Food Waste Research in China:  
Motivation, Field Study and Preliminary Results

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Motivation and Background

Food Waste: A Worldwide Issue

♦ FAO: Globally, 1.3bt food (1/3 of total food produced) wasted per year, in which 0.67bt by developed countries and 0.63bt by developing one.

Huge cost of resources and environment: 1.4bha farmland (23%-30% of the total), 23% fertilizer wasted, and 3.3bt GHG. Direct economic lose per year 750bm dollar.
A remarkable success in the past decades...

However, costs (econ. and environ.) of production growth are rising. → **Food loss and food waste** throughout the supply chain must be taken into account (Liu et.al 2013 *Nature*)…
Motivation and Background

- Food demand increasingly, but the production inputs reaching the limit, food increase very hard

In 2010:
- Sown area of grain crops: 110mha.
- Total grain output: 550mt
- Fertilizer: 55.6mt
- Irrigation water: 370.7bm3
- Agr-electric: 96.6bkw
- Ari-plastic: 1.40mt
- Pesticide: 1.25mt
- 农业机械总动力: 9.3亿千瓦

Food waste reduction: an important way for China’s food security

(source: china statistic data and FAO)
Motivation and Background

- Huge lose and waste of grain in whole supply chain

From field to table: grain lost and wasted 67.5mt, 11% of total grain output, 12.55mha farmland wasted

Data source: state administration of grain in 2014
Motivation and Background

Food waste: very popular in city catering

Quantity of wasted food in catering in the provincial capital cities (left) and the food wasted per capita (right)

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Note: Provincial capital cities refer to Beijing, Chengdu, Cheng, 2012, and cities with a high number of tourists such as Beijing and Tibet are included in the calculation of provincial capital cities.
Motivation and Background

- Food waste: huge resources and inputs wasted and severe environmental pressure besides the food security.

Food surplus%

Food waste dwindling: Save huge resources and huge environmental benefit.

Food surplus

(Jun Tai et al., 2011)
Population increase, urbanization, Industrialization

Consumption

production

Rural reform
policy
water/land
Fertilizer....
Energy, variety

Food waste

proc store trans Har v

?
Food waste in China: special characteristics

- **Food culture**: long history, diverse cuisines, local resources
- **Save food & save face**: a cultural conflict
- **Official/Business and private (birthday or wedding) banquet** with more waste
- **Food waste at consumption stage** appears more serious
- **Food byproducts efficiently used** (e.g., bones, blood, heads, internal organs…)
How much do we waste? Data, data, data!

Little information for developing countries (incl. China), many data out of date;

FAO report: China aggregated with Japan and South Korea in “Industrialized Asia”;

Dramatic lifestyle changes in a fast urbanizing and industrializing China…

→ we need more primary data collection!

Source: FAO
Focusing on away-from-home food waste in urban China, including:

- Large-scale surveys (10,000 tables) in Lhasa and Beijing (IGSNRR, AII, CCAP)
- **Patterns, impact factors, and policy implication** (IGSNRR; CCAP)
- **Resource and environmental impacts** (IGSNRR)
Field surveys and interviews for consumer stage (in 2013):

- **187 restaurants** had been investigated, large, middle, small, canteen and fast food
- **3833 samples (table)** had been collected
- Each sample includes two parts: **consumer questionnaire, weight of food waste generated.**
Survey- Step 1: Volunteers Training

including: survey process, questionnaire, workload, etc.

The training in Beijing

Team capacity building activities of volunteers
Survey - Step 2: Manager and head chef interview
Survey—Step 3:
Customer interview and weighing of table food waste
Results: in Beijing’s urban catering sector

- About 80 gram per capita per meal food waste (raw food equivalent), vegetables—cereals---meat. Wasted rate 23.5% of the ordered food (including soup and oil...)

Food waste in the urban catering sector in Beijing, by food category (left) and absolute and relative amount per capita (right)

Source: Cheng Shengkui, et al., unpublished
Results: Comparison between Beijing and Lhasa

- Food waste per capita: in Beijing (75 g), in Lhasa (120 g),

- ...due to a higher share of tourists in Lhasa (tourist in Lhasa consumes, and wastes much more than those in Beijing).

Food consumption and waste patterns in Beijing and Lhasa

Food waste generated by tourists in Beijing and Lhasa

Source: Cheng Shengkui, et al., unpublished
Results: Estimation of food waste at schools: A case study in Beijing

- Around 131.5g/cap/meal food is wasted, nearly occupied 23% of total food supply: staple food (45%), vegetables (30%), meat (15%), others (10%).

- Scaled up to the whole Beijing city: 98.6 tons of food was wasted for each meal, cost ¥1.97 million.
Total food waste in urban catering sector in China

- No considering tourism consumption: about **12 million tons/year**
- Considering tourism consumption: about **14 million tons/year**.
- Taking use of the data—the kitchen waste production of provincial capital city (media reported): about **25-30 million tons/year**

Now the popular saying:

The food wasted in catering can **feed 2 billion people**—a little exaggerated, feeding **30-50 million people** more reliable.
Total catering EF of food waste is $294.5 \times 10^3 \text{ hm}^2$, nearly one fifth that of Beijing’s territory area, the largest contribution from meat (80%) and grain (7%).
Food production causes greenhouse gas emissions along the entire food supply chain and wasting food means that those emissions are produced in vain.
Total catering carbon footprint of food waste is $2.1 \times 10^6$ t CO2eq., with meat (49%), vegetables (25%), and grain (11%) contributing the most.
Results: Carbon Footprint—By chains (in Beijing)

- **Agricultural production 50%**
- **Catering consumption 40%**
- **Treatment of leftover 14%**
Results: Phosphorus footprint (in Beijing)

1.21 kt of P is embodied in these food wastes

- meat 43%
- vegetables 20%
- grain 17%
The next work

• In 2015: Beijing, Lhasa, Shanghai, and Chengdu.
• Database construction
• Methodology collaboration with University of Southern Denmark
• New projects funded EU Horizion 2020: 2015-2019, with 29 European partners (potential matching funding sought from Chinese Academy of Sciences)

… and welcome more collaboration from YOU!
Take-home messages

- Food loss and waste throughout the supply chain
- Food waste differences from different level cities, from different areas, from urban and rural, from catering restaurant and household
- First-hand data and quantitative research
- Supporting policy-making and arousing public saving awareness.
Thank you for your attention!