

## COMPLETION REPORT

Strategic Design and Tactical Management for Metropolitan Public Bike Sharing Systems

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In a bike sharing system, public bikes are allocated in unmanned rental sites that are distributed in metropolitan areas so that people can rent, ride, and return bikes between rental sites. Such a system utilizes the public transportation assets and resources more effectively, reduces the number of fueled vehicles, carbon emission, traffic congestion, and noise, and improves the health of commuters and trend of LOHAS. This project calculates the best locations for installing rental sites, as well as number of bikes and empty racks to be installed at each site. We can also provide guidelines based on scientific and quantitative analysis for repositioning bikes among rental sites to reduce the number of customers encountering no bikes to rent or no empty racks to return bikes. We have also shared our knowledge and technology for helping a few bike sharing systems in Taiwan and Japan to improve their service, which may help promote the popularity of bike sharing systems in both countries.

In particular, we have used the GIS data to design mathematical formulation and solution approaches that identify potential locations for installing rental sites of bike sharing system in a city. Given the estimates on the attractiveness for each "hot spot" which represents popular places such as train or bus stations, hotels, and scenic spots, we can calculate how good a given set of candidate locations is, and visualize it on Google Map. We have interviewed YouBike in Taipei and C-bike in Kaohsiung for several times. By this moment, YouBike has the highest daily turn-around rate (up to 12 rentals per bike) worldwide on the usage of bikes. We also learned from C-bike on their first-hand experience in encouraging ridership of MRT transferred from the bike users.

During the one and half year of the project period, we have done 3 trips to Japan, each time about 7-10 days. We have visited and interviewed the staff of community bikes in the following cities: Sapporo, Sendai, Tokyo Kotoku, Yokohama, Toyama, Kanazawa, Kyoto, Okayama, and Kitakyushu. These systems are much smaller, compared with YouBike or C-bike. Limited budget and strategic conservatism are the major reasons why such a system cannot be enlarged to succeed in Japan, from our point of view. We have successfully exchanged the more successful experiences in bike sharing systems at Taiwan to those staff that run such systems at Japan. We also helped to bridge a visit of Tokyo Metro to the Kaohsiung Rapid Transit Co. for building up collaboration relationship. In addition, we have published a journal paper, 4 international conference talks, and 2 university talks.

From our point of view, based on the successful experience of YouBike and C-bike in Taiwan, we recommend Japan to strengthen the following issues, if possible, for further improving their community bike systems:

1. The government should provide more support to the system. An important key to the success of YouBike and C-bike lies in the full support of the local government to enlarge the economies of scale. In particular, this system relies on a “positive feedback” in that more rental sites/bikes/racks attract more users. If the system is not sufficiently large, it goes to a “negative feedback” and results in fewer users. In Taiwan, the local government helps to obtain lands and budgets for building new rental sites, whereas in Japan we see very little help came from the government. Part of the reason is due to the conservatism of policy makers in Japan.
2. Better integration of different transportation parties: another key issue is that local bus or taxi companies may treat community bikes as their “enemy”. Again, this requires better integration of policy makers, local governments, and different transportation companies. A better integration of these different transportation modes will help compensate the first and last mile of users. Take the C-bike for example, Kaohsiung RT Co. has given a discount bonus for C-bike users who transfer to MRT before or after their bike rentals. This has helped promote up to 30% more bike users to use MRT. Similar integration actions can be taken to make a win-win situation for multi-transportation parties and users.

#### Publication of the Results of Research Project:

Verbal Presentation (Date, Venue, Name of Conference, Title of Presentation, Presenter, etc.)

1. Wang, I.-L., 2013 Apr., Optimal Vehicle Deployment for Public Electrical Scooter Sharing Systems, **2013 International Conference on e-Commerce, e-Administration, e-Society, e-Education, and e-Technology (e-CASE & e-Tech 2013)**, Kitakyushu, Japan.
2. Wang, I.-L., C.-W. Wang, 2013 Aug., Analyzing Bike Repositioning Strategies based on Simulations for Public Bike Sharing Systems, **1st ACIS International Symposium on Applied Computing & Information Technology (ACIT 2013)**, Matsue, Japan.
3. Wang, I.-L., 2013 Oct., On Deploying Vehicles for Public Electrical Scooter Sharing Systems, **INFORMS Annual Meeting (INFORMS 2013)**, Minneapolis, MN, USA.
4. Wang, I.-L., 2014 Apr., On simulating the effects of information sharing for the bike sharing systems, **2014 International Conference on e-Commerce, e-Administration, e-Society, e-Education, and e-Technology (e-CASE & e-Tech 2014)**, Nagoya, Japan.

Thesis (Name of Journal and its Date, Title and Author of Thesis, etc.)

N/A

Book (Publisher and Date of the Book, Title and Author of the Book, etc.)

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