

Mori Fund Research Achievement Report 2013

Title of research project: Assessment of Current Situation and Future Outlooks for Household Waste Classification in Shenzhen, China

Name of the researcher: Qiming Qin

Affiliation: EI course, EG program, Graduate School of Media and Governance

Key words: smart cities; household classification; urban management system; sensorized garbage containers.

1. Introduction

1.1. Study Background

Urban modes of city have been developed by mankind's consistent endeavor of exploring. City, as a major style of residential environment, has been endowed new concepts ever emerged in the history. 'Garden city' in the Athinai Charte in 1933, 'Eco city' of sustainable development proposed in Machu Pichu Declaration in 1977, 'Digital city' in late 20th century and in recent years the latest conception 'Smart city' emerged, all these ideas enriched the contents of urban development and significantly affected the development direction of urban mode.

Smart city was pushed forward with the hot tides of combining IT technologies and protection of environment. Shenzhen is a digital city with the first digital urban management system in China and it is the first special economic zone in China as well. Due to the rapid economic growth, the issue of household waste disposal is getting severe.

The number of household waste generation in Shenzhen has reached 14,420 tons per day. At the current rate of increase, the city is expected to produce more than 17,800 tons of domestic waste a day by 2015.

The first round promotion of garbage classification was in the year of 2000. However, the city's campaign for garbage classification was mostly a failure. Then the city restarted the second round in 2012. It started from Futian District, one of the central districts in Shenzhen, with 500 points. A new department affiliated to Shenzhen Urban Management Bureau called Shenzhen Household Waste Classification Transaction Management Center was founded.

Shenzhen City

Shenzhen is a major city in the south of southern China's Guangdong Province, situated immediately north of HongKong. The area became China's first Special Economic Zones. It currently holds sub-provincial administrative status, with

powers slightly less than a province. The green coverage in Shenzhen is over 50%. Statistics have shown that the energy and power consumption of ten thousand yuan GDP in Shenzhen has fallen by 4.25% and 2.12% respectively. These statistics show that the green economy in the city is developing with great momentum.

Shenzhen has become the first city in China that has a digital urban management system by City Urban Administration and Law Enforcement Bureau. The system has been successful in integrating multiple high-tech technologies into one application, including 3S technologies, namely, GIS (Geographic Information System), GPS (Global Positioning System) and RS (Remote Sensing), CTI (Computer Telephony Integration) and DRTS (Digital Trunking System). Figuratively speaking, the so-called digital urban management is dividing nearly 2,000 square kilometers of land in Shenzhen into 633 management grids, and the city recruit about 2000 information collection staff to do daily inspections, each grid by two information collection staffs. The information collection staffs send reports to Surveillance Centre via GPRS wireless transmission. Currently, the city has 21 departments, 8 Districts, 57 sub-district offices, more than 1,500 enterprises and institutions involved in the collaborative disposal on the implementation aspects of urban management issues.

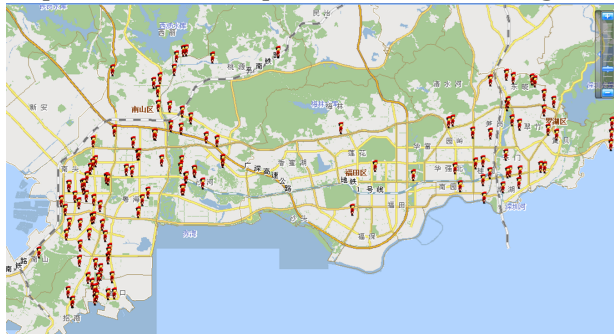


Figure 4: Overview of Digital Urban Management System (Source: Introduction of Digital Urban Management System in Shenzhen)

According to the urban development in Shenzhen, it can be concluded that Shenzhen has great potential to evolve into a smart city, since it is making progress to the way of an eco-city and digital city.

1.2. Research Questions

Shenzhen government has decided to stage a comeback after going through the failure of first promotion of garbage classification. The functions of facilities are considered much better compared with the ones in 10 years ago. However, it is still uncertain that whether the second promotion will be successful or not. Thus, it raises research questions as follows:

1. What are the differences and improvement in terms of political and technical aspects done between this time and the first promotion of

- garbage classification in Shenzhen?
2. How is the current progress of promoting garbage classification, is it implemented as the plan scheduled?
 3. What are the potential problems of current system that probably challenge the result of promotion?
 4. What can be the possible solutions regarding to the problems found?

1.3. Research Objectives

The research questions draw forth the following research objectives:

1. Make assessment of current situation and figure out the causes for failure of garbage classification in Shenzhen.
2. Addressing to the problem of waste management recycling and shortcomings found in the current system, both of political and technical solutions are proposed in this research as possible solutions.

1.4. Research Aims

1. To develop more effective waste collection facilities.
2. Strengthen the social consciousness on garbage classification.
3. Technically and economically feasible to apply the sensorized waste collection containers
4. Organizational structure becomes more clear and efficient

2. Methodology

Qualitative research methods are used in this research:

1. Review of documents
 - a) Literature review on case studies in foreign countries
 - b) Government document about future planning on garbage classification
2. Observation
 - a) Observe the process of collecting and classifying garbage in study area
 - b) Data collection
3. Interviewing
 - a) Key information interviewing (related authorities)
Elite interviewing (technicians)
 - b) Focus-group interviewing (citizens, sanitation workers)
4. Questionnaires and Surveys
 - a) Progress and effectiveness of the promotion of garbage classification
 - b) Social consciousness on garbage classification increasing or

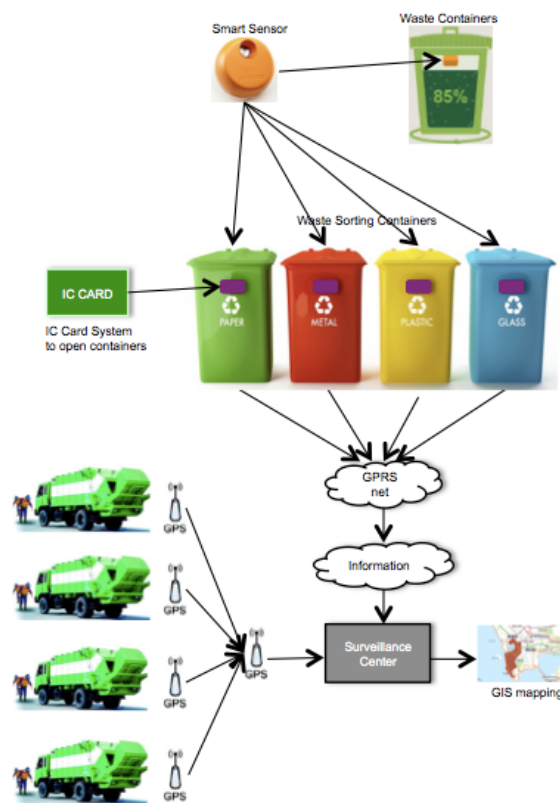
not

5. Data Analysis

- a) Sort collected data and summarize interview memos
- b) Conclude main causes of the past failure and current situation

3. Proposed Solution

A new type of sensorized waste collection containers will be applied in Shenzhen's Qianhai area by using Digital Urban Management System to collect garbage more wisely and contribute to waste sorting. The flow chart of the concept of sensorized waste collection containers:



As the diagram shows, it is real-time status monitoring with wireless sensor devices. We put it under the cap of each category of waste container. It detects the filling status of the waste and sends information to data center through GPRS. When the garbage containers become full, data center will send trucks on mission to go collect garbage separately according to classification, it allows staff to design the most efficient routes to collect. Also, IC card system will be established for residents in the community to swipe card with identities to open containers. It is going to record time by the IC card. If they throw in garbage properly, at the end of each month they can receive something in reward (e.g. shopping bags, garbage bags, or gain social credits, etc.).

4. References

Cristian, George. Roscia, Mariacristina. *Definition methodology for the smart cities model.*

Di Maria, Francesco. Micale, Caterina. *Impact of source segregation intensity of solid waste on fuel consumption and collection costs.*

M. Economopoulou. *A methodology for optimal MSW management, with an application in the waste transportation of Attica Region, Greece.*

Guerrero, Lilliana Abarca. Maas, Ger Hogland, William. *Solid waste management challenges for cities in developing countries.*

Karagiannidis, Avraam. *Waste to Energy: Opportunities and Challenges for Developing and Transition Economies.*

Leitão, Patrícia O. Marques, Manuel B. Dep, Phys. Porto, Inesc. *Reliability Of A Line-of-view Sensor For Recycling Point Waste Containers.*

Marcoux, M-a. Matias, M. Olivier, F. Keck, G. *Review and prospect of emerging contaminants in waste - Key issues and challenges linked to their presence in waste treatment schemes: General aspects and focus on nanoparticles.*

Takatsuki, Hiroshi. *Waste problems and our lifestyle.*

Vicentini, F. Giusti, A. Rovetta, A. Fan, X. He, Q. Zhu, M. Liu, B. *Sensorized waste collection container for content estimation and collection optimization.*

马诗院, 马建华. 我国城市生活垃圾分类收集现状及对策