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Analysis of the value chain and network structure of informal waste recycling in Beijing, China

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ABSTRACT

Despite the intensive efforts that the People's Republic of China has invested in the improvement of municipal solid waste management, Municipal Solid Waste collection is still heavily contested by the informal sector. These informal stakeholders divert recyclables such as waste metals, plastics, paper and glass out of municipal solid waste and sell these along informal trading networks for a living. This study aims to present a qualitative and quantitative description of the informal sector and its role in the collection of recyclables in Beijing. Via a semi-structured and -quantitative questionnaire survey among informal stakeholders we could ascertain daily individual collection quantities (kg/cap/day), thereby generated revenues and respective trading network and structures (informal recycling value chain) of informal stakeholders. The field survey identified three groups of informal collectors, namely Waste Pickers, Waste Merchants and Middle Men, who on average collect 16, 311, and 890 kg of recyclables per day and capita respectively, and achieve turn-over levels of 1200; 2500 and 5250 CNY per month. In order to explain the strong performance of the IS the approach of the old institutional economics has been chosen as analytical tool.

1. Introduction

The current waste management (WM) system in the People's Republic of China (PRC) has been shaped by two major institutional transformations, which the country has experienced in the last 60 years: The founding of the People's Republic in 1949 and the Reform and Opening process in 1978/9. The first of these transformational changes was characterised by the implementation of a socialist planning economy, whereas the second was marked by the evolution of the economic system from a planned economy towards an increasingly market-oriented economic system.

Since the late 1980s, this latter transformation process had induced major institutional, i.e. rule and regulation related, changes in as far as private entrepreneurship was allowed to flourish according to the forces of the market, while the government would from time to time intervene in and curtail market forces by means of legislation and ad-hoc policy measures that often enough allow a wide room for interpretation. In regard to the management of environmental challenges, such as the collection, treatment and disposal of municipal solid waste (MSW), the Chinese central and local governments currently practice an approach, which focuses on firm top-down coordination of stakeholders based on target indicators (Beijing Municipality, 2011) as well as governmental supervision and monitoring (Steuer et al., 2014; SWEPPL, 1995, 2004, 2013, 2015). In order to make such a waste management regime effective a high degree of civil cooperativeness via a set of legal sanctions and a sufficiently evolved institutional framework is required. At present China lacks a rule system, within which public and private stakeholders' rights, responsibilities and possibilities are fully clarified and allocated. Furthermore, the relatively dominant top-down command structure tends to exclude the non-conforming, bottom-up practices and organisational structures of the informal sector (IS), which adopts its own solutions to the MSW challenge.

The institutional clash between formal and informal institutional systems is especially visible in urban recyclable collection and pre-processing (cleaning, sorting and separation) of recyclables. The reason for this conflict is founded in the institutional shift of the reform and opening of 1978/9: Urban WM systems have been very well organised during the Maoist period (1949–1976), but following pro-market reforms in the 1980s these WM structures stemming from the planned economy were dismantled (Li, 2002). This can be analysed as results from two different development agendas: During the early period of the PRC sustainability strategies in WM were the result of scarce resources. For example,

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the government promoted concepts of "reduce" and "re-use", so as to alleviated the demand for primary resources from consumer and light industries (Laepple, 2007). Therefore most urban areas had official recycling depots deployed in nearly every city block: These depots fulfilled the function of stationary take-back points, where wastes were collected – recyclables were delivered by residents or by state employed collectors – and then either repaired or prepared for transport to places for refurbishment or further treatment (Zhang and Wen, 2014; Li, 2002). What may be seen as early efforts towards sustainability was bound to change in the course of reforms during the 1980s. Municipal governments deprioritised waste collection and recycling, and shifted respective budgets to increasingly support commercial activities that were expected to foster economic growth—the primary task set forth by the reformist government. Not only were budgetary means drawn out of the waste management system, also the physical infrastructure was affected: The thriving of urban commercial and business activities required an ever growing demand for space and infrastructure, which in turn led to the relocation of recycling depots away from city centres to more suburban areas (Tong and Tao, 2016). This made it less convenient for people to dispose of their waste personally at the recycling depots, which in many cases had stopped their collection service (Li, 2002; FON, 2011). These developments show that the economic transformation has come at the cost of the formal WM system and thus earlier efforts to achieve sustainability: WM was seen as a negligible element on the path towards economic growth.

Within this institutional void that arose from the demise of formal WM structures, a new, informal waste collection system gradually emerged. Here again its origins are the result of institutional change: Firstly, de-collectivisation in agriculture forced surplus rural labour to migrate into the cities in search of a higher income. Apart from poorly formalised employment in industry, services and construction a part of these migrant workers also engaged in MSW collection and trade to make a living. Secondly, this newly constituted segment in parts emulated former formal institutions and in parts devised new rule-based mechanisms to collect and pre-process recyclables: Informal waste collectors established door-to-door collection structures similar to the earlier formal structures and also built-up their own recycling depots in- and outside of urban areas (Tong and Tao, 2016). Unfortunately very little is known on whether there is a similar informal system in China's rural areas. Thirdly, the public (official, "formal") sector that is commonly responsible for WM seemed to welcome the IS as it could economise on respective budgets (Zhao, 2013). Given these institutional circumstances, the IS began to play an increasingly important role in the collection, pre-processing and recycling of recyclables in many Chinese cities.

Despite its strong presence and respectively generated institutional structures very little has been so far explained about the performance in collection and exchange of recyclables of the IS. Preceding research on urban WEEE collection in Chinese cities indicates that the IS collects approximately 60% of the quantities generated at the household level (Salhofer et al., 2015) and that it does so by employing its specific rule systems (Steuer, 2016). In order to fill this gap for the broader field of MSW, a case study was conducted so as to capture the magnitude of informal waste collection and respectively generated revenue for the district of Haidian in Beijing. The case study aimed to identify and analyse the institutional value chain along informal waste collection and pre-processing (separation, sorting and cleaning). We also intended to interview informal waste collectors and traders in order to gain quantitative as well as qualitative information (e.g., collected quantities and types of recyclables, net income generated, involved stakeholders, network etc.). For this purpose a questionnaire survey and field observations were conducted in Haidian so as to answer the following key questions: Which institutional, i.e. rule-based, practices are adopted by the IS in WM to collect and trade recyclables? Which stakeholder groups are engaged in the collection of recyclables from household waste (HW) and how does is their network structure organised? What are the average volumes of recyclables collected and transacted by individual stakeholders? Which revenue can be yielded from collection and selling recyclables by individual stakeholders? With the help of the quantitative results derived from these key questions, the following sections will discuss the institutional, i.e. rule-based, underpinnings that buttress the performance of the IS.

2. Material and methods

The first step of the survey was to identify the existing informal collection and transaction systems as well as the involved stakeholder groups and stakeholders operating in Beijing. Therefore, preliminary field observations and interviews with the help of Ms Zhou Yanfgang and researchers from the Beijing Institute of Petrochemical Technology (BIPT) were conducted in the city's Haidian district in 2013 prior to developing and conducting guided interviews. In advance, informal communications with officials responsible for WM in China have been conducted so as to clarify whether official permissions were needed. Haidian was chosen due to its specific geographical nature, as it stretches from the densely populated centre of Beijing to the less populated urban fringe. In addition, this district offers a variety of household types representing different levels of income that consequently influence waste generation and composition.

The first preparatory step for the field research was to delineate the entire district (548.8 km^2, 3.28 Mio. inhabitants (Demographia.com, 2010)) and choose a reasonable sample size for the questionnaire survey. Thereby 8 of the 29 sub-districts of Haidian were selected through a stratification of the sample based on the population densities of each sub-district. The respective criteria followed two sample stratification approaches: The population density of Haidian was divided into three strata or so-called quartiles, whereby 50 % (population densities) are within the 2nd quartile ("interquartile range"), and another 50 % of data are equally split into the 1 st quartile ("lower range") and 3rd quartile ("upper range") (see Table 1). From these three quartiles, 8 sub-districts were chosen for sampling, out of which two sub-districts were chosen from the 1 st quartile ("lower range"), four sub-districts from the 2nd quartile ("interquartile range"), and two sub-districts again from the 3rd quartile ("upper range"). This stratification approach is also depicted in Table 1 and the location of the selected sub-districts is illustrated in Fig. 1.

The subsequent step was to identify the location of points, where recyclables are exchanged between informal stakeholders, i.e. collectors and Middle Men (waste traders) (see Fig. 2). Via preliminary field observations and interviews with informal stakeholders the authors verified the location of so-called Trading Points (TPs), where recyclables are exchanged for money. These TPs were documented in terms of size and location and then taken as a proxy for informal waste collection and trading activities: We assumed that the higher the number of TPs in a specific area, the more informal collectors would be active in that area. In the course of preliminary observations this assumption proved to be correct and thus helped to focus on specific areas for the dissemination of questionnaires, so as to obtain a sufficient turnout of valid responses from informal stakeholders. The questionnaire itself is structured along Key Performance Indicators (KPI) for urban informal collection of MSW, which addresses size, collected daily quantities as well as income and employment levels of the informal sector