaction with the environment and his work on the changing patterns of Orang Asli settlement in peninsular Malaysia showed the need to map on-going change in human settlement(Moore 2009).

The collection consists of *circa* 5,000 aerial photographs of Angkor, Cambodia (128 photos), Singapore (240 photos), Malaysia (2,632 photos), Thailand (1,671 photos), Myanmar (821 photos) and miscellaneous areas of 'Indo-China' (312 photos). The locations of the photographs were tabulated from information and flight plans recorded by Williams-Hunt and supplemented by research in the Public Records Office, United Kingdom connecting the flight paths and dates with accounts in the Operation Records Books held in the National Archives,

Kew, Richmond (Public Records Office 1992:3). This is the sole collection of aerial photos of the mainland Southeast Asia in the period from 1940s to 1950s. With the increasing urbanisation and development of Southeast Asia, the photographs have become an increasingly rare record of the region before post-World War II expansion. The Collaborative Project aims to update the 1982 inventory.

Figure 1 Oblique image of Ayutthaya, Thailand taken in 1946

2. Online provision and digitization phase

The majority of the photographs were put online following their digitizing and scanning through the Map Room of the Center of Southeast Asia Studies (Kyoto University), thanks to the oversight offered by Surat Lertlum during periods of research at the Center of Southeast Asia Studies (Kyoto University). These were made available through the 'Geo-Spatial Digital Arhvie for Southeast Asia' (http://gdap.crma.ac.th [currently under repair]). This phase was a collaborative effort between E.Moore (SOAS), Surat Lertlum (CRMA), the Center for Southeast Asian Studies, Kyoto University (Kyoto CSEAS) and the Inter-University Netowrk of

Thailand (UniNet).

This resource was developed by Surat Lerlum, Prachya Chalermwat, Supachai Srihom, Pisan Benjarat and Sarawut Ninsawat as a demonstration system of online geo-spatial data in a service that the user was able to search and access the data through various methods: text search, geo-location search and meta-data search (Lertlum et.al.2014). The Data Flow Diagram and GDAP Search engine illustrations below give examples of the structure that underlay the online site.
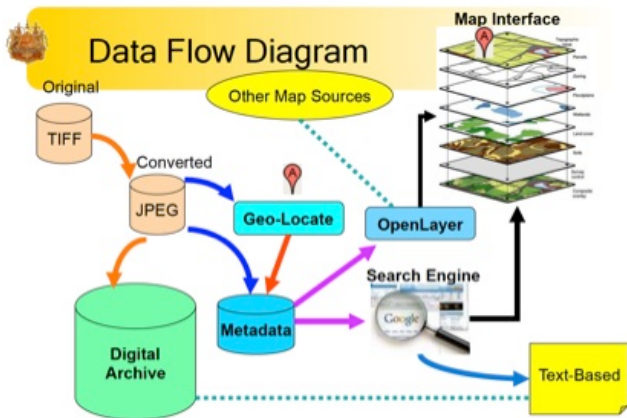

Figure 2 GDAP Data Flow (Lertlum et al, 2014)
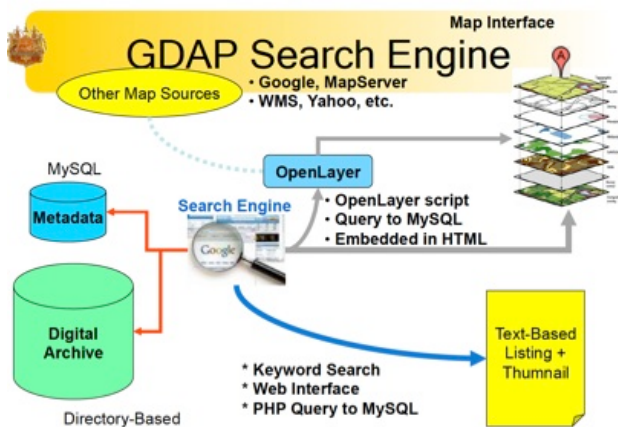
Figure 3 GDAP Search Engine (Lertlum et al 2014)

Figure 4 GDAP Web page showing Ayutthaya (Lertlum et al 2014)

The application of the data was useable for any studies that can utilize these data sets (Letlum et. al. 2014.). The GDAP was a far-seeing development to make available data as an online digital archive for public research. The site is now under repair following hacking in 2013 but researchers used the online resource for a decade to carry out urban studies and land use and land cover change, historical and archaeological studies.

3. Current development Myanmar ancient sites

The project aims to develop more documentation in text and image and accessibility in printed and online formats of the Williams-Hunt Collection of aerial photographs of Southeast Asian countries dated to 1942-1953. This phase of the Williams-Hunt Collection is through the International Program for Collaborative Resaerch (IPCR), Kyoto CSEAS. The members are Prof. Elizabeth Moore of SOAS, Prof. Shibayama Mamoru, Associate Prof. Kobayashi Satoru, Mr. Hasegawa Hiroshi of Kyoto Unviersity, and Dr. Surat Lertlum, Chulachomklao Military Academy (CRMA), Bangkok, Thailand.

Kyoto CSEAS has begun preparation of updating the online resource database to include enhanced search methods and to input thematic layers within the main database, as done by Surat Lertlum for the Thailand-Cambodia 'Living Angkor Road' Project. The updated online page will include SOAS CSEAS, Kyoto CSEAS and CRMA and other additional collaborative parties to be determined.

Hiroshi Hasegawa is in the process of producing 3-dimensional image map representations in 3D-CAD, with a sample provisional project of Dawe (Tavoy) in Lower Myanmar see in the illustration below. The mapping includes photogrammetric 3-D image modeling.
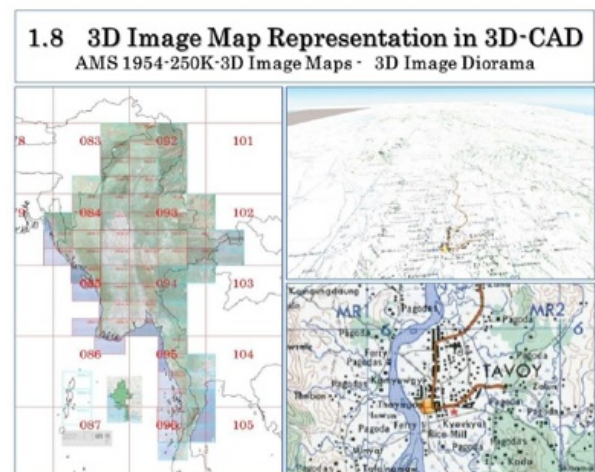

Figure 5 Sample 3-D image representation of Dawei (Tavoy)

402: Photogrammetric 3D Image Modeling
Myanmar; Dawei Projects
Dawei-airport-mosaic-map

Figure 6 Sample 3-D image of Dawei (Tavoy) airport

The aerial photographs have intrinsic value for the archaeological information and also as a data layer available to researchers in a range of fields including urban development and agricultural expansion in the areas covered by the collection over the last seventy years since they were taken. This can be seen in the three illustrations of Ancient Sites in Myanmar from the Williams-Hunt Collection compared to recent imagery below.

Shwebo 22° 34'7.33", 95° 41'46.09"
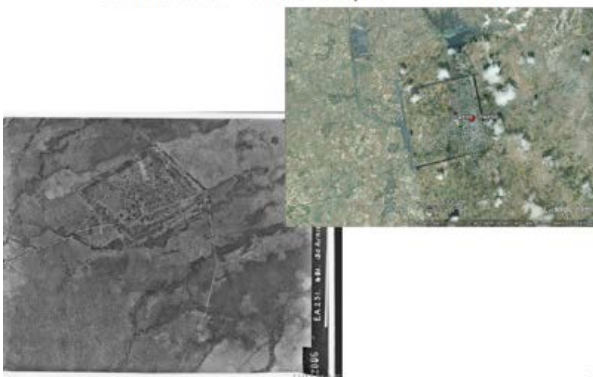
Figure 7 Ancient Myanmar capital of Shwebo seen on Williams-Hunt Collection and Google Earth

Pakokku
21° 19'57.88"
N, 95°
5'0.76"E

Figure 8 Ancient City of Pakokku seen on Williams-Hunt Collection and Google Earth
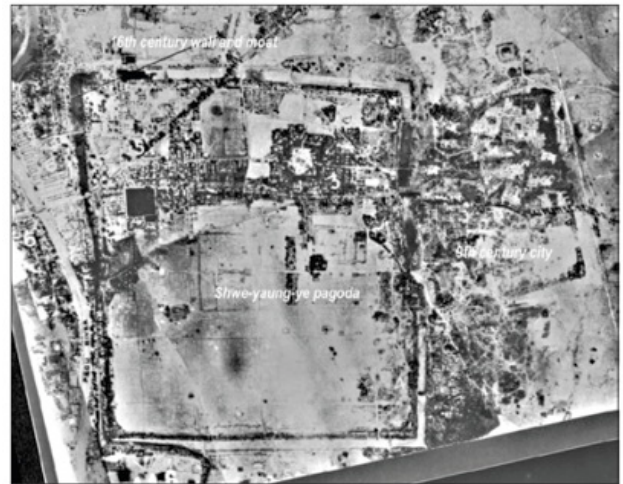

Figure 9 Ancient City of Bago (Pegu, Hanthawaddy) in 1942 with clear visibility of palace site, geo-referenced courtesy Surat Lertlum (Moore 2013, Fig.2)

Figure 10 Ancient City of Bago in 2002, IKONOS image courtesy Surat Lertlum (Moore 2013, Fig. 3)

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Surat Lertlum et. al. 2014. Geo-Spatial Digital Archive Project (GDAP)

Khao Khlang Nok Stupa: Construction Concepts and Comparative Study in Southeast Asia

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Abstract: The archaeological works at Khao Khlang Nok stupa have revealed that the great Buddhist stupa of Si Thep is fairly complete in terms of its architecture. It does not stand alone but is surrounded by satellite stupas in four directions. This results in making it a monastery with unique plan and different from other monasteries in Dvāravatī culture. This disparity raises a question about concept on the construction of this stupa since no similar plan can be found in other archaeological sites in Thailand. Therefore, the comparative study with other archaeological sites in Southeast Asia could be one way to answer this question. Also, it is reasonable to extend the period of study out of the contemporary Dvāravatī culture since the concepts may have occurred prior to the culture or inherited in the later periods. The observations from the study show that Khao Khlang Nok stupa may have been built under the concept of "mandala", the important Mahayana Buddhist doctrine. This is because its plan is similar to several other monasteries that were built under this concept in Southeast Asia. Furthermore, the observations are in line with the prosperity of Mahayana Buddhist in Si Thep area at 8 – 9 century. More importantly, it is found that the monastery has been renovated to reflect the direction of the sacred Mountain which is a concept that is widely found in Southeast Asia.

New archaeological finds in Southern Laos: Considering on the significant cultural interactions and overland trading route between the ancient kingdoms in Northeast Cambodia, Southern Laos and Central Vietnam

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Abstract: The paper deals with the new archaeological findings in the southernmost provinces of Champasak, Salavan, Sekong and Attapue in Laos PDR those are bordering with Cambodia and Vietnam. The artifacts including sculptural and architectural features dated from the 7th to the 11th century. These new findings being good evidences to learn about the links between Khmer Empire in the West and Champa in the East in which several ancient states in Southern Laos played an important role as middlemen on the overland trading routes and cultural exchanges among the kingdoms in the region

Keywords: Archaeology in Southern Laos; Khmer and Champa cultural interactions.

Archaeology, scales and spaces:
Recent developments in the cartography of Angkor

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Abstract: Since the first western explorers in the mid-nineteen century, mapping Angkor has been an important tool for revealing the archaeology of the successive medieval capitals of the Khmer Empire. Since the early introduction of aerial reconnaissance in the Twenties, it evolved with the development of techniques, but also with the enlargement of the vision and a deeper historical understanding of Angkor. This close association between the historical interpretation and its physical mapping has been a key factor to understand the historiography of the Khmer capitals.

For the last two decades, a fundamental reappraisal of its urbanism has been operated, facilitated by the development of new geo-spatial facilities and new technologies (radar, LiDAR etc…). Previously mostly – if not only - oriented into the study of that civilization monumental remains, the recent researches enlarged the scope analysis beyond the great temples and started to integrate non-monumental vestiges into a broader landscape archaeology. The presentation will show different steps of that recent evolution which has now shaped a new vision of Angkor and its urban history.

Keywords: GIS, remote sensing, mapping, LiDAR, urbanism, hydraulics, Angkor, Cambodia

The 9th Century A.D. Shipwreck found in Samut Sakhon Province, Central Thailand

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Abstract: In September 2013, archaeologists of the 1st Regional Office of Fine Arts Department, Ratchaburi got reported by the Subdistrict Administration Organization of Phan Thai Norasing in Samut Sakhon that Mr. Surin and Mrs. Phanom Sri-ngamdee, the land owners of shrimp farm, discovered a keelson of shipwreck first as well as other infrastructures and many ceramic sherds still buried several meters deep under the muddy ground in a shrimp farm. The location of shipwreck is located onshore in central Thailand and far from current coastline around 8 kilometers. According to the previous researches assumed the area has been found this shipwreck was the former shallow of the Gulf of Thailand.

The rescue excavation has immediately begun in cooperation between the 1st Regional Office of Fine Arts Department, Ratchaburi and the Underwater Archaeology Division of Fine Arts Department, the excavation is ongoing so far. The progress of excavation has been found almost complete condition of wooden ship structure including many ceramic sherds, a part of basketwork attached on a ceramic, dammar, a possible round grinding stone, rattans ropes, fiber ropes, rice grains, betel nuts, coconut shells with a small hole, fishbones, ivory, and other horns.

The ship was built by a 17.65 meters long rectangular keelson and the bottom of keelson through many holes as mortise and tenon joints with the frames but the keel was not found yet. The bow possibly faced to the south and the ship collapsed to the larboard that only its starboard was above the ground. The hull planks were enforced and stitched with fiber ropes and every drill-hole was probably sealed using putty of dammar that found the evidence in a torpedo stoneware shape-like jar. Two round masts were collapsed and laid on the larboard, which one of them was 17.37 meters high. This ship building is similar to the Arab-style of Belitung shipwreck sunk near the Indonesian island of Belitung. Hence, the Phanom Surin shipwreck assumed to be Arab-style of ship as well.

The ceramic sherds were found in a large number more than other evidence and were full of variety came from several origins.

The first type is the carinated earthenware pots with cord marked or incised designs related to the ceramics commonly found in a large number on the Dvaravati sites in central Thailand including some parts of northeastern Thailand during the 5th to 10th centuries A.D.

The second type is a lower portion of torpedo stoneware shape-like jars that the archaeologists believed they were possibly from India or the Middle East as well as inside of them was also contained the dammar that stuck on their interior wall. However, this type of jar is still unclear identification because they are similar to the amphoras producing somewhere in the Greek or Egypt and usually found in the shipwrecks on the maritime trade routes in the Mediterranean Sea.

The last type is Chinese Tang ceramic sherds that they were produced from two kilns at least, specifically the Guanchong kilns in Xinhui kiln group, Jiangmen, Guangdong and the Fengkai kilns, Zhaoqing, Guangdong. The Guanchong celadon jars with four to six ring handles partially glazed only on upper part and were a flat unglazed base as well as some of them were inscribed only a Chinese alphabet "吉" (Ji) onto its shoulder that was possibly a part of the word "大吉" (Daji) as it meant "lucky", which approximately dated to the first half of 9th century A.D. A Fengkai unglazed jar with six ring handles still stringed together the original fiber robes in all handles and its clay body was brown as well as this jar also approximately dated to the first half of 9th century A.D.

By the evidence especially the AMS dating and the dating of ceramics, this shipwreck dated around the first half of 9th century A.D. as well as all its assemblages were possibly the foodstuffs and consumer goods for sailors to survive. However, this shipwreck is ongoing excavation and do not conclude in a number of its assemblages as well as the archaeologists cannot know what shall be cargo this ship carried in the past. The shipwreck assemblages also show that this ship has a sailing area between India or the Middle East, Southeast Asia, and southern region of China. This ship is regarded as the earliest ship in Thailand, shedding light on the maritime trade network between countries near along Arab Sea, the Indian Ocean, and the China Sea, with Southeast Asia as a major link.

Keywords: Shipwreck, Samut Sakhon, Amphora, Tang Dynasty, Arab-style ship.

Recent maritime archaeological reseach at Van Don

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Abstract: To promote trade, King Ly Anh Tong found Van Don trading port in 1149 C.E. Being found in twelfth century and actually disappeared in nineteenth century, Van Don becomes one of the oldest and longest-last trading port in maritime trading history of Vietnam. Furthermore, the Kublai Khan's invasion fleet was defeated at Van Don in 1288 AD. Previously very little archaeological research has been conducted to locate the actual port of Van Don, to understand more about the scale, structure and development of it as well as to reconstruct the naval battle. For initially bridging this gap, Van Don investigation team from Murdoch University, Monash University, the Institute of Nautical Archaeology at Texas A & M University, and the Institute of Archaeology (IA) have conducted fieldwork over four seasons between 2011-2014 at the site. Over this period, the research team has conducted preliminary investigations of available historical sources, maps, charts and aerial photographs and documentation of intangible cultural heritage. The waters off Van Don also have been being studied by using remote sensing survey and SCUBA diving. The internationally collaborative project intends to investigate the maritime cultural landscape, archaeological evidence and intangible cultural heritage encompassing the topography, archaeological evidence, temples, cultural monuments and intangible cultural heritage associated with the port and battlefield. The scheme of the project includes public awareness raising on maritime and underwater cultural heritage in Vietnam.

Keywords: Van Don, trading port, naval battle, maritime archaeology.

Historical sites in Lower Myanmar: World War II and today

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Abstract: The presentation summarizes the history and development of selected key towns in Lower Myanmar. The development of the towns and thus the preservation of historical aspects is considered through comparing their appearance on the Williams-Hunt. World War II archive of aerial photographs. In addition, the study highlights the key role played by Lower Myanmar in World War II.

Keywords: ANGIS, Aerial photographs, World War II, ancient sites, Lower Myanmar, Thaton, Ye, Dawei, Myeik

1. Introduction and Mon State Geography

The Williams-Hunt World War II aerial photograph collection includes some images taken over key towns in Lower Myanmar. This paper compares selected images of four of these towns – Thaton and Ye in Mon State and Dawei and Myeik in Tanintharyi Division - to illustrate the changes to town in this lesser-known southern region of Myanmar. As explained, below, there has been more natural landscape change in the Mon State than in Tanintharyi, principally affecting the proximity of Mon State towns such as Thaton to the coastline. In contrast, the topography and shoreline of Dawei has been relatively stable over time. This contrast was also apparent in the greater damage to the Mon State shoreline than to for example Dawei in the 2004 Tsunami on the map below.
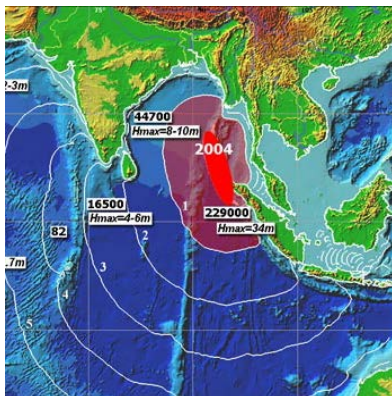

Figure 1 Areas affected by 2004 Tsunami
(http://tsun.sscc.ru/PIC/TTT/TTT_2004.jpg)

The author, a historian, was born in Dawei, and worked for a many of years with the university on development of a history curriculum for Tanintharyi Division. He has published a number of articles and monographs on the ancient and more recent history of historic towns in the division (Than Swe 2000, 2002, 2002a, 2003, 2003a).

2. Mon State Geography

Mon State borders Tanintharyi Division on the north, with Bago Division lying to its north and Kayin State to the east. It is *circa* 300 km north to south and contains an area of 12, 155 square kilometres. The region is traditionally associated with the ancient 'golden lands' or *Suvannabhumi* (Moore and San Win 2007). In contrast to the predominant hilly regions of Tanintharyi, much of Mon State is composed of delta lands. In addition, Mon State has abundant thick surface accretions of laterite (*gawun*). Although there is Dawei laterite, it is iron-rich (Fe) rather than the magnesium-rich (Mg) laterite of the Mon State. Also, the pebble accretions of the Fe-type are smaller than the magnesium-rich variety, a process accelerated by the high percentage of sand in the area (Geography Department, Dawei University. pers.comm.13.12.03).

Figure 2 Roads of Mon State
(http://hlaoo1980.blogspot.co.uk/2011_05_01_archive.html)

3. Background: Tanintharyi Division

Tanintharyi Division (previously Tenasserim Division) is a long narrow (*circa* 600 km north to south) landmass flanked by the Andaman Sea to the west and the high Tanintharyi Range to the east bordering Thailand. The area of the division is 43,328 km², with an estimated population of 1,455,000 in 2002. As can be seen from the soil map below, much of the landmass of Tanintharyi Division is composed of forest soils, with the exception of the areas around the Dawei estuary. Roads to the east of Dawei cross the hill ranges and connect to towns in Thailand such as Kanchanabrui. To the south, the islands of the Myeik archipelago have long been a source of exotic produce such as bird's nests, with roads likewise stretching inland across the peninsula to Thailand.
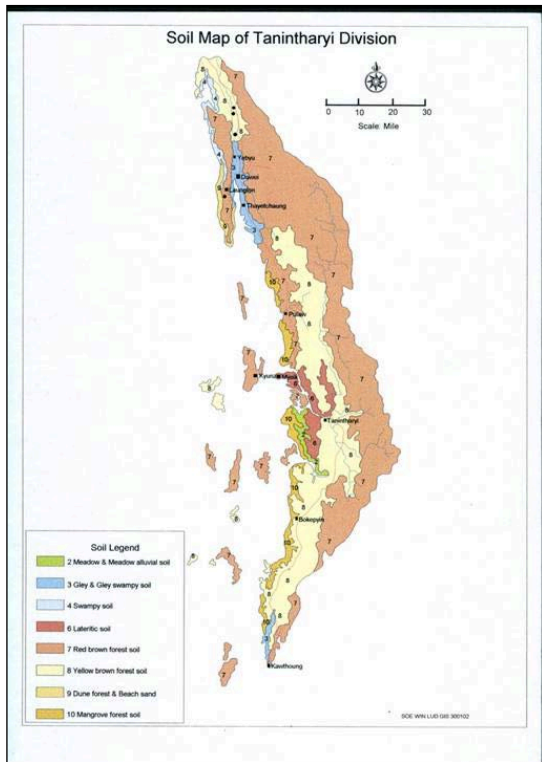
Figure 3 Soil map of Tanintharyi Division
(http://www.apipnm.org/swlwpnr/reports/y_ta/z_mm/mm_map/
mmmp222f.jpg)
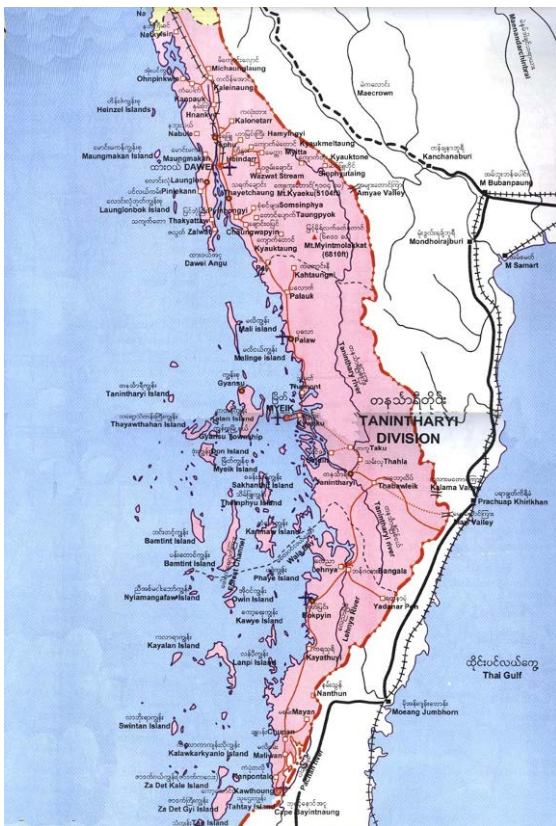

Figure 4 The principal towns of Tanintharyi Division
(*http://www.myanmars.net/myanmar/images/tanintharyi_zoom.j
pg*)

4. Thaton and Ye

The ancient town of Thaton (286 hectares, 16°54'30.46"N, 97°22'8.16"E) is laid out on the escarpment of laterite high ground or *myenigon*, red-earth soil which is slightly elevated from the surrounding rice fields. The site is naturally fortified on the east by the 2.4 kilometre long Myathabaik hills with the lowland swamp of Leik-in (Tortoise-lake) on the west, perhaps remnants of the Old Thaton harbour. This may have connected with the Sa Chaung or Thaton River, an old canal parallel to the railway which extends 16 kilometres to the northwest. Numerous small town sites such as Hsin Phyu Kyun (16°56'16.56"N, 97°20'29.14"E), Mayangon (16°59'7.26"N, 97°15'6.71"E) are located on isolated mounds of laterite high ground 80-160 metres above the surrounding rice fields on the west of this canal with artefacts such as pottery, beads and *mye-bon-hpaya* or terracotta tablets dating to the first millennium CE (Moore and San Win 2014: 225) The changes affected the visibility of the ancient ramparts around the isolated hillock of Hsin Phyuu Kyun can be seen on by comparing the 1944 and present day Google Earth images of the hillock in the figures below.
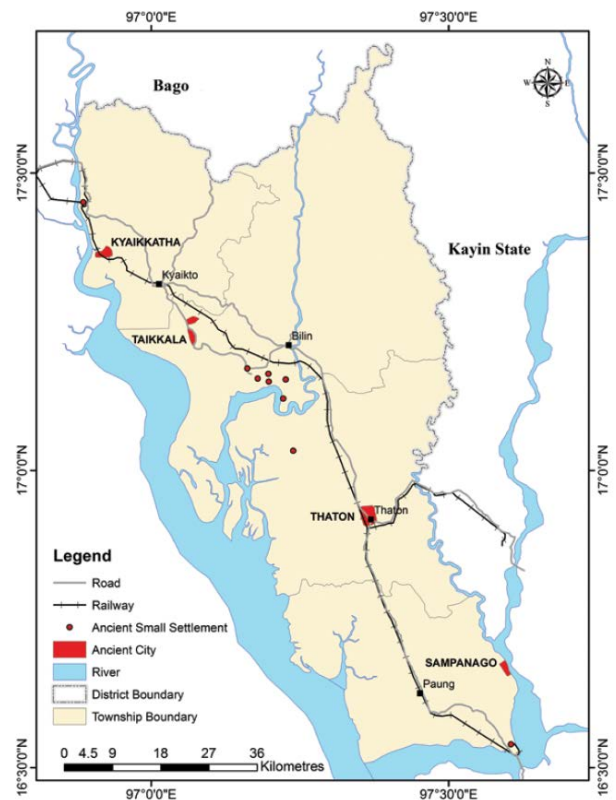

Figure 5 Map showing location of Thaton in relation to other ancient settlements and rail line (Thazin Kaing, from Moore and San Win 2014:221)

On the north side of the long rectangular city is an enclosed area known as 'Thami-daw-gon' (roughly 'princess hill') seen on the map below. While not yet subject to excavation, it is possibly one of the earlier parts of the ancient city. To the south, much of the area of the town has been continually occupied,

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making the historical chronology of the city difficult to piece together in the absence of large-scale excavation. Most parts of the wall, however, have yielded finger-marked bricks in the lower portions, an indicator of construction prior to *circa* the ninth century C.E.
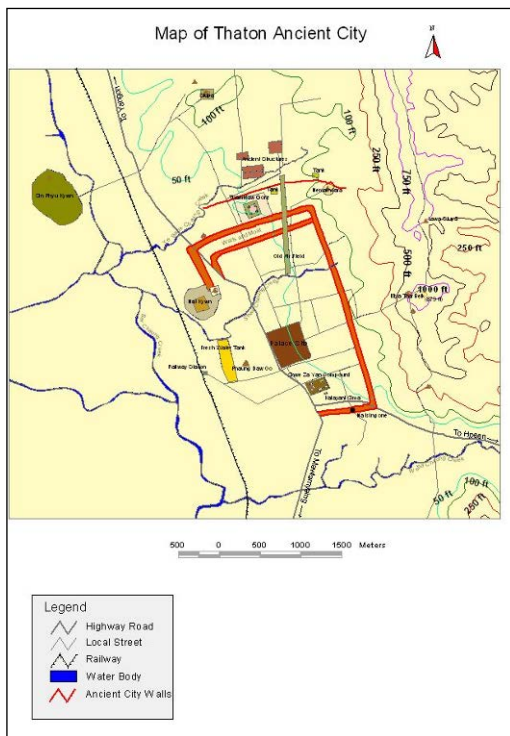

Figure 6 Location of 'Thami-daw-gon' on north side of Thaton and location of the ancient town flanked by hills on the east and delta lands on the west coastward side. The isolated hillock of Hsin Phyuu Kyun is seen also on the west flank of ancient Thaton in the photograph below.
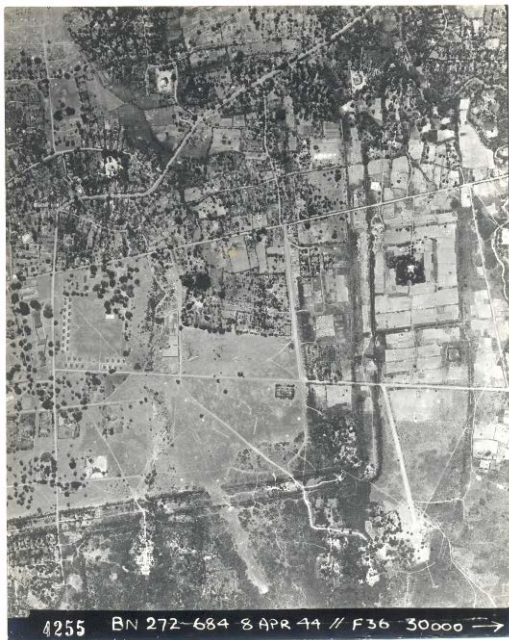

Figure 7 Northeast corner of Thaton with Thami-daw-gon seen on the right side of the image (Williams-Hunt Collection, taken April 8, 1944)

Figure 8 Isolated and walled hillock of Hsin Phuu Kyun (Williams-Hunt Collection, taken on October 6, 1944)

Figure 9 Hsin Phyuu Kyun today (Google Earth)

Thaton also figures in the historic moments of World War II, illustrated by the image below taken in 1945. The photograph shows the turning over of the sword by Lieutenant General Takehara, commander of the Japanese 49th Division to Major General Arthur W. Crowther, commander of the 17th Indian Division at Thaton.

Figure 10 Surrender of the Japanese 33rd Army, 1945 (http://commons.wikimedia.org/wiki/Category:Thaton#mediavie wer/File:General_Takehara_hands_sword.jpg)

The town of Ye (15°14'55.65"N, 97°51'21.03"E) is close to 200 km south of Thaton and marks the southern limit of the present day Mon State. The photograph of Ye in the Williams-Hunt Collection shows the town's location on the Ye River, at present some four kilometers from the coast. The expansion of the city over the last sixty years is apparent in comparing the two images below, the Williams-Hunt photograph taken on November 5, 1944 and the present day image available on Google Earth. The clear old city wall seen on the 1944 photograph pretty much marks the limits of the urban area at that time. Today, the enclosed area is engulfed by urban growth, particularly on the north and west which are open land on the older image.

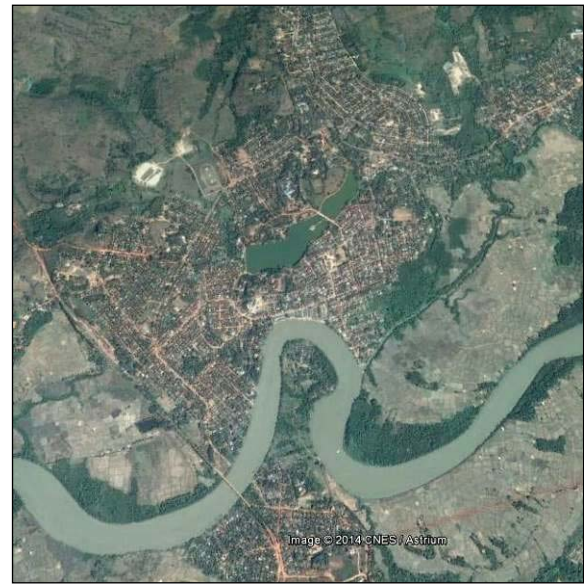Figure 11 Ye old city wall (Williams-Hunt Collection, taken November 8, 1944)

Figure 12 Expanded urban area of Ye today notably to the west and north of the walled area (Google Earth)

5. Dawei and Myeik

Dawei is sited on a low terrace mound east of the Dawei River, with further hills and ranges on the east forming the border with Thailand. This topography is mirrored on the west where the mountains separate it from the Kappali or Andaman Sea, with Kappali being a Myanmar word referring to Negrito peoples (Kyin Swan 2003:2; Myanmar Language Commission 1993: 23).

The Dawei River has a relatively short course with a high sedimentation rate. It is not prone to flooding although there is heavy rainfall in the area (5842mm per annum). The bend in the river eight kilometres south of Dawei is a meander typical of the river's expansion in the lower valley where it widens to form the port inlet with access to the sea (Cho Cho Aye (Geology), Kyin Swan (Geography) Dawei University, pers.comm. 29.03.04; Ministry of Mines 1989:12). The shallow inlet is bordered on the west by the Dawei peninsula and on the east by a narrow floodplain.

The town of Dawei is a contiguous area reaching from the river north to the current airfield. While there has been little archaeological exploration to date, the so-called 'Shan-ma-leh-swe' quarter on the eastern part of the town has yielded both polished stone tools and silver coins, reminiscent but much smaller than those of the first millennium C.E. Mon and Pyu cultures lying north of Dawei.
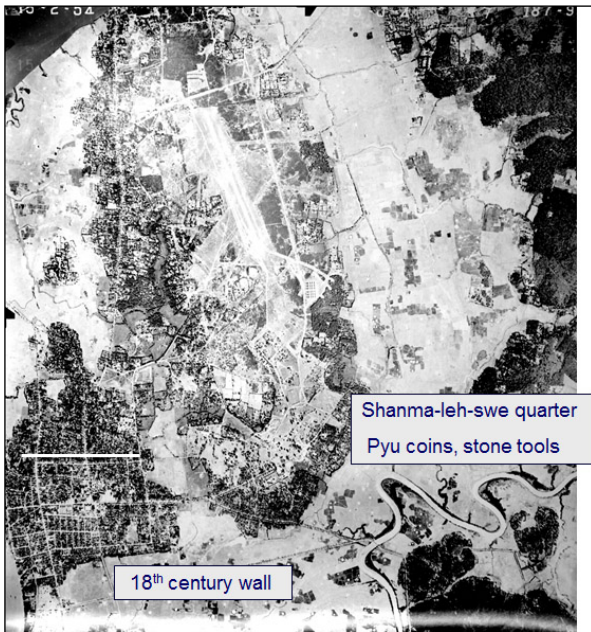
Figure 13 Aerial photograph from 1954 showing areas of archaeological and historical note
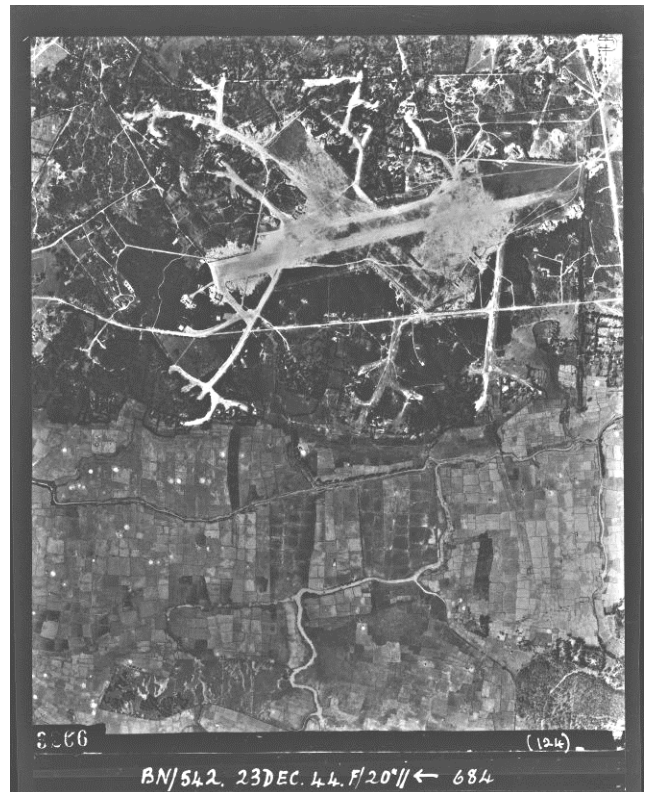

Figure 14 Dawei airfield (Williams-Hunt Collection, taken December 23, 1944)

Figure 15 Dawei airfield today showing extension of runway into urban zone (Google Earth)

In the town itself, the World War II image from the Williams-Hunt collection shows the main part of the town. As with the 1954 image, traces of the city walls laid out in 1754 CE (1116 ME) under King Min-neh-hla can be detected (Than Swe 2003a). The greatest numbers of photographs in the Williams-Hunt Collection cover of Dawei are not of the town, however, but of the airfield. This has today expanded so that the Dawei airfield area now covers more than sixty hectares (605.693 acres) and is 1200 feet long and 100 feet wide. This makes it larger than the airfields of Kawthaung (541 hectares, 9000 by 200 feet) and Bothpyin (399.76 hectares, 10,000 by 100 feet) to the south.

The clearest explanation for the photographs of the airfield, taken on December 23, 1944, is the chronology of World War II. Dawei was invaded on 18 January, 1942, with the battle being the first clash between British and Japanese troops inside Myanmar. The Williams-Hunt Collection photographs of Dawei include the elaborate Japanese expansion of airport runways taken in December 1944 during the British campaign to re-take the country (Defence Surveyors Association: 216, 237).

The airfield today is in the process of rapid expansion, seen in the image below. Whereas once it was exclusively within the north part of the town, lengthening in the process of enabling international flights has brought it close to the marketplace and heart of the town.

Other images of Dawei in the Williams-Hunt Collection likewise record the town prior to its rapid change in recent years. For example, the image below shows the location of the old jetty, prior to the construction and opening of the Kamyawkin Bridge in 1974.

In Myeik as well, the images in the Williams-Hunt Collection focus on the airfield providing a contrast to the appearance of the same area today.

Figure 16 Old Dawei jetty (Williams-Hunt Collection, taken on December 23, 1944)
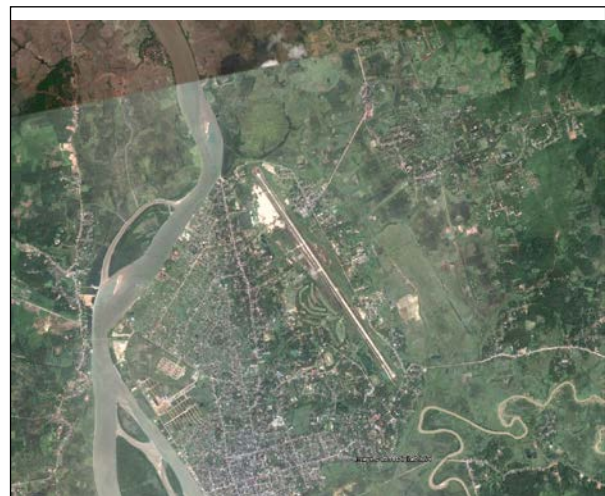

Figure 17 Myeik seen on March 26, 1944 (Wiliams-Hunt Collection)

Figure 16 Opening of Kamyawkin Bridge 1974, the first bridge across the Dawei River at Dawei

Figure 18 The same Myeik area with urban expansion just east of the airfield on the Williams-Hunt collection (Google Earth)

Figure 17 Dawei Bridge today (Google Earth)

6. Conclusion

The Williams-Hunt Collection provides a valuable archive of a lesser known region of Myanmar in the final years of World War II. Much of this is now in the process of change, with the images recording many archaeological and historical features. The Mon State and Tanintharyi Division include a large part of the present day landmass of Myanmar, and contain valuable data testifying to a unique heritage of the southern peninsula in its strategic location as an east-west cultural crossroads.

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The East-West Cultural Corridor Project: planning for the future

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Abstract: The East-West Cultural Corridor Project in tandem with Living Angkor Road Project (LARP)/ Cultural Relationship in Mainland Southeast Asia (CRMA) is to widen on both its eastern and western frontiers for identifying common cultural processes at the center of crossroads significance of Si Thep (circa 6th-13th CE). These routes link both to the ancient Dvaravati cities from Myanmar to the Chao Phraya valley and beyond to cities in the eastern. In Khmer period, the eastern and western links the ancient Khmer network stemming from Angkor to ancient cities located in Sukhothai, Kanchanaburi and Phetchaburi, and to the eastern region. On the west, the project, especially, focuses on Myanmar-Thai Royal and Tribal trans-border region with four routes. And we explore the classification of communication network systems in the region. On the east, we also examine Northeast Cambodia with Southern Laos and Central Vietnam as well. As the study and publications of our research group show, our multi-disciplinary project underlines the complementarity of archaeological, historical, and ethnographical data.