Person Trip Survey Data as a Source Material for the Study of the Greater Cairo Residential Area
A Case Study on Animal-Drawn Transportation at the Beginning of the 21st Century

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Introduction

We present the first attempt at an area study on Greater Cairo using the Cairo person trip survey data in 2001. Our purpose was to tentatively evaluate the usefulness of person trip survey data for the area study on Greater Cairo. Samples with the attribute of the animal drawn (i.e., people riding animals) were extracted for the case study.

The person trip survey is an investigation to "get information about what types of people move, by what types of transportation, for what purposes, and where they move to, from, and within what period, paying attention to the movements of people in the city, and asking them about their household, personal characteristics and single day movements" (homepage of the Ministry of Land, Infrastructure, Transport and Tourism in Japan. https://www.mlit.go.jp/en/).

The person trip survey is also called the 'traffic fact finding survey', because it was devised in the United States, against a backdrop of road supply not catching up with increased use of privately-owned car, to investigate the optimal plans for combining private and public transportation methods. Thus, the person trip survey is an investigation with practical purposes such as traffic plans and city master plan development.

In addition to these practical purposes, person trip survey findings have been used in social science studies (e.g., consumer models, influenza infection course simulations) that focus on 'person flow.' Such studies are feasible because the person trip survey produces big data, including detailed information about the individual attributes of large samples and their daily life patterns.

The Cairo person trip survey was carried out by the Japan International Cooperation Agency (JICA) on Monday October 1, 2001, to collect basic data on the transportation network of the Greater Cairo area.[1] After the person trip survey, JICA undertook a global survey of Greater

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1   Nakamura et al. "Introduction to the database of the urban traffic development surveys by JICA:

Cairo's urban development and maintenance plans during 2007-2008.[2]

The 2001 Cairo person trip survey sampled about 117,000 individuals, representing valuable source material on the daily patterns of Greater Cairo's inhabitants at the beginning of the 21st century. This paper is an introductory attempt at describing how to use these big data to study the social life in Greater Cairo from a novel flow of the-person viewpoint.[3]

I.   Greater Cairo at the beginning of the 21st century

1-1   Greater Cairo as the administrative entity of the *qism* (district)

Egypt is a political entity composed of administrative units. The largest administrative unit is the governorate (*muḥāfaẓa*), which is subdivided into districts that contain urban areas called *qism* and rural areas called *markaz*. The smallest administrative units are the urban town (*shiyākha*) and rural village (*qarya*).

Herein, the *qism* is used as the unit for aggregating statistics. Greater Cairo is not a strictly defined area. In 2021, it is an extensive residential area consisting of three governorates: Cairo, Giza, and Qalyubiya, although the substantive conceptual unit is the network of Cairo's cities, towns, and their surroundings, which expand into agrarian and desert areas (**Map 1**). Historically, it was the transportation network of roads and subways that secured the city network and embodied Greater Cairo as an administrative entity. Greater Cairo is now a megapolis with a population of over 20 million.

In other words, Greater Cairo is not a formal administrative unit, but rather an informal residential area with space that has been historically ambiguous and that has changed depending on its demographic and socioeconomic circumstances. An administrative map of the *qisms* of Greater Cairo in 1996 — the year closest to the 2001 person trip survey when Greater Cairo consisted of 51 *qism*s — is shown in **Map 2**.[4]

1-2   Greater Cairo in the age of globalization

Beginning in the 1940s, the population flowed into Cairo, which expanded greatly to become the large urban area referred to as 'Greater Cairo.' However, in recent decades, the population began migrating from Greater Cairo to the newly developed suburban city centers,

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satellite cities of neighboring desert areas, and local cities. At the beginning of the 21st century, the living circumstances of Greater Cairo were at a residential tipping point from topographic, demographic, and socioeconomic points of view.

In fact, the cityscape underwent a complete change, with its inferior traffic conditions and pollution designed so as not to revert to past conditions. In 2001, when Greater Cairo was at a significant turning point in living standards, a person trip survey was carried out. This paper is an attempt to convey one aspect of the environment in which the inhabitants of Greater Cairo lived at the turn of the 21st century, and to imagine Greater Cairo as it underwent its qualitative transformation.

II.   Data and method

2-1   Cairo 2001 person trip survey data

As can be seen by the fact that the person trip survey is also called the 'household interview survey', it contains a wealth of information. Its main categories are: 1) household member characteristics and possession status of cars and motorcycles (household attributes); 2) personal information such as gender, age, and occupation (personal attributes); and 3) person flow by means of transportation (flow information).

The person trip survey items have been internationally standardized. However, in conducting the survey, its items were modified depending on the site circumstances. For example, in the 2001 Cairo person trip survey, classification of buses and quasi-public transportation such as taxis was detailed according to the actual situation in Greater Cairo. The items or categories in the 2001 Cairo person trip survey were as follows.

1) Age (8 categories): 7-9 years, 10-19 years, 20-29 years, 30-39 years, 40-49 years, 50-60 years, more than 60 years, and unknown.

2) Traffic means (23 types): on foot, bicycle, motorcycle, private car driver, private car passenger, pickup for passengers, taxi, shared taxi, public minibus, public bus, public A/C bus, cooperative minibus, company (work) car, factory/company bus, school bus, truck for passengers, Nile bus, tram, Heliopolis metro, underground metro, ENR train, animal drawn, other, stay, and unknown.

3) Occupation (19 types): legislature; administrative management worker; professional worker; technician or assistant; clerk or related worker; sales or service worker; farmer, fisher, or hunter; craftsmen or related worker; production worker; unskilled worker; other; student (primary, secondary, high school, technical or university), housewife, retired, jobless, and working person or no answer.

4) Purpose of movement (13 types): to work, to school/institution, to home, selling or delivering, meeting or other business purpose, return to workplace, shopping or eating, sending or fetching, recreation, medical treatment, social visit or other private purpose,

other, and no answer.

Using such information, we can analyze the purposes, means, and times of movement, as well as the lifestyles of Greater Cairo's citizens, by focusing on various aspects of their household/personal attributes and flow information. The personal characteristics of those surveyed are shown not only in their household/personal attributes and the purposes of their movements, but also by their means of transportation.

Among the various information types in the 2001 Cairo person trip data, we pay special attention here to occupation (based on residence) and purpose of movement (based on the business of the first destination of the day) among about 117,000 individuals, and the traffic means (based on starting point) for a total of about 570,000 trips.

Information about transportation means is particularly valuable, since in Greater Cairo the availability of public transportation is relatively low, and the various types of transportation include taxis and shared taxis. Thus, the transportation type that people use reflects individuals' characteristics, as explained below.

2-2   Person trip survey data as a source material for area study

Various information can be extracted from person trip data by devising an aggregation method. Aggregating trips by space and time zone reveals the daily rhythm of city activity. By continuously tracking the daily behavior of the surveyed person, it is possible to get an overall picture of their lifestyle, such as when and where the person spent their work and leisure time. Herein, data are aggregated based on Greater Cairo's *qisms*. By such aggregation, it is possible to understand the city's nodes.

Person trip survey data are more useful as area study material for Greater Cairo when linked to macro demographic and socioeconomic statistics published by the Central Agency for Public Mobilization and Statistics (CAPMAS) and geographic information including satellite images. **Map 3** shows trip density by *qism* based on the person trip survey data, which signifies the fluidity of people. **Map 4** shows population density by *qism* based on the 1996 population census. The correlation between trip and population densities is apparent and confirms that the older the *qism* (i.e., in the older city area), the higher the movement of people. In addition, this correlation shows that the person trip survey sampling does not include strong bias.

Another correlation example is the distribution of farmers (in the category: agriculture, forestry, and fishing) in Greater Cairo. **Map 5** is the ratio of farmers by *qism*, showing the distribution of farmers' residences based on person trip survey data. Farmers were abundant in the less urbanized provinces of Qalyubiya and in southern and northern Giza, opposite the Nile (see also **Map 12**). The ratio of population density by *qism* almost completely overlaps with the ratio of farmers by *qism* based on the 1996 population census data shown in **Map 6** and is consistent with the topographical features around Greater Cairo in the satellite photographs of

Map 2.

It is interesting to note the transportation information, from which we can see traffic conditions in various areas of Greater Cairo at that time. For example, the shared transportation ratio differs completely from the distribution of people in private cars.

Map 7-1 shows the number of serbis (shared taxi in local Arabic term) users in Greater Cairo. In rural areas, people used serbis more often, and private cars were used less often. However, even between rural areas, traffic patterns differed; there were many truck trips in Qalyubiya Governorate (**Map 7-2**) and more motorcycle trips in Giza Governorate (**Map 7-3**).

III. Case study: the animal drawn (the people riding animals)

3-1   Why the animal drawn?

As noted, the 2001 Cairo person trip survey investigated about 117,000 people and 570,000 trips. Thus, these big data offer vast choices for problem setting and the selection of personal characteristics for analyses. Herein, data on the animal drawn were targeted for analysis. There were only 221 trips and 114 individuals in the category of the animal drawn. Thus, these measures represent a relatively small proportion of the overall sample. In other words, the animal drawn is a minor subset of the survey and thus qualitatively and quantitatively exceptional; therefore, we targeted the category of the animal drawn for analyses.

Again, the purpose of this paper was not to use the 2001 person trip survey data to exclusively analyze the demographic, social, and economic circumstances in Greater Cairo at the beginning of the 21st century. Rather, the purpose was to demonstrate the effectiveness of these data as a source material for the study of living circumstances in Greater Cairo. Thus, focusing on such a social category as the animal drawn with simple attributes, which can easily be interpreted with few indices, is more appropriate than other social categories with complex attributes whose explanation would have required significant information.

3-2   Daily life behavior of the animal drawn
3-2-1   Age, occupation, and purpose of movement

The total animal drawn sample was 114 individuals, who took 221 trips. Information on these individuals' attributes (age, occupation) and their daily behavior (purpose of movement) is summarized in Fig. 1.

a) age

attribute	numbers
10~19 years	13
20~29 years	23
30~39 years	25
40~49 years	26
50~60 years	17
More than 60 years	9
Unknown	1
Total	114

b) occupation

attribute	numbers
Farmers, Fishers and Hunters	84
Sale and Service Workers	14
Unskilled Workers	5
Legislature,Administrative Management Workers	3
Craftsmen and related Workers	3
Student (Primary)	2
Housewife	1
Production Workers and Workers related	1
Others	1
Total	114

c) purpose

attribute	numbers
To Work	102
Meeting or Other Business Purpose	8
To School / Institution	1
Shopping or Eating	1
Other	2
To Home	107
Total Trip	221

**Fig. 1 Basic Information on the animal drawn**

The age range of the animal drawn includes every generation, from young people to older adults (i.e., the animal was not just used by older people for transportation). Regarding the residence of the animal drawn, 99 lived in Giza governorate, 11 in Qalyubiya governorate, and 4 in Cairo governorate (**Map 8**).
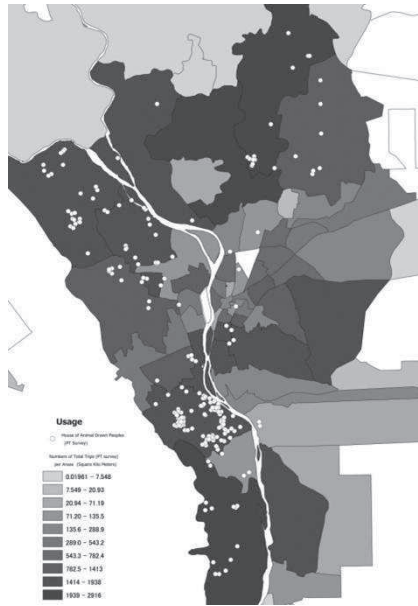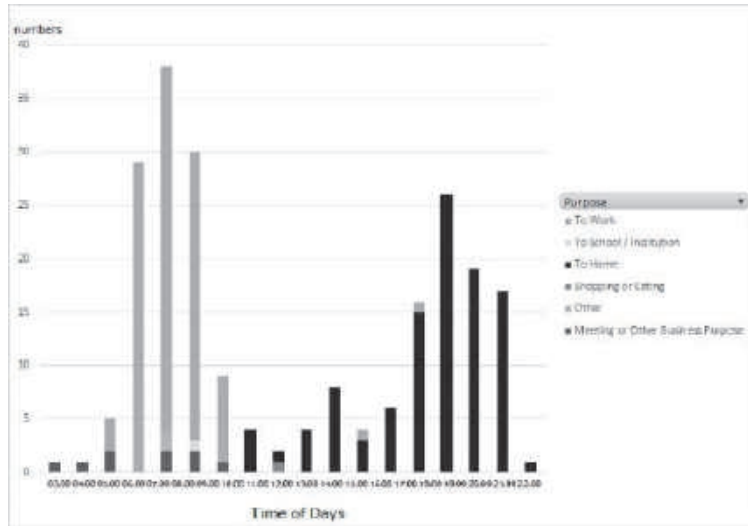
Note: Based on the person trip data

Map 8   Distribution of the animal drawn

The timing and purpose of the animal drawn's movement are shown in Figs 2 and 3, respectively. Timing reflects the times of departure from home to a destination and returning. It is apparent that almost all cases were for commuting to work in the morning and returning home in the evening.
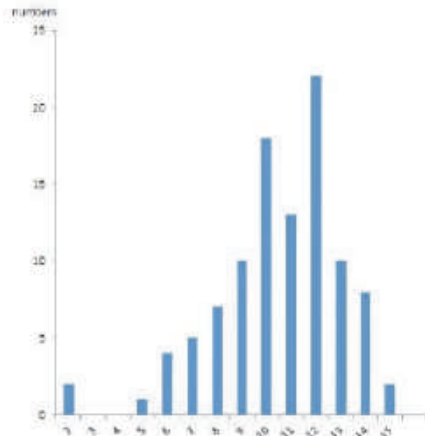
Note: Based on the person trip data

Fig. 2   Departure times for the animal drawn

Note: Based on the person trip data

Fig. 3   Purpose and time of the animal drawn movement

The animal drawn often departed from home between 06:00 and 08:00 and returned home between 17:00 and 20:00. When calculating individuals' outings, they often lasted about 10-12 hours, which we interpret as reflecting a full workday. The most common pattern (used by 14 of 141 total person surveyed) was departing from home at 08:00 and returning home at 18:00. These data were collected on a Monday and so this pattern likely reflects a daily work routine.

3-2-2   Scope of animal drawn movement

Of the 221 trips using animals, 103 people took a round trip, 11 traveled one-way, and 1 person took two round trips (thus 114 individuals).

Where, then, did they go? **Map 9** shows the places traveled from and to by animal in the morning and evening. These were considerably concentrated in the west bank of the Nile, in the Cairo suburbs.
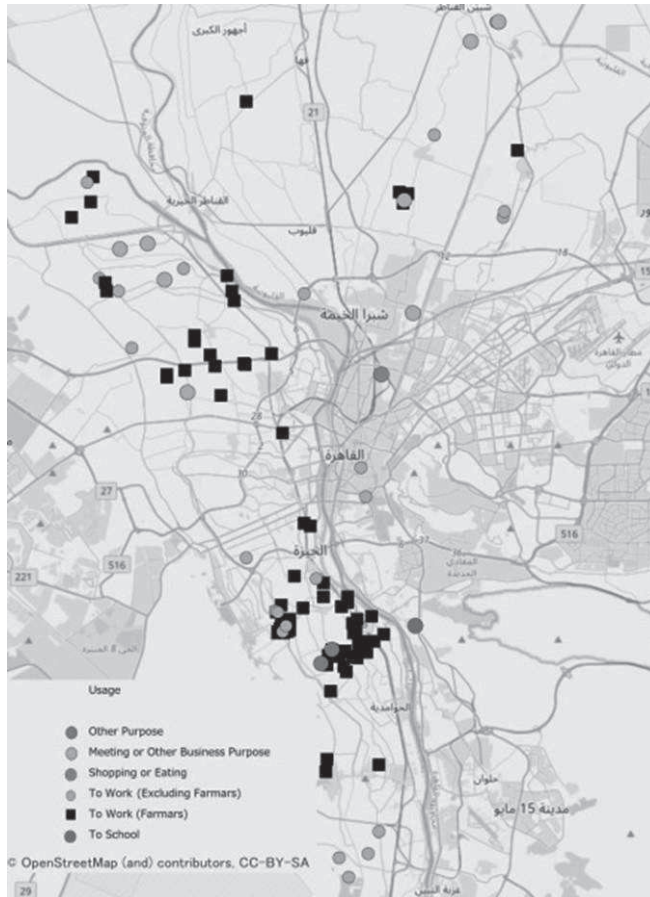
Note: Based on the person trip data

Map 9   Scope of animal drawn movement

Only four cases of departure by the animal drawn took place in the center of Cairo governorate, which was then undergoing modernization. One man in his 50s left his residence in Gamaliya *qism* to go shopping in Muski *qism*. An unskilled worker in his 30s living in Sayyda Zainab *qism* and a man in his 50s living in Khalifa *qism* each commuted to work in their neighborhoods. In the suburb of Tura *qism*, an elementary school child went to school alone. Each case was unique and interesting.

IV. Who were the animal drawn?

4-1   Occupations of the animal drawn

The next question concerns the occupation of the animal drawn. **Map 10** shows their distribution by occupation based on the information in Fig. 1.

Note: Based on the person trip data

Map 10   Distribution of the animal drawn by occupation

It is generally assumed that the animal drawn were farmers or agricultural workers (in the category of agriculture, forestry, and fishing) living in the marginal areas of Greater Cairo. Indeed, among the total 141 of the animal drawn, 84 were farmers and 14 were service workers.[5]

In other words, 73% of the animal drawn were farmers. **Map 11** shows the ratio of the animal drawn by *qism*. There is a clear correlation between this proportion of the animal drawn by *qism* and the ratio of farmers by *qism* shown in **Map 5**. This conclusion is also confirmed by the correlation between the distribution of the animal drawn (**Map 8**) and the distribution of farmers (**Map 12**). The two ratios also correspond with the degree of urbanization, as reflected in **Map 3**, which shows trip density by *qism*.

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5   Regarding purpose of travel, 102 of total 141 people commuted and 8 were traveling on company time (i.e., not commuting).

Note: Based on the person trip data
Map 12   Distribution of farmers

4-2   Is the animal drawn "minority"?

In 2021, few people ride animals down the streets of Greater Cairo. Indeed, the animal drawn was a minor category even in 2001, and thus became even more marginal as Greater Cairo grew into a megapolis.

Particularly with the motorization of society in the 1980s, the street scene in Cairo changed dramatically. Cars flooded the streets, trams were abolished, and subway construction was planned. Before the advent of a motorized society and modernization of the distribution system, the daily scene included people riding animals on Cairo's streets. Early in the morning, farmers carried vegetables harvested that day by wagon to street markets. Even at the beginning of the 21st century, when the person trip survey was conducted, one could see a wagon running beside a luxury Mercedes-Benz.

Fewer people ride animals today. However, although they were less likely to travel by animal in 2001, those who did so continued using this transport method until their social role in Greater Cairo was eliminated. The question is: what kinds of people used animal for transportation? There is no doubt that most were farmers or workers related to agriculture. Nevertheless, in the leading megapolis of Greater Cairo, 27% of people who traveled by animal in 2001 worked in occupations other than agriculture. Although they numbered few, some lived

in densely populated areas of Cairo governorate. For example, in the overcrowded, narrow, densely developed urban area, workers such as garbage collectors (*zabbarin*) still found it convenient to travel by donkey.

It is also noteworthy that many people traveled long distances with animals. For example, many of the animal drawn were located in southern and northern Giza governorate. Specifically, 56 people of total 141 were from southern Giza governorate, all of whom worked in agriculture, forestry, or fishing. Nonetheless, although this was clearly an agricultural area, there were still very many animal drawn relative to other agricultural areas.[6] It is likely that many were part time farmers. In this agricultural area near Cairo, it is assumed that many farmers were also employed in additional, nonfarming jobs. Although the person trip data do not include part time job information, this notion is supported by the fact that the average distance from the animal drawn' homes to farmland in southern Giza governorate is quite far. **Map 13** is an enlargement of southern Giza (also shown in **Map 9**), and shows that the average travel distance by animal would have been 2.7 km, and 2.5 km.

Note: Based on the person trip data

Map 13   Scope of animal drawn movement in southern Giza

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6   According to the survey, the percentage of farmers was 11.9%. Although urbanization had progressed within Greater Cairo, there were many areas with high rates of agriculture, forestry, and fishing, which cannot be explained only by the existence of the animal-drawn.

Although the individual data analysis approach can reveal basic daily rhythms based on departure from and returning to home, it is unclear whether the animal drawn traveled to cultivated land or other workplaces. However, it seems plausible that they commuted to part-time, nonfarmland workplaces since this area was near many ancient Egyptian ruins in Giza governorate. Therefore, it is possible that they used animals for tourism.

Concluding remarks

The most important data for macro analyses of Greater Cairo's society are aggregates of administrative units published by CAPMAS (the Central Agency for Public Mobilization and Statistics). In fact, most previous studies on Greater Cairo society used CAPMAS macro aggregated data, especially the population census data. This situation is not expected to change.

Macro aggregated data by administrative unit in the population censuses show general trends and patterns across a range of activities among Greater Cairo's inhabitants. However, this does not provide information about the actual areas in which the people of Greater Cairo lived their lives. In contrast, the person trip survey data reveal where people actually lived out their lives, which was not restricted to administrative units. They show us not only the scope, but also the intention of people's movements around Greater Cairo. In other words, the person trip data provide a glimpse into the lives of the people of Greater Cairo, as depicted by person flow.

The advantage of this approach is shown simply by the fact that the behaviors among those surveyed can be visualized by their dispersion on map points, not by aggregation within administrative units. In this respect, the macro aggregated data reflect the conditions or cortexes of behaviors among those surveyed. Thus, when connected with auxiliary sources of population census data by administrative units, and geographical information including historical maps and satellite imageries, the person trip survey data may open up new directions for the area study of Greater Cairo's society.

Using nonaggregated data in this way, it is possible to obtain micro information regardless of the aggregate unit. Although the volume of data processing will be enormous, much of this can be aided by technological progress and the development of analysis tools. Nonaggregated data (mostly sample surveys) should be used separately from census data,. It will be important to rigorously verify data (including via common sense), based on locations and timing, so as not to be misled by trends within small samples.

A final example demonstrates the usefulness of person trip survey data as a source material for the area study on Greater Cairo. Person trip surveys are individual based and generally do not provide family information. However, in Cairo's person trip survey data, there were many cases in which people moved along the same trajectories at the same time, among those who were animal drawn. It can be inferred that these were families traveling together.

There were 25 pairs of persons traveling by animal, all but one of whom were male. As

shown in **Fig. 4**, there are many varied age combinations, so it seems that parents and children went to work in the same place. Sixteen of these groups traveled for farming, while four groups traveled to work in the service industry. One group went to work as a couple. A final group of three from different generations may have been grandparents going to work and their grandchild who went to elementary school. Clearly, a number of inhabitants of Greater Cairo used animals as a means of daily transportation.

elder members	younger members 10~19 years	20~29 years	30~39 years	40~49 years	Total
10~19 years				1	1
20~29 years	1	2			3
30~39 years	1	2			3
40~49 years	2	2	1		5
50~59 years	2	4	1		7
More than 60 years	1	3	1		5
Total	7	13	3	1	24

Note: Based on person trip data

Fig. 4 Animal drawn passengers

Here, the effectiveness of person trip data for the area study of Greater Cairo was shown using a case study of the animal drawn. However, since our sample was small, and represented a social category with special attributes, some of our interpretations are necessarily hypothetical. Nevertheless, it is apparent that person trip data can provide new directions for the area study on Greater Cairo from a 'person flow' perspective. The effectiveness of this approach will be clarified when the subjects of analysis are expanded to social categories with large samples and diverse attributes.

Figures and maps
Figures
Fig. 1   Basic Information on the animal drawn
Fig. 2   Departure times for the animal drawn
Fig. 3   Purpose and time of the animal drawn movement
Fig. 4   Animal drawn passengers
Maps
Map 1   Satellite imagery of the regions surrounding Cairo (Cairo, Qalyubiya, and Giza governorates)
Map 2   Administrative map of the *qisms* of Greater Cairo in 1996

Acknowledgments

Note: (1) Green areas are indicated in red. Some of these are spaces where trees have been planted in new residential areas, but most are agricultural. The urban area is shown in gray, and desert areas in white. (2) North of the black line is Qalyubiya governorate; west of the Nile and south of the black line is Giza gyovernorate.

Map 1   Satellite imagery of the regions surrounding Cairo
**(Cairo, Qalyubiya and Giza governorates)**

The numbers on the map (qisms): 27, 29, 31, 30, 25, 28, 19, 57, 15, 22, 23, 18, 55, 20, 21, 17, 14, 13, 16, 56, 11, 10, 9, 8, 48, 12, 5, 7, 45, 54, 6, 4, 47, 59, 3, 60, 66, 65, 2, 1, 43, 42, 41, 68, 38, 39, 37

No. Name of qism / No. Name of qism

Note
1) The numbers of *qisms* are the serial numbers of *qisms* in Fig.3 in Kato et al.
   "Historical Transition of the Qisms" in this volume (Mediterranean World 25).
2) Nos. 30 and 31 belonging to Qalyubiya governorate.
3) Nos. 54–7, 59, 60, 65, 66, and 68 belonging to Giza governorate.
4) Others belonging to Cairo governorate.
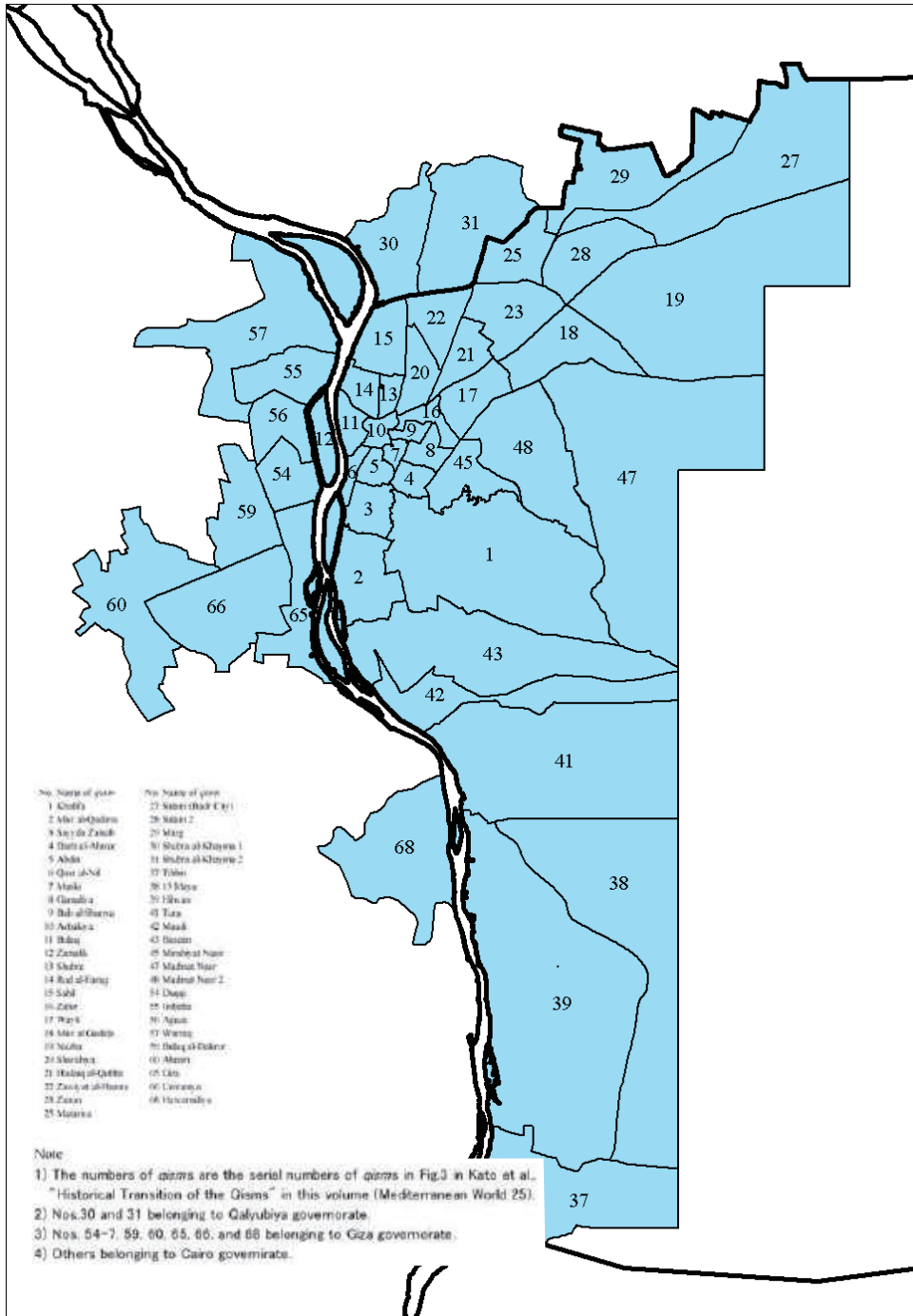
North of the black line is Qalyubiya governorate; west of the Nile and south of the black line is Giza governorate.

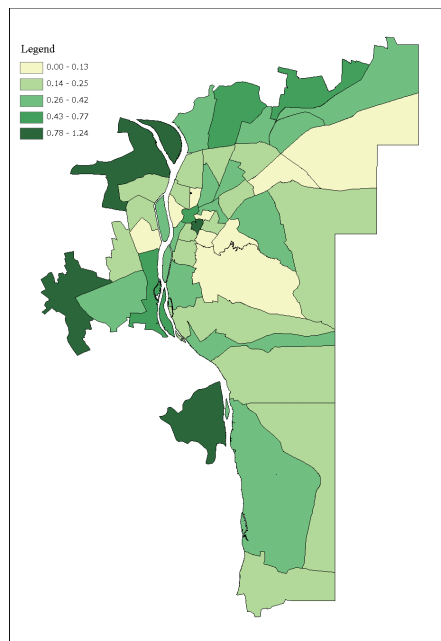**Map 2   Administrative map of the *qisms* of Greater Cairo in 1996**
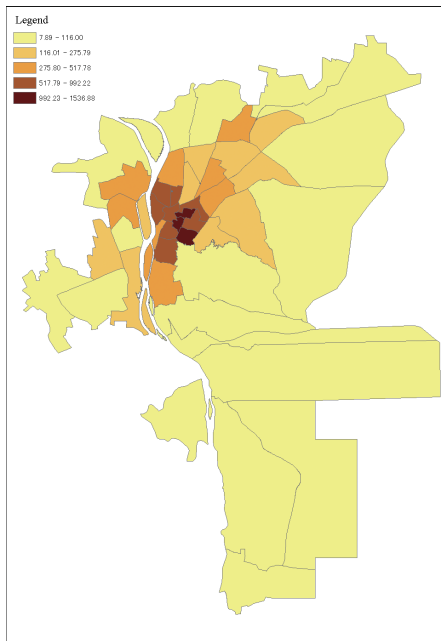
Note: Based on the person trip data
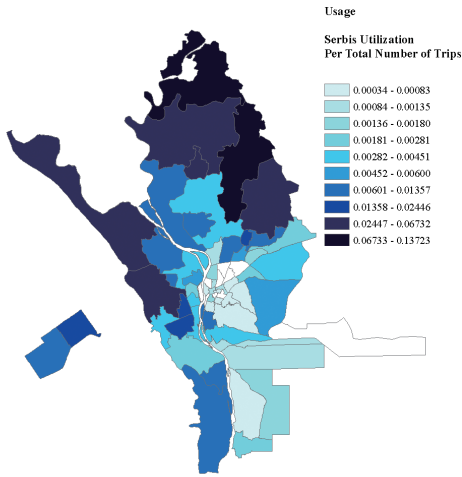
Map 3   Density of trip by *qism*
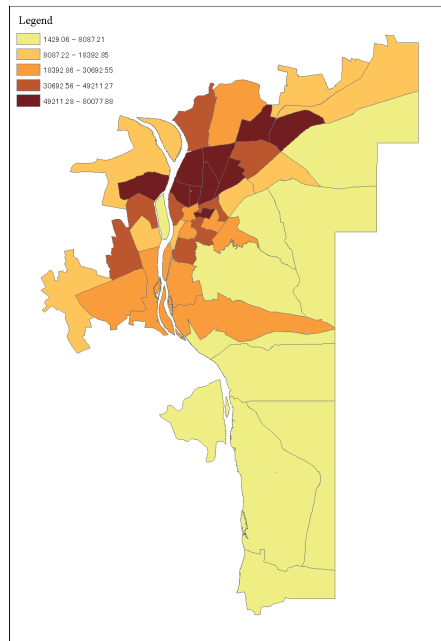
Note: Based on 1996 population census

Map 4   Density of population by *qism* in 1996
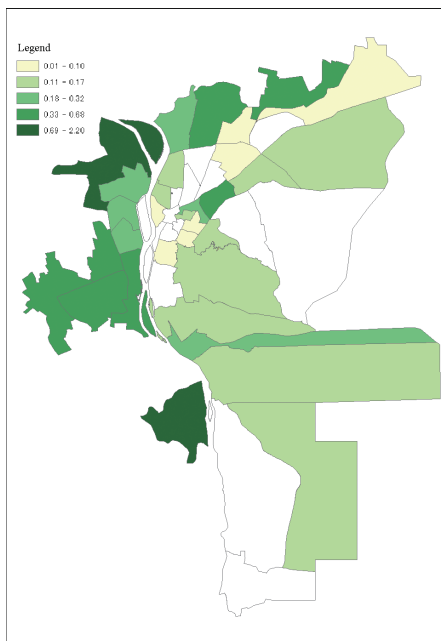
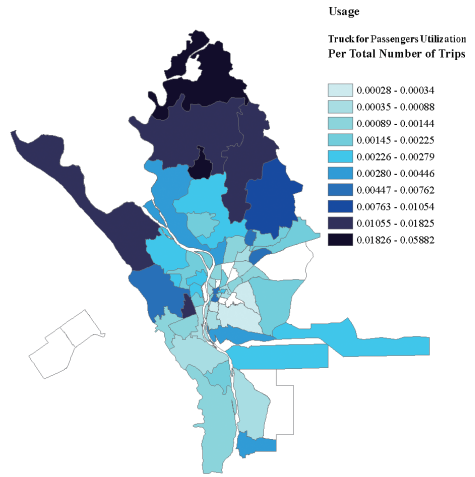Note: Based on the person trip data

Map 5   Ratio of farmers by *qism*

Note: Based on 1996 population census

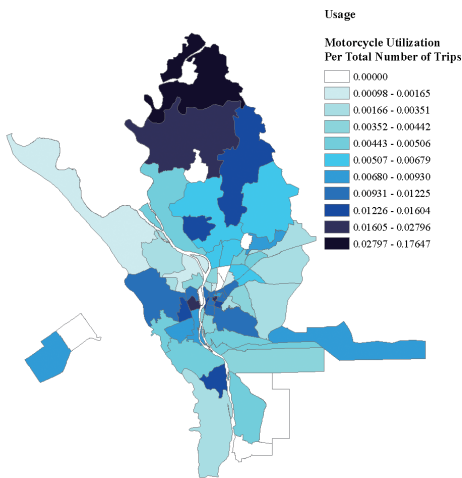**Map 6   Ratio of farmers by *qism***

Note: Based on the person trip data

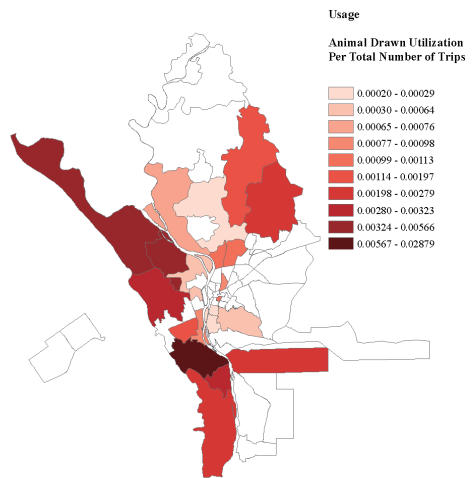**Map 7-1   Users of Shared taxi '(Serbis) in Greater Cairo**

Note: Based on the person trip data

Map 7-2   Users of trucks in Greater Cairo

Note: Based on the person trip data

Map 7-3   Users of motorcycles in Greater Cairo

Note: Based on the person trip data

Map 11   Ratio of the animal drawn by *qism*