

I-TWO REPORT 2010

**Public Attitudes to Climate Change and Travel Behavior
in Asian Cities:
Bangkok, Beijing, Kathmandu, and Tokyo**



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PREFACE

Global warming and climate change are important keywords in the discussion of environmental issues today, and have been recognized worldwide as global problems. The consensus is that the cause of these problems is the rapid increase in CO₂ emissions since the Industrial Revolution. The fundamental solution would be to control and thereby reduce such emissions. Transportation is one source of these emissions, and ways to reduce emissions from automotive transport are particularly sought after. Measures to address this problem are now being studied and implemented.

I. INTRODUCTION

1.1 Rationale and statement of the problem

It is clear that global warming is already under way, as evidenced by the scientific report issued by the IPCC⁽¹⁾ noting that global surface temperatures have increased since the middle of the 20th century and are likely to rise further during the 21st century. This rise was caused by increasing concentrations of greenhouse gases (GHG) resulting from human activity, mainly the burning of fossil fuels and deforestation. Transportation is one of the major sources of GHG, accounting for one-fifth of global energy-related CO₂ emissions.

While public transport and non-motorized transport modes (e.g. walking, bicycles, tricycles) are widely recognized as key to reducing GHG emissions in the transport sector, the challenging question of how to promote the use of public transport remains. Many factors influence personal decisions in the choice of a transport mode, including travel time and cost as well as comfort and reliability. The influence of such factors on travel choices differs in magnitude by individual, family, city, etc., and may also vary with culture, lifestyle, economic factors, and geography.

At present, global warming, the term for the effect of increased GHG emissions on the atmosphere, might be considered one travel choice factor. Travelers who are concerned about climate change issues might change their behavior by shifting to low-carbon transport modes or reducing unnecessary trips. However, these changes always relate to other factors. Therefore, the main research questions are as follows:

- What factors influence travelers' behavior (e.g. choice of traveling mode) and how do they vary in different cities in Asia?
- Is it possible to change travelers' behavior with respect to concerns about climate change?

The present study was conducted in order to survey public attitudes to climate change and travel behavior, comparing the three developing cities of Bangkok, Beijing and Kathmandu with Tokyo.

1.2 Objectives of the study

- To study factors influencing the use of private vehicles and public transport
- To compare travelers' attitudes to climate change to assess the possibility that travelers in Asian cities can change behavior toward low-carbon transport modes

(1) Intergovernmental Panel on Climate Change, <http://www.ipcc.ch/>

II. BACKGROUND OF STUDIED ASIAN CITIES



FIG 1. Locations of target Asian cities

In this research, we selected four Asian cities: Bangkok, Beijing, Kathmandu, and Tokyo, for comparative analysis under our objectives. FIG 1 and TABLE 1 show locations and basic information of research target cities. Details on these cities are as follows:

Bangkok

Bangkok is the capital and largest city in Thailand, covering 1,568.7 km². The city is the economic center of Thailand, home to the national stock exchange, the country's financial institutions, and more than 500 publicly traded companies. Tourism is also a significant component of the Thai economy, accounting for approximately 5 % of GDP.

Most of the city's population is made up of ethnic Thais, with expatriate Chinese forming the largest minority, complemented by more recent immigrants, mainly from neighboring countries. The structure of the Thai economy has led to a growing problem of income inequality, in which rural populations tend to have significantly lower incomes than their middle and upper class counterparts in Bangkok.

Many means of transportation are used in Bangkok. Its network of rivers and canals is trafficked by boat and ferry services. Elevated highways, re-developed intersections, and road and rail projects in various stages of completion can be found around the greater Bangkok area, but traffic jams remain commonplace due to widespread use of private vehicles. The public transport sector includes inner-city buses, the Sky Train monorail, MRT subway lines, taxis, and tuk-tuks. Suvarnabhumi Airport is Bangkok's international airport and one of the busiest hubs in Asia.

Beijing

Beijing, the metropolitan capital city of the People's Republic of China, is divided into 16 districts and two rural counties over an area of 16,807.8 km². The Beijing economy is increasingly post-industrial in character, with finance being one of its most important industries, contributing nearly 15 % of the city's GDP. In addition to serving as the seat of the national government and political system, Beijing is home to many financial, banking, and insurance firms, wholesale and retail sectors, and the regional tourism industry. The great majority of Beijing's citizenry belongs to the Han ethnic group, while Manchu, Hui, and Mongol ethnicities contribute significant minorities.

Beijing is the major transportation hub in northern China, crisscrossed by many railways, roads and motorways. Railway lines link Beijing with the other main cities of China, as well as destinations in Russia, Mongolia, Vietnam, and North Korea. The Beijing Subway has recently expanded to nine lines. Beijing is linked to all parts of China by roadways, including the five "ring" roads surrounding the city. There are hundreds of bus and trolley routes in the city. Taxis, both registered and unregistered, can be found throughout Beijing. Beijing's primary airport is Beijing Capital International Airport, which is serviced by both domestic and international routes.

Kathmandu

Kathmandu is the capital and largest city of the Federal Democratic Republic of Nepal, as well as its industrial and commercial center. The city has the most developed infrastructure in predominantly rural Nepal. Exports, such as handi-crafts, garments, carpets, cashmere, and locally manufactured paper account for 21 % of GDP, while manufacturing accounts for 19 %. Agriculture, education, transport, and tourism are also important. Per capita income is low at just US\$ 400. The largest ethnic groups are Newars, followed by Tamangs and other ethnic groups.

The main transportation means in the valley are motorcycles, cars, buses, gas tempos, microvans, and taxis, and bicycle and pedestrian travel is common. There is no railway network. The only International Airport in Nepal, Trivuvan International Airport, is in Kathmandu.

Tokyo

The Tokyo metropolis is one of the 47 prefectures of Japan, with an area of 2,187.08 km² and the world’s largest metropolitan economy. The city is a major international finance center and serves as a national hub for industries including finance, transportation, publishing, and broadcasting, with tourism also playing a significant role in the local economy. Its location at the hub of the nation’s transportation network with extensive transportation infrastructure makes Tokyo highly accessible and networked. The population is predominantly Japanese, but the city has residents of many nationalities, including Chinese, Korean, Filipino, American, British, Brazilian, and French.

The Greater Tokyo Area is central to Japan’s domestic and international rail, ground, and air transportation networks. Trains and subways are dominant mode of public transportation within the city, with JR East operating the most extensive system of rail lines. In addition, there are both municipal and private bus and monorail routes that provide local, regional and nationwide services, with terminals at major railroad stations. Expressways also connect points in the metropolis with a national network of roads, highways and bridges. Taxis are also widely available in the city, and ferries service the many small islands incorporated into the greater metropolitan area. The Tokyo area has two major airports: Haneda International Airport, which offers mainly domestic flights, and Narita International Airport, in Chiba Prefecture, which is the major international travel hub in Japan.

	Bangkok Thailand	Beijing China	Kathmandu Nepal	Tokyo Japan
Elevation above sea level	2 m	43.5 m	1,400 m	5 m
GDP Per Capita (PPP)	US\$ 8,100 (est. 2009)	US\$ 6,600 (est. 2009)	US\$ 1,200 (est. 2009)	US\$ 32,600 (est. 2009)
Population	6,355,144 (January 2008)	8,614,000 (2006)	949,486 (2009)	12,790,000 (October 2007)
Population Density	6,450 people / km ²	11,500 people / km ²	13,225 people / km ²	5,655 people / km ²
Literacy Rate	92.6 %	97 %	77.11 %	99 %
Poverty	7 %	n/a	3.3 %	n/a

TABLE 1. Basic information on target Asian cities

III. METHODS

3.1 Survey design and data collection

We designed a questionnaire form to interview travelers in the four designated cities, Bangkok, Beijing, Kathmandu, and Tokyo, in order to meet the objectives of the research study. We randomly selected frequent travelers whose ages ranged from 20 to 40. The questionnaire was non-compulsory, and requests to participate in the survey were made only after prior consent was obtained. Versions of the questionnaire were produced in five languages in consideration of the languages primarily used in each city. Question topics included:

- Knowledge of climate change or global warming
- Daily trip information
- Main trip information (purpose, origin-destination, travel time, and cost)
- Available travel modes
- Factors in the choice of travel mode
- Personal attitudes
- Images of cars and public transportation
- Images of the environment and culture
- Personal information

As the sampling units were travelers in four cities, two main methods for collecting information were used. In Bangkok, Beijing, and Kathmandu we conducted face-to-face interviews, and in Tokyo participants received postal surveys. TABLE 2 shows the situation of survey in each city.

	Bangkok	Beijing	Kathmandu	Tokyo
Survey Period	Oct. – Dec. 2009	Oct. – Dec. 2009	Oct. – Dec. 2009	Oct. – Dec. 2009
Survey Method	-----	Face-to-face interview	-----	Postal survey
Sample	300	303	322	124

TABLE 2. Survey implementation in each city

3.2 Analysis method

The questionnaire survey results were aggregated using a common data format and the acquired data analyzed using ANCOVA and PCA.

ANCOVA (analysis of covariance) is a statistical test for the comparison of averages across multiple variables. Unlike the more commonly used ANOVA (analysis of variance), ANCOVA enables the correction of data bias through the use of covariate variables. As described below, in the current study, differences in sampling method and sample size between cities resulted in data bias. During the process of aggregating the basic data we also discovered bias between cities with regard to the number of respondents by sex and age range. We therefore elected to employ ANCOVA to reduce data bias.

PCA (Principal Component Analysis) is a data compression method that converts a number of possibly correlated variables into new measures called “principal components”. One advantage of this method is that compressing multiple related items along a new scale makes new interpretations possible. In this study, we created new measures for perception data using PCA and then applied them to ANCOVA comparisons between cities.

IV. RESULTS AND DISCUSSION

Below, we describe data obtained from our survey conducted in four cities, and a set of results from our analysis.

4.1 Respondent demographics

We begin with a brief description of respondent demographics. FIG 2 and FIG 3 provide statistics for gender and age. In Beijing, more than 60 % of respondents were female, but in general the gender sample was balanced in each city. In Beijing and Bangkok, we received data primarily from respondents aged 20 to 40. In Kathmandu, we also had a group aged 19 and under and were able to obtain data in general. In contrast, there were many respondents aged 50 and over in Tokyo, which showed a different age distribution than the above three cities. This demographic bias may reflect methodological differences. In Bangkok, Beijing and Kathmandu, we conducted face-to-face interviews, which allowed us to estimate age and gender directly from target respondents’ appearance and thereby to constrain our samples. In Tokyo, however, the survey was conducted by mail, making it impossible to employ such constraints in advance. Given these results, we used ANCOVA statistical analysis of the covariate gender and age data.

4.2 Understanding global warming and climate change

Here we describe the results of the responses to the question “Do you know about global warming and climate change?” in FIG 4. It is evident that there is a wide inter-city variation in responses. In Tokyo and Bangkok, the majority of respondents said that they were aware of global warming and climate change, with middling understanding of the phenomena. In Tokyo in particular, 25 % of respondents answered “Yes, I know well,” to this question, indicating a high level of understanding. In Beijing, around 70 % of respondents answered “Yes, I know a little,” or “Yes, I know it somewhat.” However, 30 % answered “No” to this question. In Kathmandu, 90 % of respondents answered either “No,” or “Yes, a little,” indicating no awareness or poor understanding of global warming and climate change.

Next, we used ANCOVA analysis to determine whether there were differences in the results from each city. It can be seen that the mean values from highest to lowest were Tokyo, Bangkok, Beijing, and Kathmandu⁽²⁾. These mean values revealed a statistically significant difference, taking 5 % as the significance threshold. The above statistically indicates that there are differences in the level of awareness of global warming and climate change in the cities surveyed. In summary, this question item “Do you know about Global Warming and Climate Change” showed a statistically significant difference in each city. Tokyo showed the highest level of awareness, followed by Bangkok, Beijing, and Kathmandu. Most Tokyo citizens have medium or strong understanding about global warming and climate change, while citizens of Kathmandu don’t know or have only low-level information. Bangkok and Beijing showed middle level awareness, but the level of awareness was more widely distributed in Beijing.



FIG 2. Gender

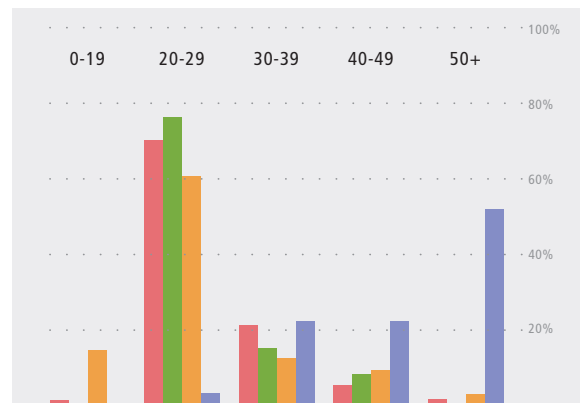


FIG 3. Age

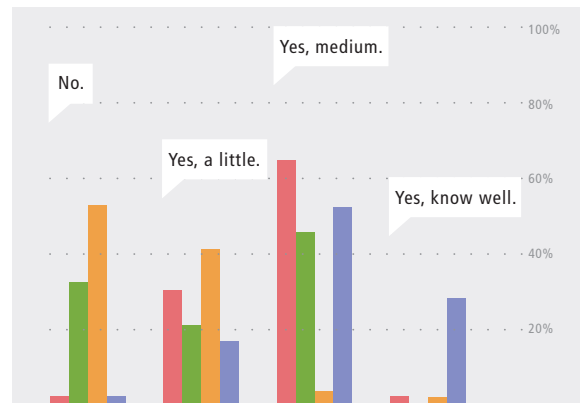


FIG 4. Do you know about ‘Climate Change’ or ‘Global Warming’?

(2) Mean values were generated using the following scoring system: “No. = 1” “Yes, a little. = 2” “Yes, medium. = 3” and “Yes, know well. = 4.”

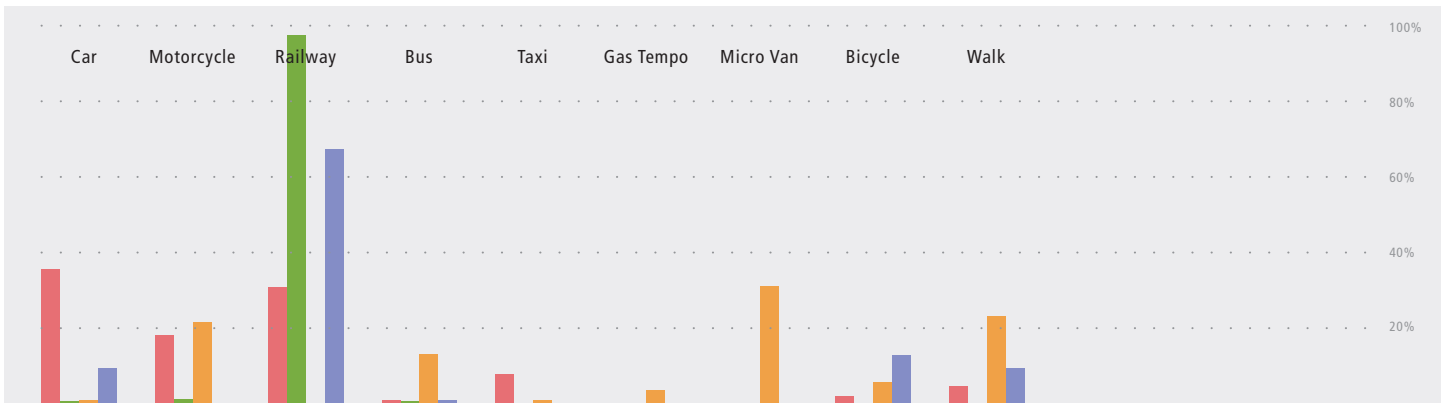


FIG 5. Transport mode

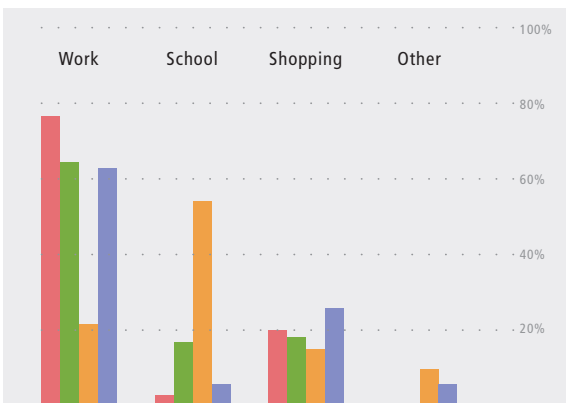


FIG 6. Trip purpose

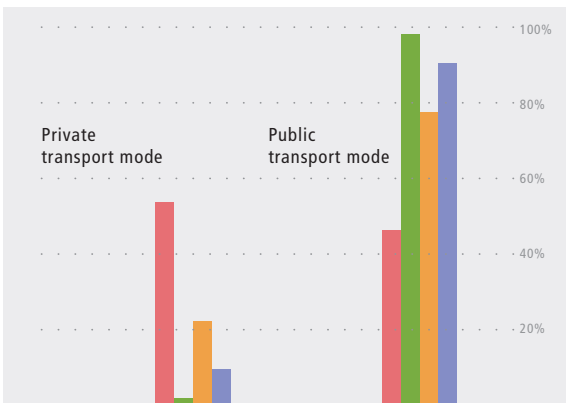


FIG 7. Private versus public

4.3 Trip purpose and choice of transport mode

In FIG 6 (Trip purpose) we aggregate data on respondents' purposes for travel. In Tokyo, Bangkok and Beijing, the most common response was commuting to work, while in Kathmandu, commuting to school was the most frequent answer. There was little inter-city difference for shopping and other trips. FIG 5 (Transport mode) shows the modes of transportation used by respondents. There is wide variation among the four cities in the modes of transportation used. In Tokyo, public transportation is common, with trains being the most frequent form. Car use was limited to around 10% of respondents. Bicycle use and walking were comparatively common. In Bangkok, private transportation such as by car or motorcycle accounted for around 50% of responses, the highest among the four cities surveyed. In Beijing, train use predominated, and public transit usage was very common. In Kathmandu, many respondents used small-scale ride-shares on gas tempos and microvans. As in Tokyo, bicycle use and pedestrian travel were common.

Regarding the differences in mode of public transportation, three factors: 1) level of public transportation development, 2) size of the metropolitan area, 3) individual demographics (such as trip purpose and income) can be considered. Tokyo encompasses a relatively large metropolitan area and has a well-developed rapid train network. For these reasons, trains are frequently used for commuting to work while shorter distances, such as for shopping, are traveled by car, bicycle or on foot. In Bangkok, the rail network is less well-developed than the road network, and rail travel is relatively expensive compared to travel by car or motorcycle, resulting in higher use of private transport. There has been active development of new subway lines in Beijing in recent years and train fares are extremely low, making rail travel a greater popular choice. In Kathmandu, there is no rail system and unique alternatives such as gas tempos and microvans provide low-cost public transportation. Automobiles are expensive and uncommon, and motorcycles are the most common form of private transport. The city itself is small, resulting in the use of modes of transport suited to short and medium distance travel.

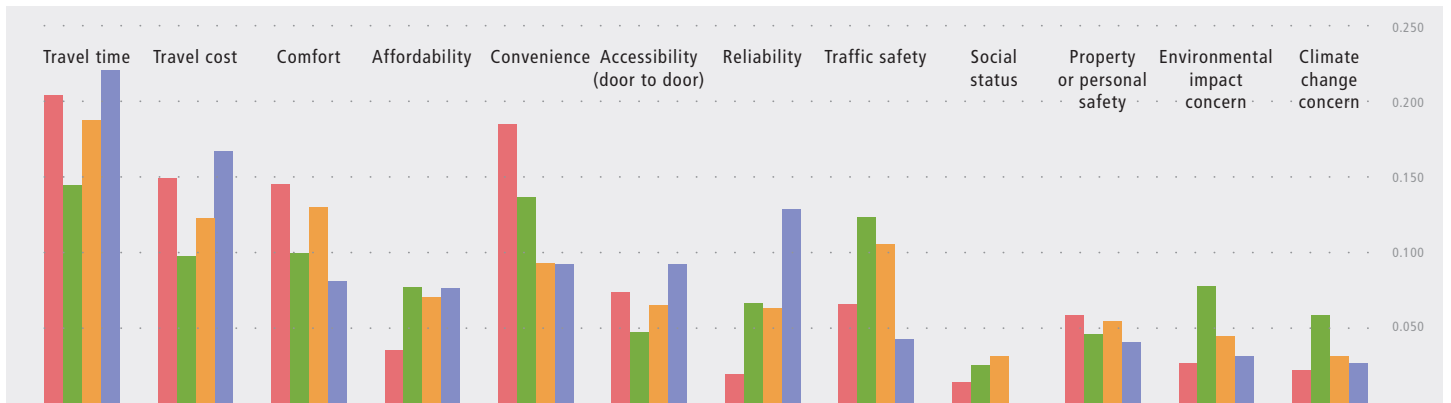


FIG 8. Choice factors

4.4 Factors in choice of transport mode

FIG 8 (Choice factors) shows factors that influence choice of mode of transportation. Respondents were asked to select factors that influenced their decisions and rank them by importance. The figure shows only items ranked 1 to 5. In each city, the items travel time, travel cost, comfort, and convenience were all highly rated. However, the survey also revealed unique characteristics for each city. In Tokyo, reliability was the third most important factor, while in Bangkok convenience was second, higher even than travel cost. In Beijing, traffic safety was highly ranked, as were factors reflecting environmental issues; environmental impact concerns and climate change concern were comparatively higher than in other cities. In Kathmandu, as in Beijing, traffic safety ranked high. Issues relating to time and costs were common choice factors in all cities, in line with findings from travel behavior theory. In contrast, factors relating to quality of transportation and safety showed some variability. This may reflect awareness of the transportation infrastructure and traffic rules. In Tokyo, for example, train and automobile networks are sufficiently organized and safe and quality of transportation was ranked correspondingly high.

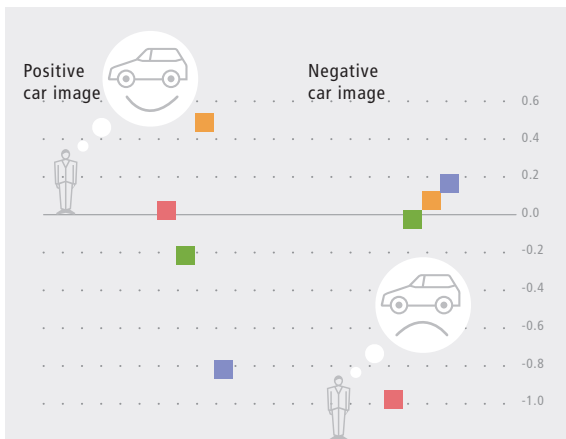


FIG 9. Image of cars

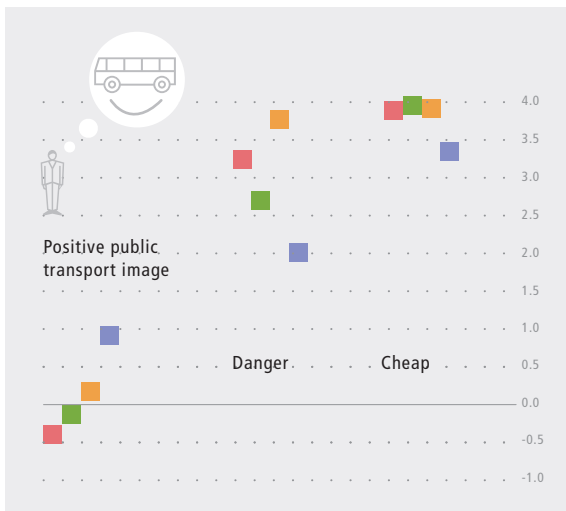


FIG 10. Image of public transport

4.5 Image of cars

Our data used seven image categories relating to automobiles; for each image, respondents were asked to choose one of five responses ranked by degree of agreement⁽³⁾.

We conducted a comparative analysis of the results using new image coordinates for automobiles calculated using PCA. We named the coordinates “positive image of cars” and “negative image of cars.” ANCOVA validation found a statistical difference for both coordinates at a significance threshold of 5%

A look at the mean scores in “positive image of cars” shows a positive score for Kathmandu, near-zero for Bangkok, and negative values for Tokyo and Beijing. A positive score suggests a background of positive images of automobiles, while a negative score suggests the opposite. It should be noted that “good for the environment” is seemingly paradoxically included in the items for “positive image of cars.”

Tokyo showed a positive result for “negative image of cars,” whereas Beijing and Kathmandu were near-zero, and Bangkok was negative. As above, a positive score indicates a general negative image of cars, and vice versa.

4.6 Image of public transportation

ANCOVA revealed a statistically significant difference across cities for all criteria, give a significance threshold of 5%.

A look at the mean scores shows a positive score for Tokyo and near-zero but positive for Kathmandu. Bangkok shows a negative mean while Beijing is near zero but also negative. These results suggest that Tokyo and Kathmandu have generally favorable images of public transportation while Beijing and Bangkok hold more negative images. Kathmandu and Beijing were both near zero, although with opposite valences, suggesting they are close to neutral on this issue. Regarding danger, Bangkok and Kathmandu both showed high mean values, suggesting they do not view public transportation as particularly safe. This may be due to the inclusion of on-road modes of public transportation in the scope of the question.

In low cost, Tokyo’s mean value was somewhat low but in all cities the overall image was that public transportation is less expensive.

- (3) Specifically, responses were categorized as: Totally disagree=1, Disagree=2, No idea=3, Agree=4, Strongly agree=5.
- (4) The values for principal components obtained through PCA differ from the base values. This is due to the differences in weight attributed to question items by individuals, which can give rise to positive values.
- (5) Note that “Positive image” includes multiple items, whereas Danger and Cost include only one each.

V. CONCLUSION

In this study, we present some of the findings from I-TWO activities focused on climate change and transportation behaviors. One important feature of this study is its survey and analysis of four major Asian cities (Bangkok, Beijing, Kathmandu, and Tokyo) in project member home countries. Such comparative analyses of cities in different countries are uncommon, enabling us to generate new research results.

There were three main findings from our calculations and statistical analysis:

- A Levels of awareness of global warming and climate change vary in different cities.
- B There are differences in the modes of transport used in each region. Time and expense are important factors in the choice of transport mode in all cities, while differences were seen in the importance of quality of transportation and safety.
- C There was a tendency for different cities to hold different images of automotive and public transportation. Kathmandu had a more positive image of cars than did any other city, whereas Tokyo did not have a positive image of cars. Bangkok did not show awareness of items considered dangerous in other cities. With respect to public transportation, Tokyo had an overall positive image, while Bangkok generally did not.

Analysis of the above results reveals that a country's developmental stage, meaning its degree of industrialization and economic development, provides a means of approaching the data. Specifically, the advance of motorization that accompanies development also generates environmental issues. Regarding the content in (C), the data analysis indicates that in Japan, cars are regarded negatively but public transportation is regarded positively (less danger and less expensive). On the other hand, in other cities the tendency is reversed, that is, cars are regarded positively but public transportation negatively. This may be a result of the fact that Tokyo has a longer history of motorization than the other cities. That is, since people in Tokyo are accustomed to using cars, cars are no longer "something new," while people in other cities are less accustomed to using cars, which are still "something new." In addition, the level of public transportation service may cause differences in the images between countries. That is, the level of public transport service in Tokyo is higher than in the other cities. Analysis of the data presented in (A) indicates that Tokyo residents show a comparatively higher level of awareness about global warming and environmental issues than those in other cities. This can be traced in part to environmental issues such as air and water pollution that affected the area during the period of rapid industrialization from the mid-1950s through 60s. At that time, environmental pollution in Japan had detrimental effects on resident's lives and it was regarded as a serious social issue directly related to the general public in Japan. The government developed regulations and improved controls and environmental issues were introduced widely into school curricula. This background may be the reason for the higher levels of awareness. If we look at the levels of awareness in all of the cities surveyed, we see that, in descending order, they were Tokyo, Bangkok, Beijing and Kathmandu, suggestively mirroring the order of each city's developmental history.

We outline the main findings of the study below:

1. Awareness of climate change varied from city to city; the order from highest to lowest was Tokyo, Bangkok, Beijing, and Kathmandu. This may reflect their respective developmental histories.
2. Auto and motorcycle usage exceeded 50% in Bangkok, while in Kathmandu it was around 20%, and in Tokyo around 10%. In Beijing, nearly all travel was by rail (subway), the result of massive rail infrastructure development.
3. Travel time, cost, and convenience were major factors in selection of mode of transport in all cities.
4. Different cities placed different emphases on other factors: in Tokyo reliability was important, Bangkok gave priority to comfort, while in Beijing and Kathmandu traffic safety was an important factor.
5. The choice of modes of transport and the reasons cited as selection factors may be related to the size of the urban areas (the Tokyo metropolitan area, with Tokyo Station at its center, is about 70 km across), the developmental state of public transportation (Kathmandu, for example, has no rail system), and geographical and climatological factors (Bangkok is extremely hot and humid, while Beijing has severely cold winters).
6. In Tokyo, public transport is regarded positively. But having experienced advanced motorization and environmental problems, private vehicles are seen more negatively than in other cities.

In order for the results of this survey to achieve social relevance, it will be necessary that they be subjected to further analysis and consideration. In particular, the analyses of public image with respect to private vehicles and public transportation have not been sufficiently considered. With respect to this issue, we hope to integrate insufficiently considered aspects such as differences in urban structure, cultural consciousness, and awareness of environmental issues into our analysis so as to develop a deeper understanding. Comparison of findings from regional history and cultural anthropology may also provide important insights. Comprehensive, multi-faceted analyses and interpretations will continue to be issues for the future.

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This report documents the results of the survey “Public Attitudes to Climate Change and Travel Behavior in Asian Cities: Bangkok, Beijing, Kathmandu and Tokyo” conducted by the members of the I-TWO Project. This study includes interpretations and views developed by project members based on statistical analyses. We would be delighted to hear readers’ comments on these viewpoints as a means of helping IATSS to develop even better analyses and understanding of the issues.

ABOUT I-TWO

The International and Interdisciplinary Transportation Workshop for Young Researchers (I-TWO) is an IATSS activity launched in 2009. I-TWO brings together a group of young researchers selected from various fields to intensively discuss specific transportation-related issues that have broad impact. The topic selected for this first edition was “Global Warming and Transportation.”

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