



Food Safety and Regulatory Measures, August 17-19

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

Shengkui Cheng

Institute of Geographical Sciences and Natural Resources Research (IGSNRR),

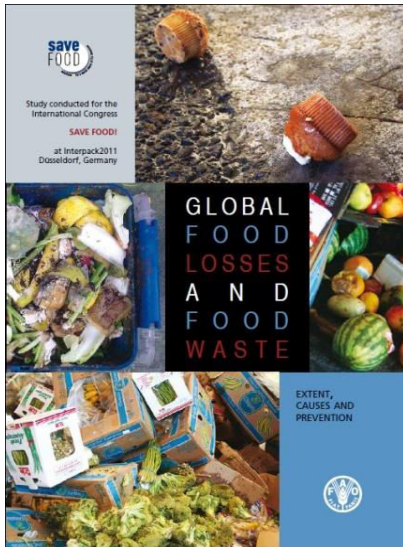
Chinese Academy of Sciences (CAS), Beijing, China

chengsk@igsnrr.ac.cn

August 17 , 2015, Birmingham, UK

Motivation and Background

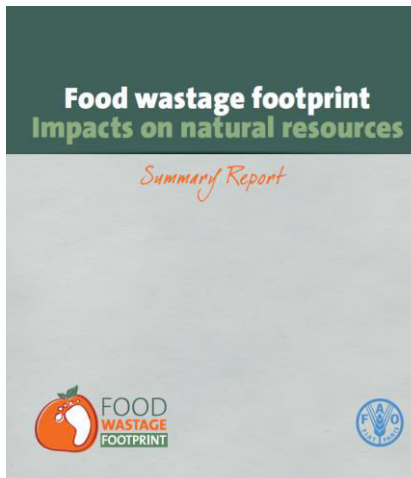
■ Food Waste: A Worldwide Issue



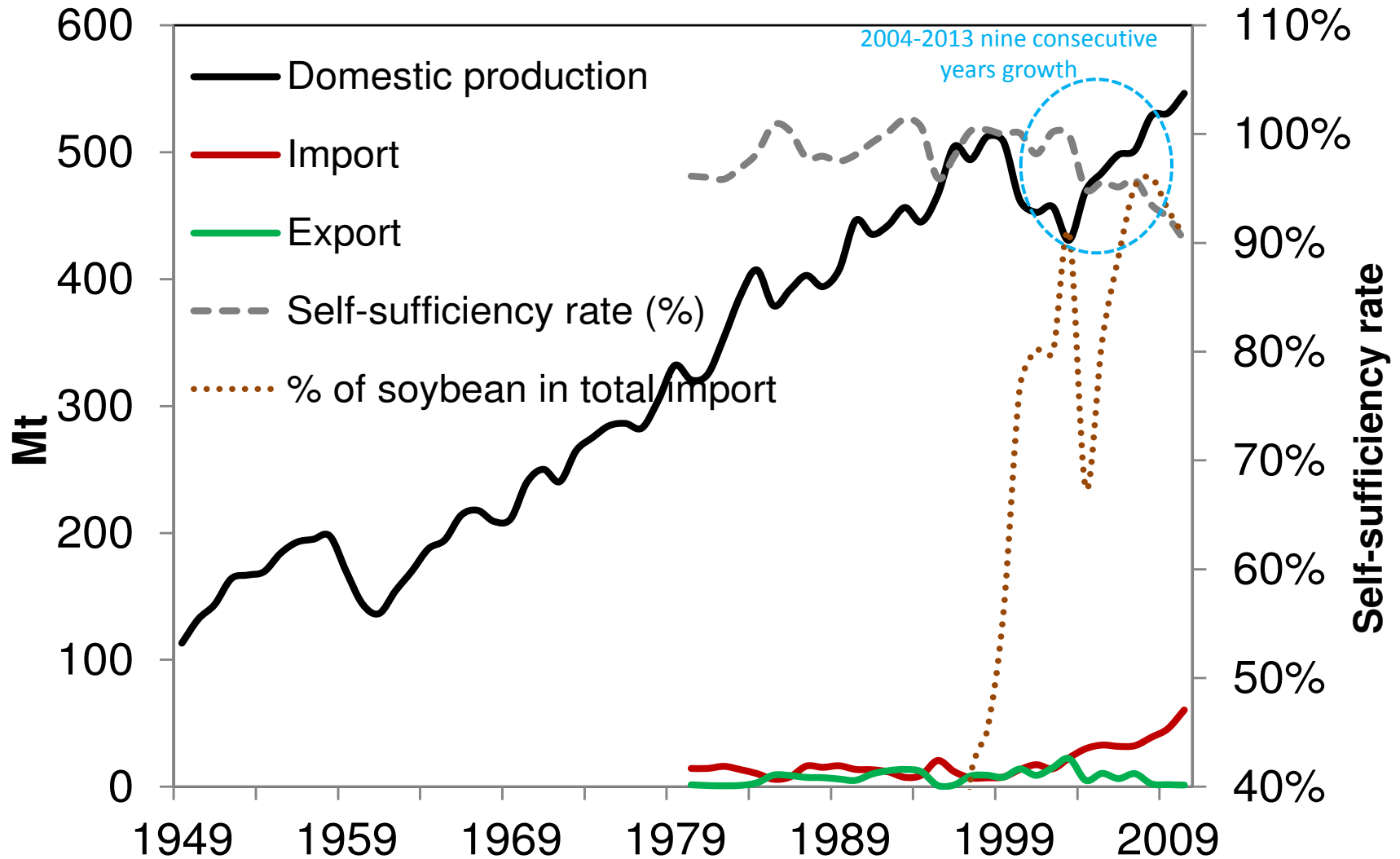
◆ **FAO: Globally, 1.3bt food(1/3 of total food produced)wasted per year, in which 0.67bt by developed countries and 0.63bt by developing one.**

■ **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

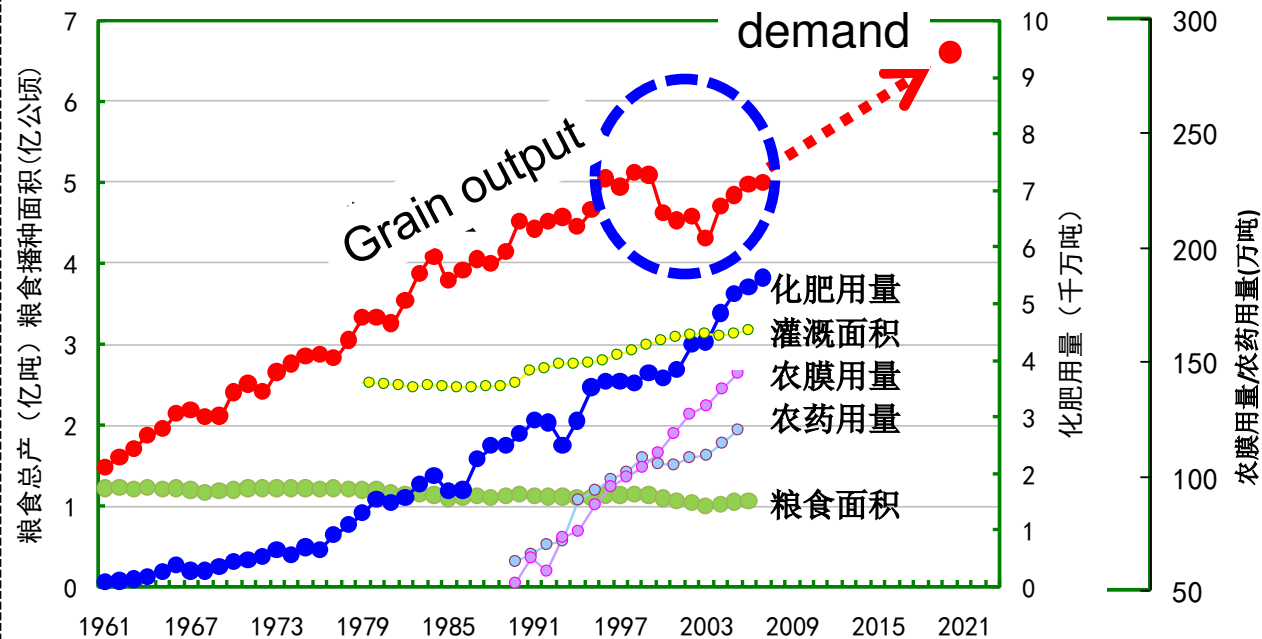
Irrigation water: 370.7bm³

Agr -electric: 96.6bkw

Ari-plastic: 1.40mt

pesticide: 1.25mt

农业机械总动力: 9.3亿千瓦



(source: china statistic data and FAO)

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

Motivation and Background

- Huge lose and waste of grain in whole supply chain



12.5mt



20mt



7.5mt



7.5mt



20mt

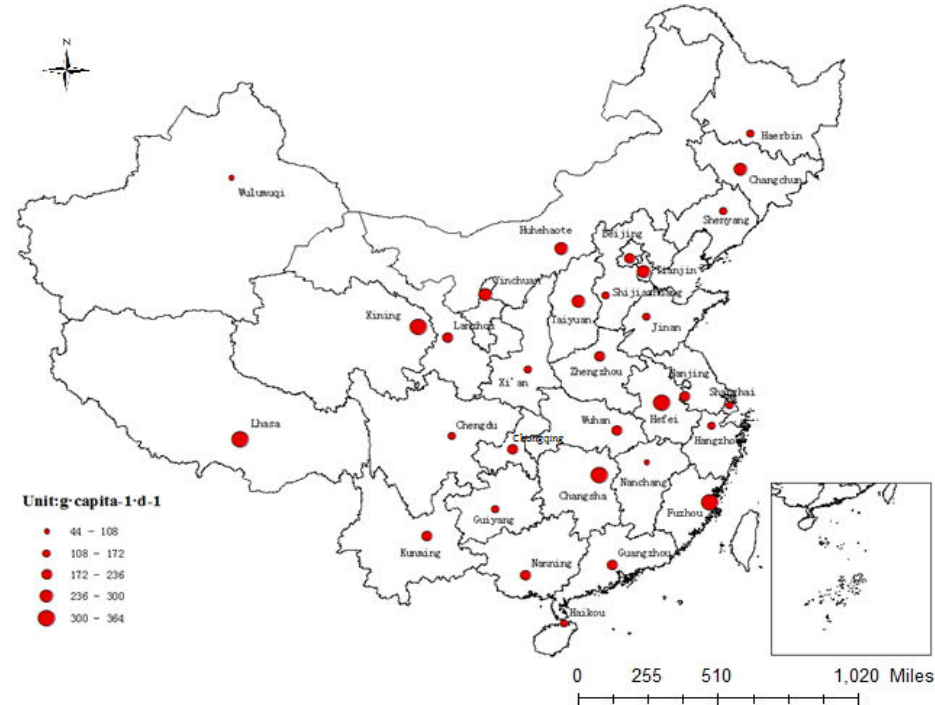
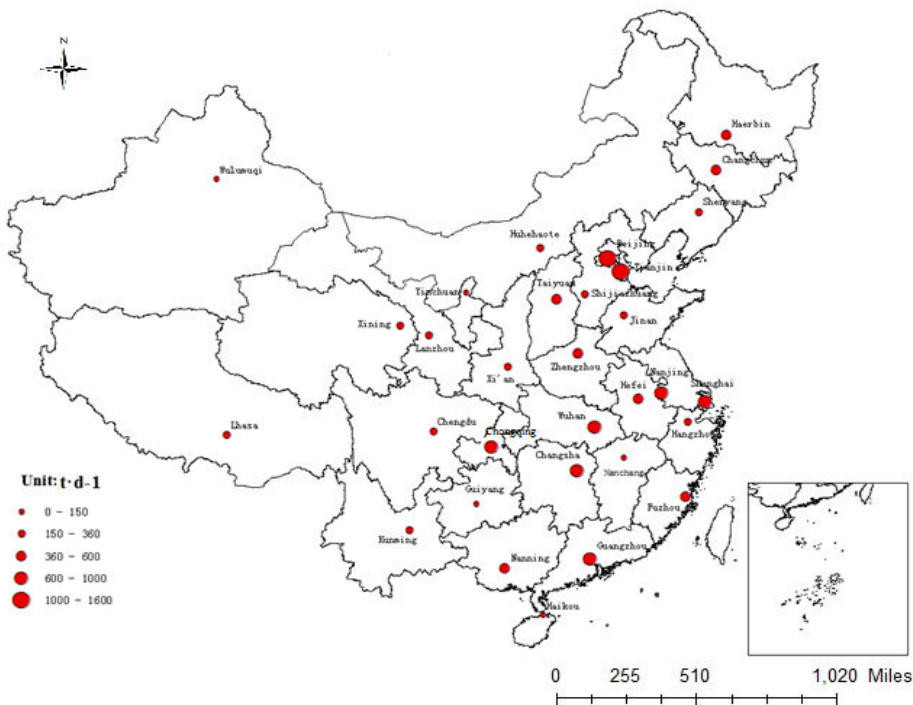


From field to table:
grain losed and
wasted 67.5mt,
11% of total grain
output, 12.55mha
farmland wasted

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)

注：省会城市餐饮业食物浪费数量根据新闻报道整理；人均食物浪费数量=省会城市餐饮业食物浪费数量/省会城市人口（北京、西藏等旅游城市加入旅游人口）（Cheng, 2012）

Motivation and Background

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



城市固体垃圾 (MSW)

食物残余物是MSW的主要组成成分

地区	Food surplus%	其他 %
北京	66.2	33.8
上海	71.1	28.9
广州	52.0	48.0
深圳	51.1	48.9
杭州	53.0	47.0
南京	70.6	29.4
厦门	74.6	25.4
桂林	61.3	38.7

(Jun Tai et al., 2011)

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

Population increase,
urbanization ,Industrialization

Consumption

production

pro	sto	tra	Har
c	re	np	v

Rural reform

policy

water/land

Fertilizer....

Energy, variety

Food waste

?

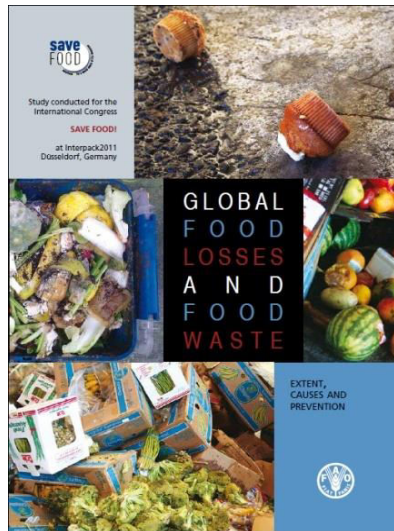
返回

Food waste in China: special characteristics

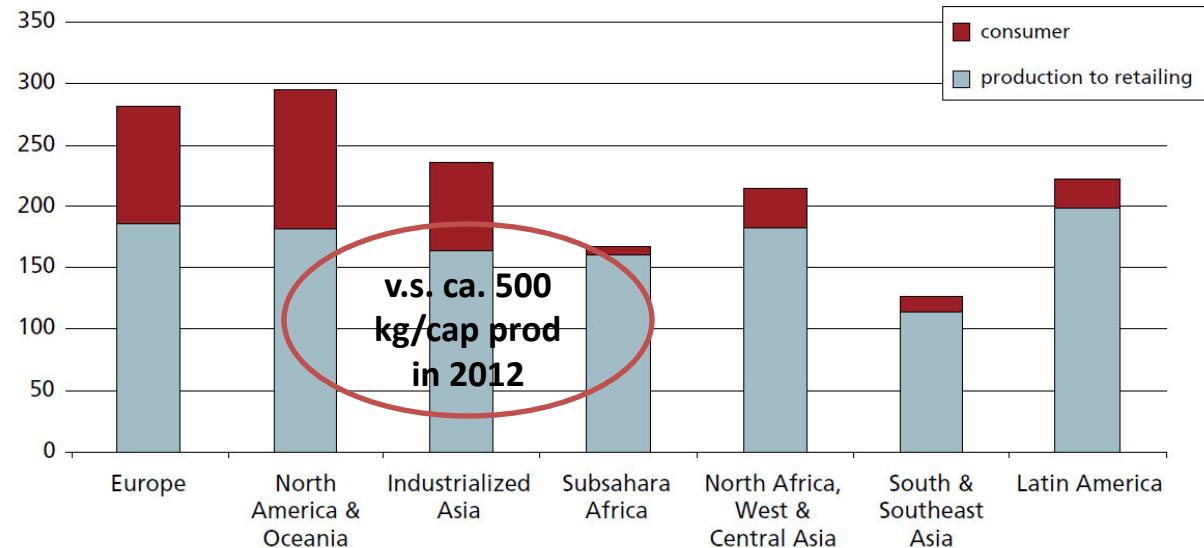
- **Food culture:** long history, diverse cuisines, local resources
- **Save food & save face:** a cultural conflict
- **Official/Business and private (birthday or wedding) banquet** with more waste
- **Food waste at consumption stage** appears more serious
- **Food byproducts efficiently used** (e.g.,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



How much do we waste? Data, data, data!



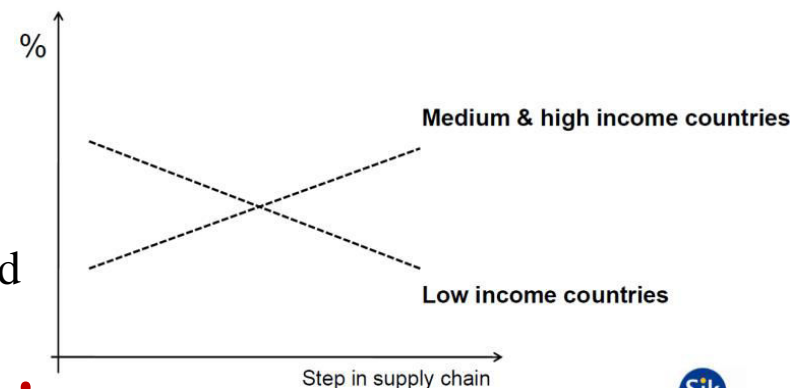
Per capita food losses and waste (kg/year)



Source:FAO

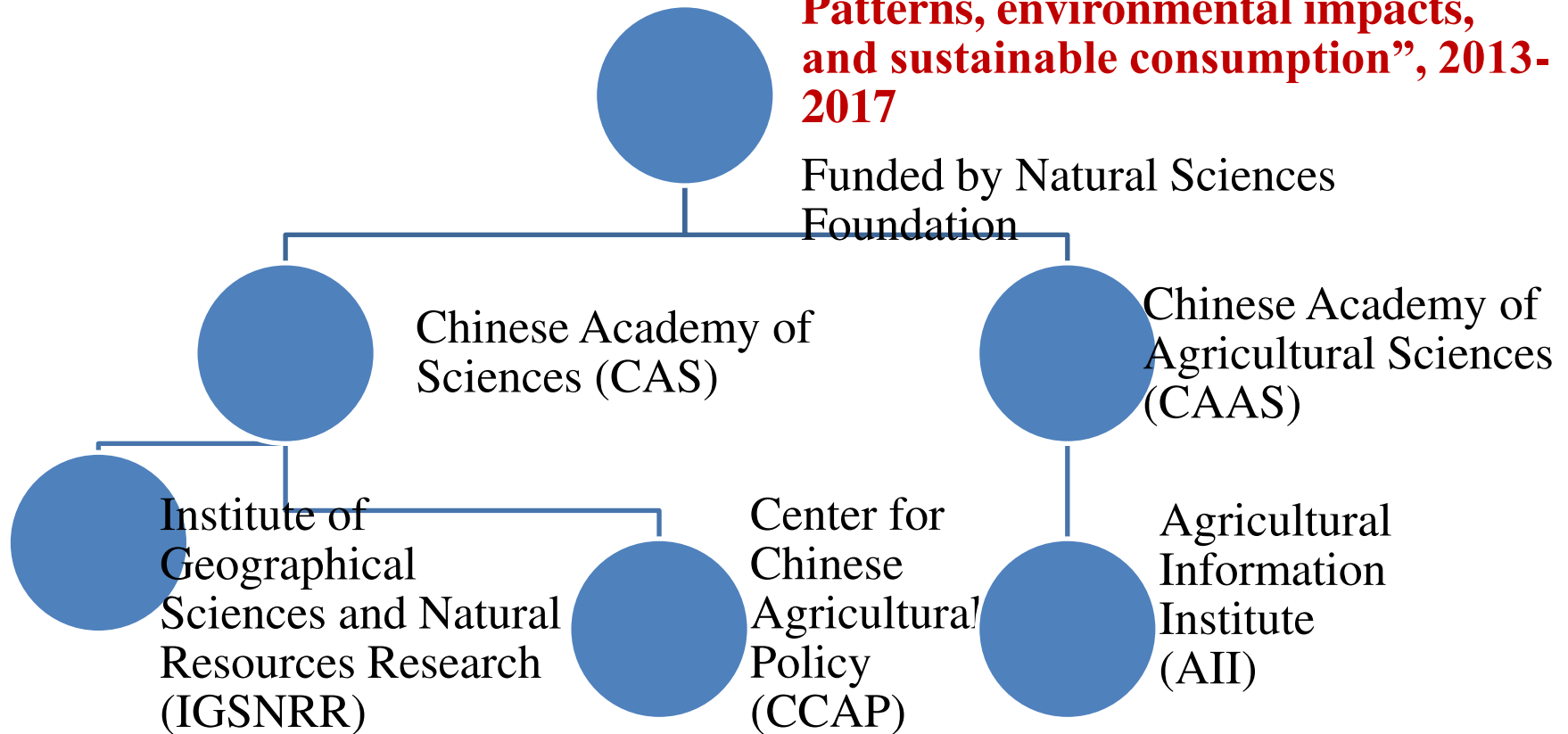
- Little information for developing countries (incl. China), many data out of date;
- FAO report: China aggregated with Japan and South Korea in “Industrialized Asia”;
- Dramatic lifestyle changes in a fast urbanizing and industrializing China...

→ we need more primary data collection!



The first national level key project

“Food waste in urban China: Patterns, environmental impacts, and sustainable consumption”, 2013-2017



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)**

Large Scale Survey for China...

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, wordload, etc.



The training in Beijing



Team capacity building activities of volunteers

Survey- Step 2 : Manager and head chef interview



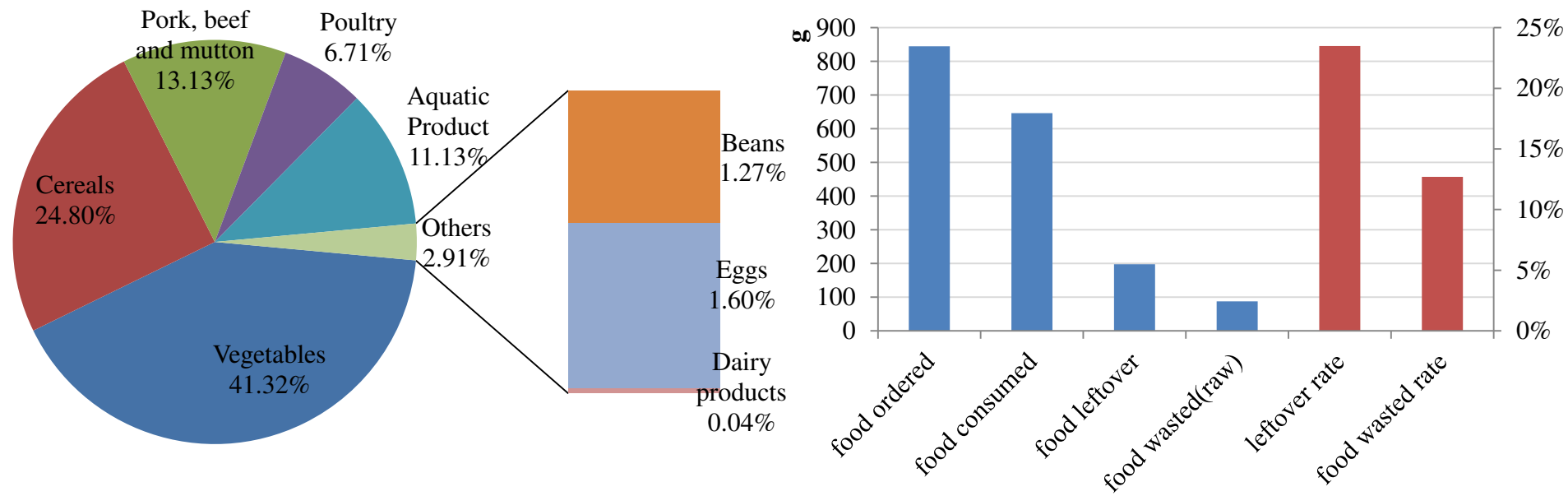
Survey- Step 3 :

Customer interview and weighing of table food waste



Results: in Beijing's urban catering sector

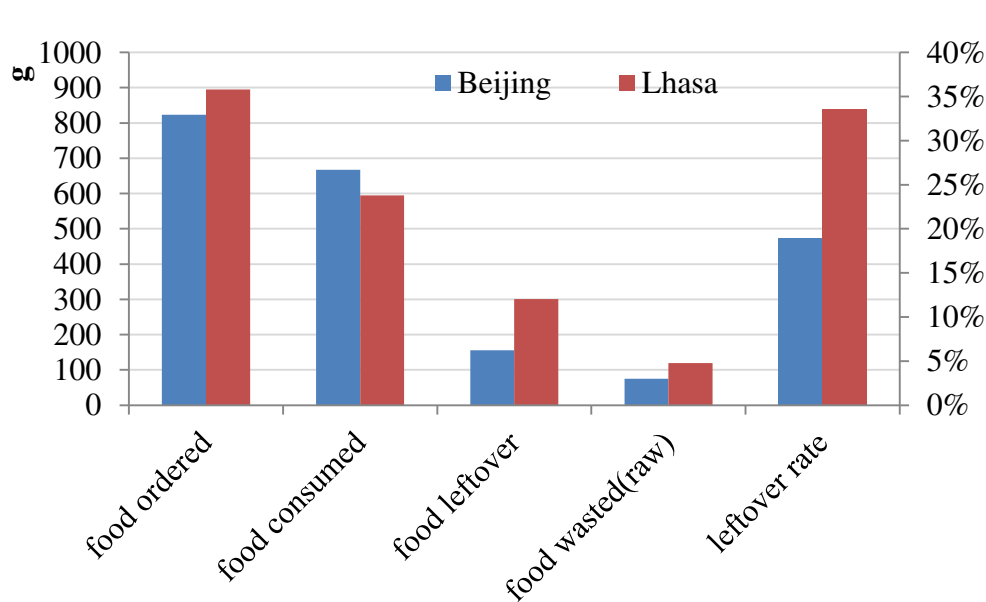
- About 80 gram per capita per meal food waste (raw food equivalent), vegetables—cereals---meat. Wasted rate 23.5% of the ordered food (including soup and oil...)



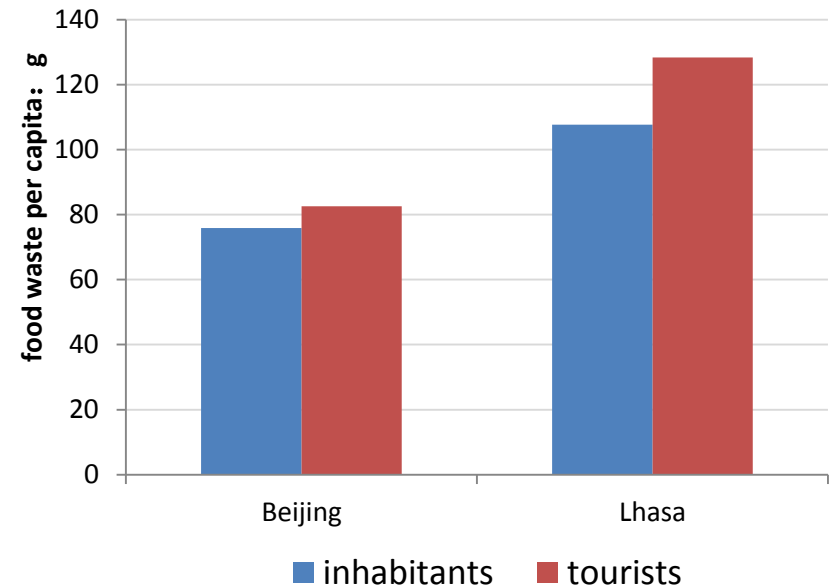
Food waste in the urban catering sector in Beijing, by food category (left) and absolute and relative amount per capita (right)

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

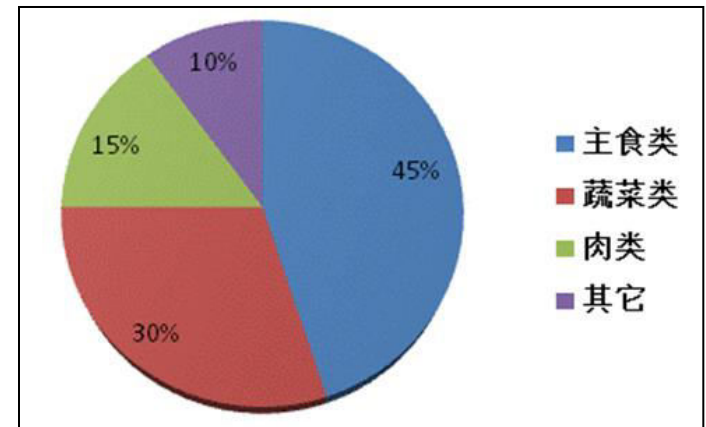


Food waste generated by tourists in Beijing and Lhasa

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

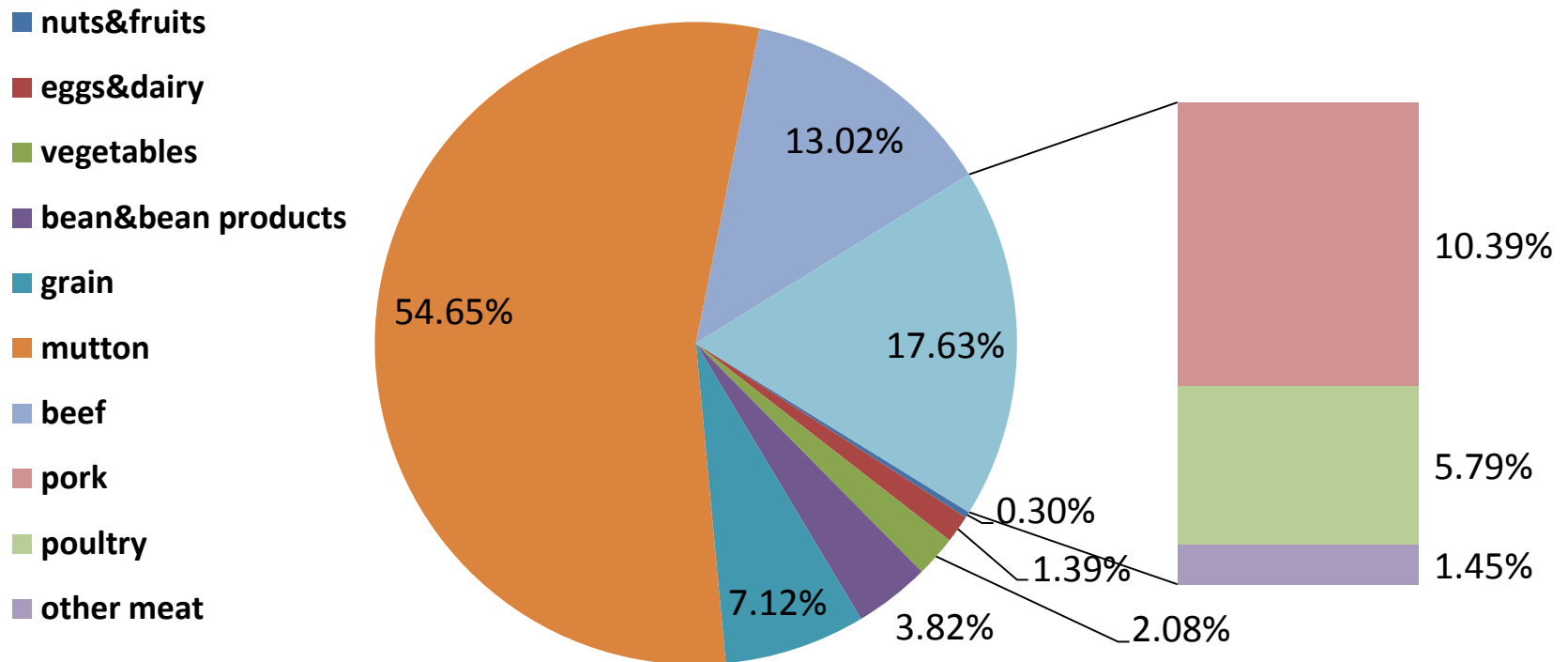
- No considering tourism consumption: about **12 million tons/year**
- Considering tourism consumption: about **14 million tons/year**.
- Taking use of the data--the kitchen waste production of provincial capital city (media reported): **about 25-30 million tons/year**

Now the popular saying :

The food wasted in catering can **feed 2 billion people** _ a little exaggerated, feeding **30-50 million people** more reliable

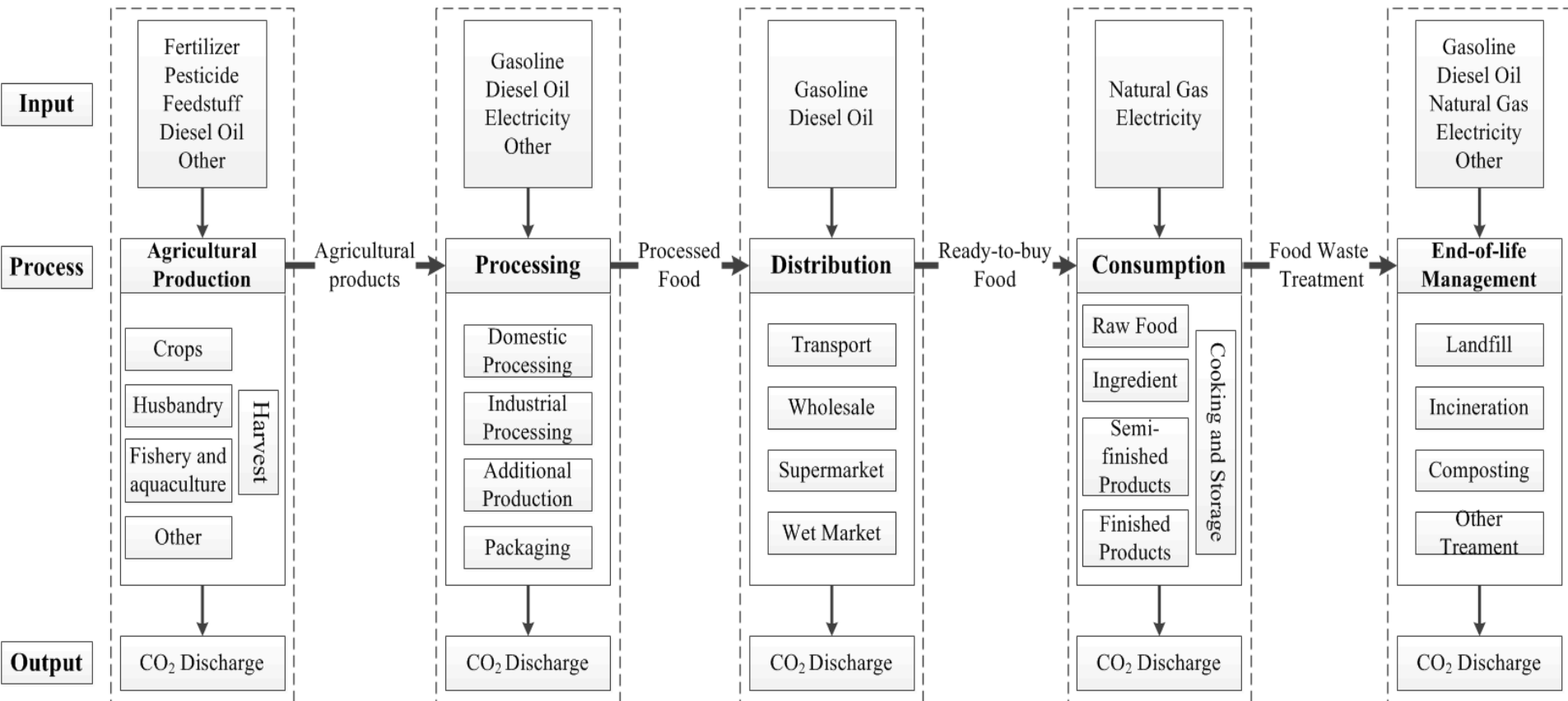
Results: Ecological Footprint (in Beijing)

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%)



Results: Carbon Footprint (in Beijing)

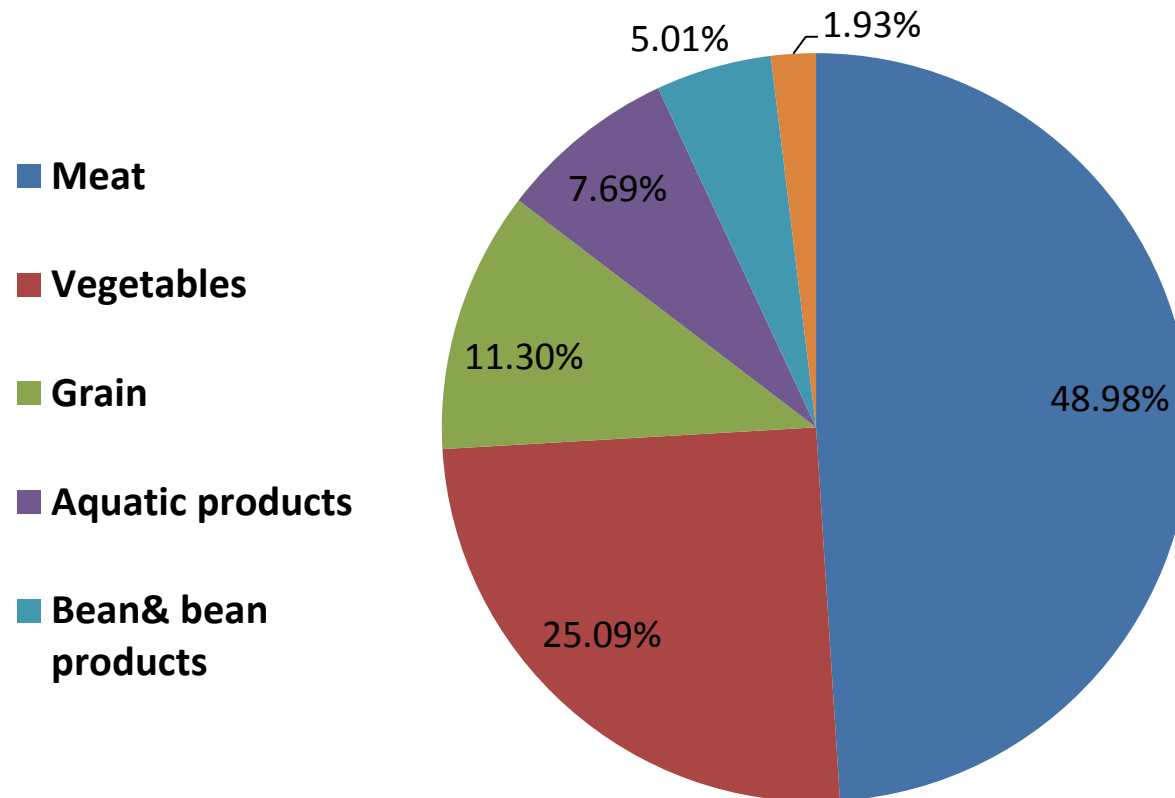
Food production causes greenhouse gas emissions along the entire food supply chain and wasting food means that those emissions are produced in vain.



Carbon emission along the different stages of the food value chain

Results: Carbon footprint - by food type

Total catering carbon footprint of food waste is 2.1×10^6 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%**

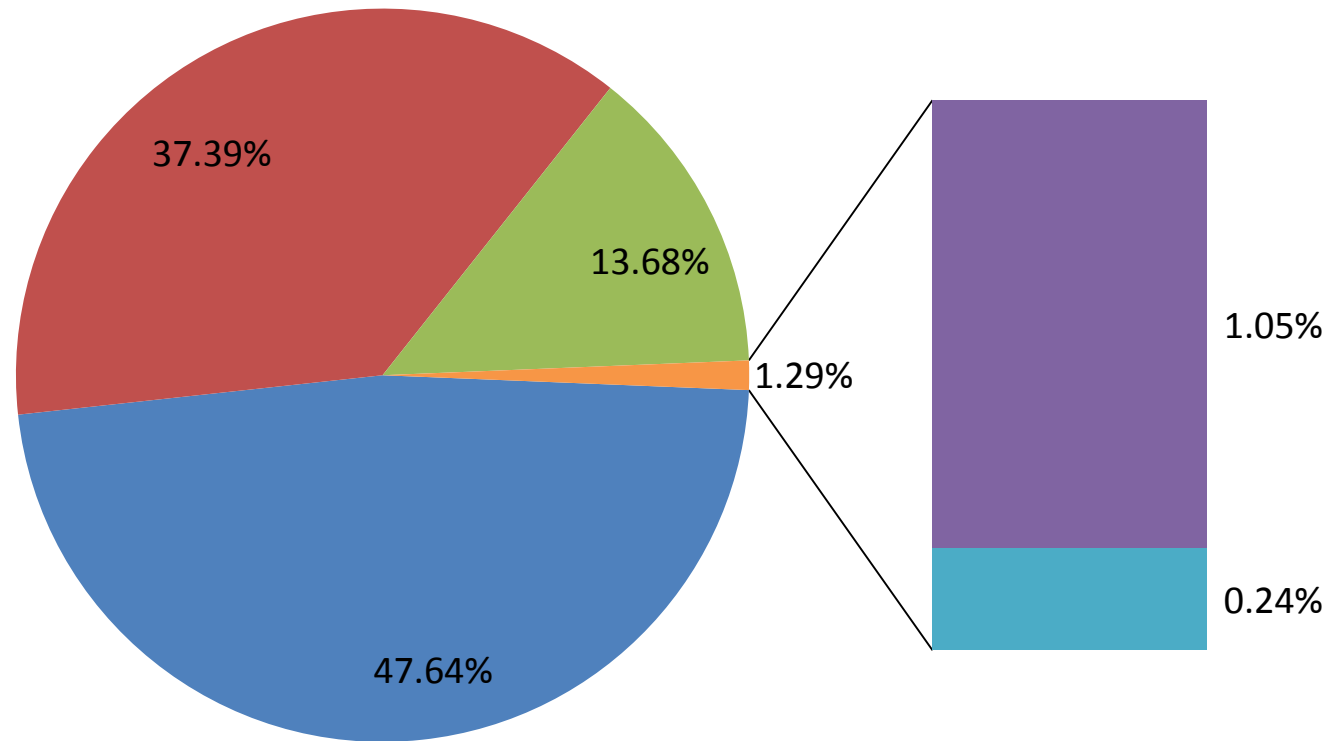
■ Agricultural production

■ Consumption

■ Management

■ Distribution

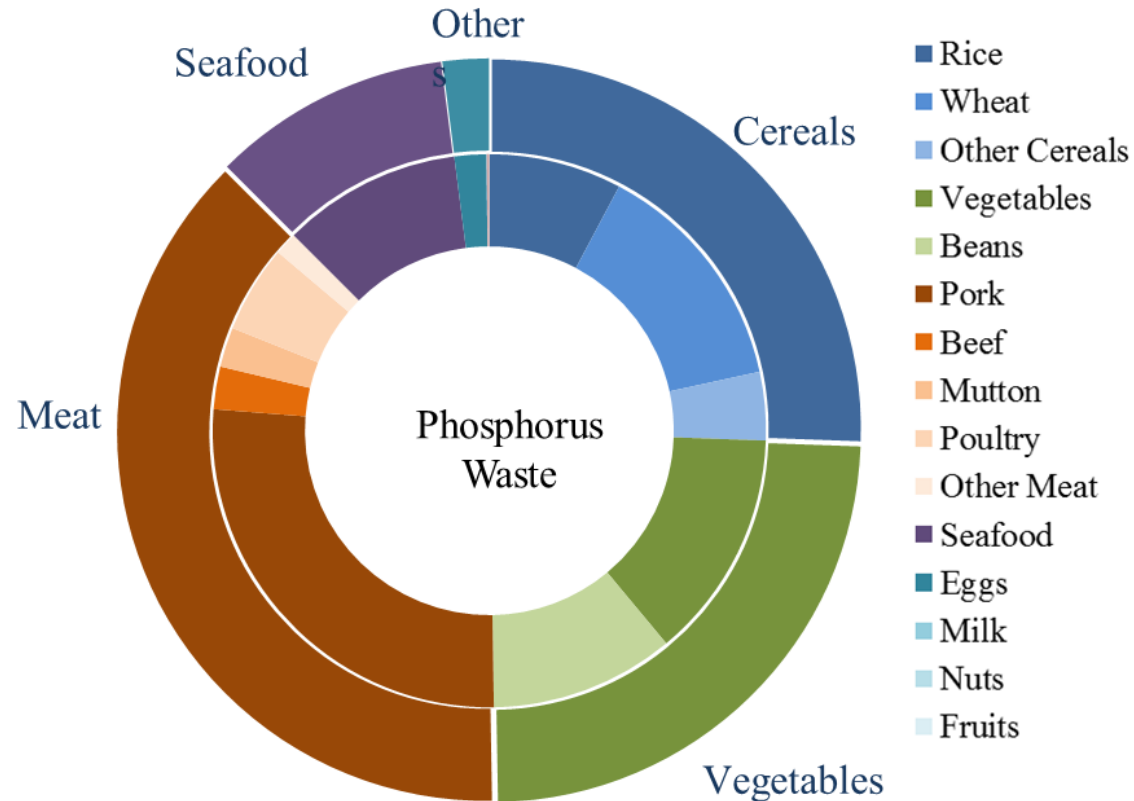
■ Processing



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 Horizon 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.**



Fresh fruit and vegetables 24 pounds Processed fruit and vegetables 10.5 pounds



Grains 18.5 pounds

Fluid milk 22 pounds

Meat and fish 10.4 pounds

Sweeteners 15 pounds

Fats and oils 8.6 pounds

Other food (includes eggs; peanuts; tree nuts; dry beans, peas and lentils; dairy other than fluid milk) 12.8 pounds



**Thank you
For your attention!**