



Flood damage analysis and development of flood damage models for the Mekong delta

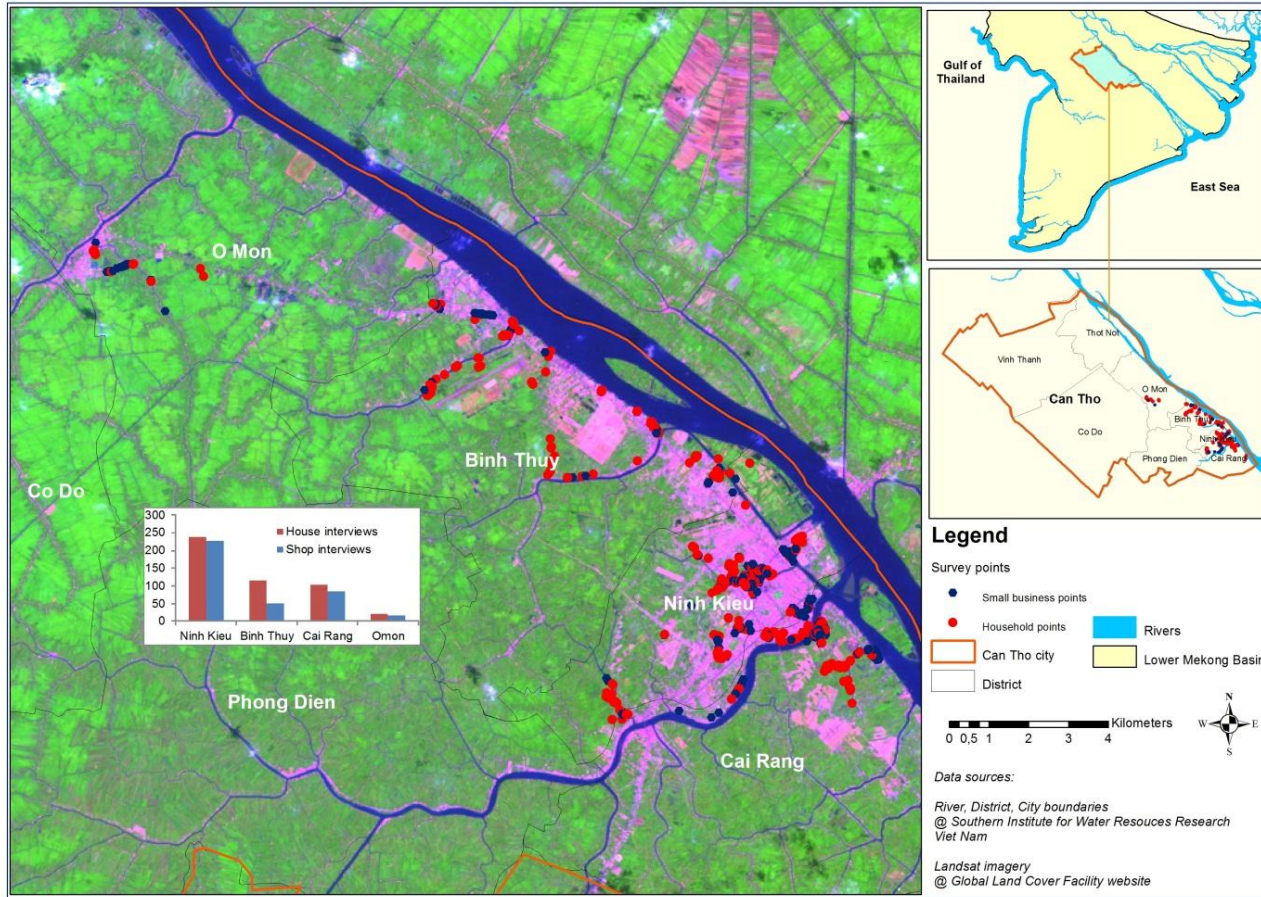
Thi-Chinh Do, Heidi Kreibich

GFZ German Research Centre for Geosciences

Bonn, June 2013

- ✓ Vietnam is severely affected by floods, which cause damage to people and assets
- ✓ Current flood risk management does not include private precaution
- ✓ Governmental damage assessment does not include indirect damage
- ✓ The flood damage models did not apply for Vietnam yet.

- Results about the phases of the flood risk management cycle including the preparedness, response, damage and recovery from interviews with households and small businesses in Can Tho will be presented.
- Multi-variate flood damage models base on regression trees and bagging decision trees are developed to select the more important damage influencing parameters and promising alternative flood damages models for Can Tho city of the Mekong delta.



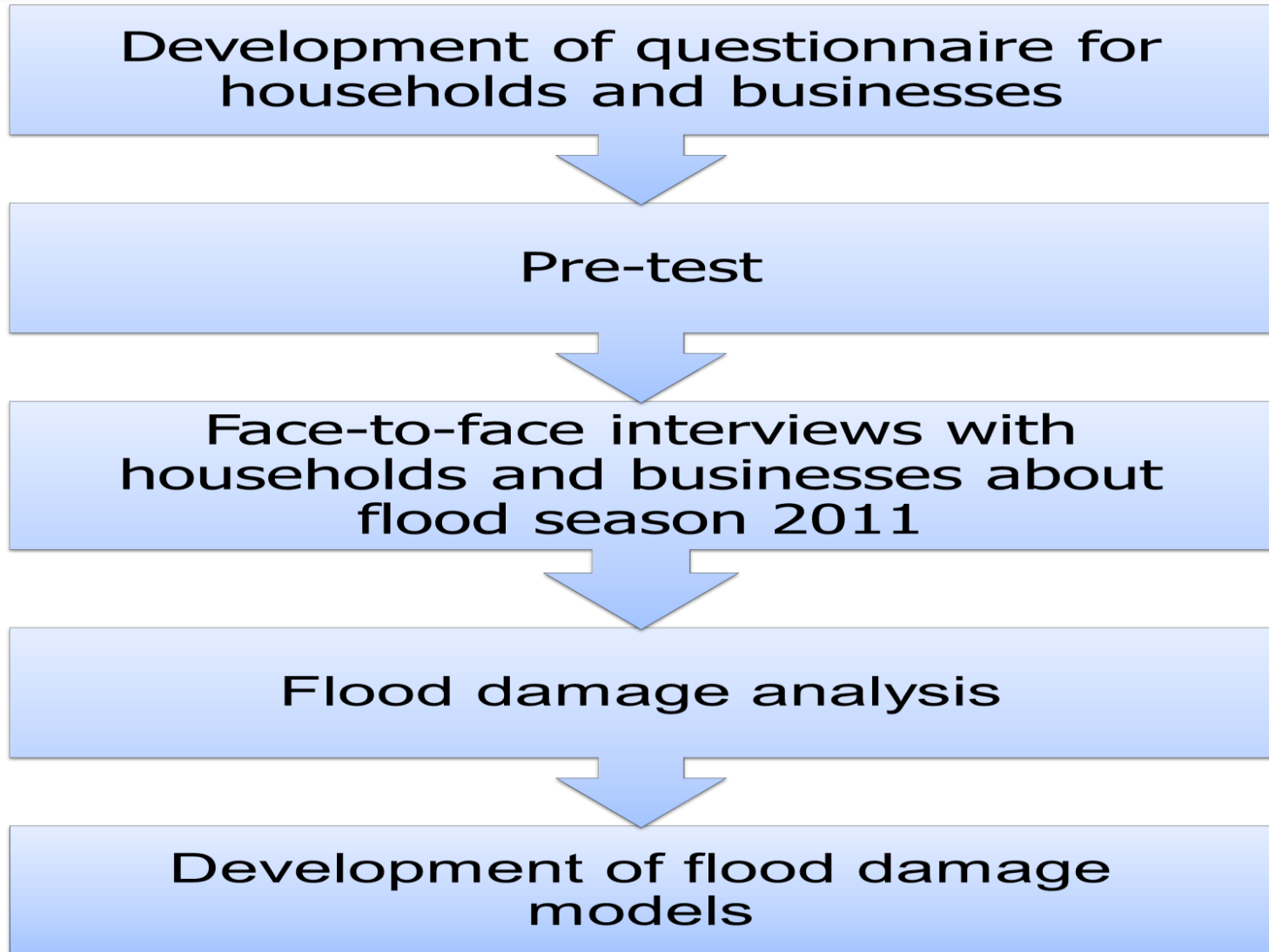
Can Tho city is considered the economic, educational and cultural centre of the Mekong delta

Area: 1,390 km²

Population: 1.2 mil. inhabitants

Influence by riverine and tidal flooding

Study area and spatial location of the sampled households and businesses



Survey was conducted in Can Tho city about flood season 2011



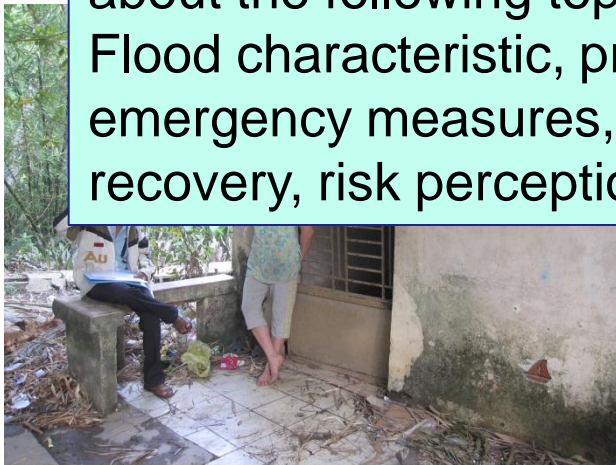
Start in
January



480 flood-prone households and 378 businesses in 4 districts of Can Tho city.

70 questions for households and 88 questions for businesses about the following topics:

Flood characteristic, preparedness, early warning and emergency measures, damage to household and business, recovery, risk perception



End in
February

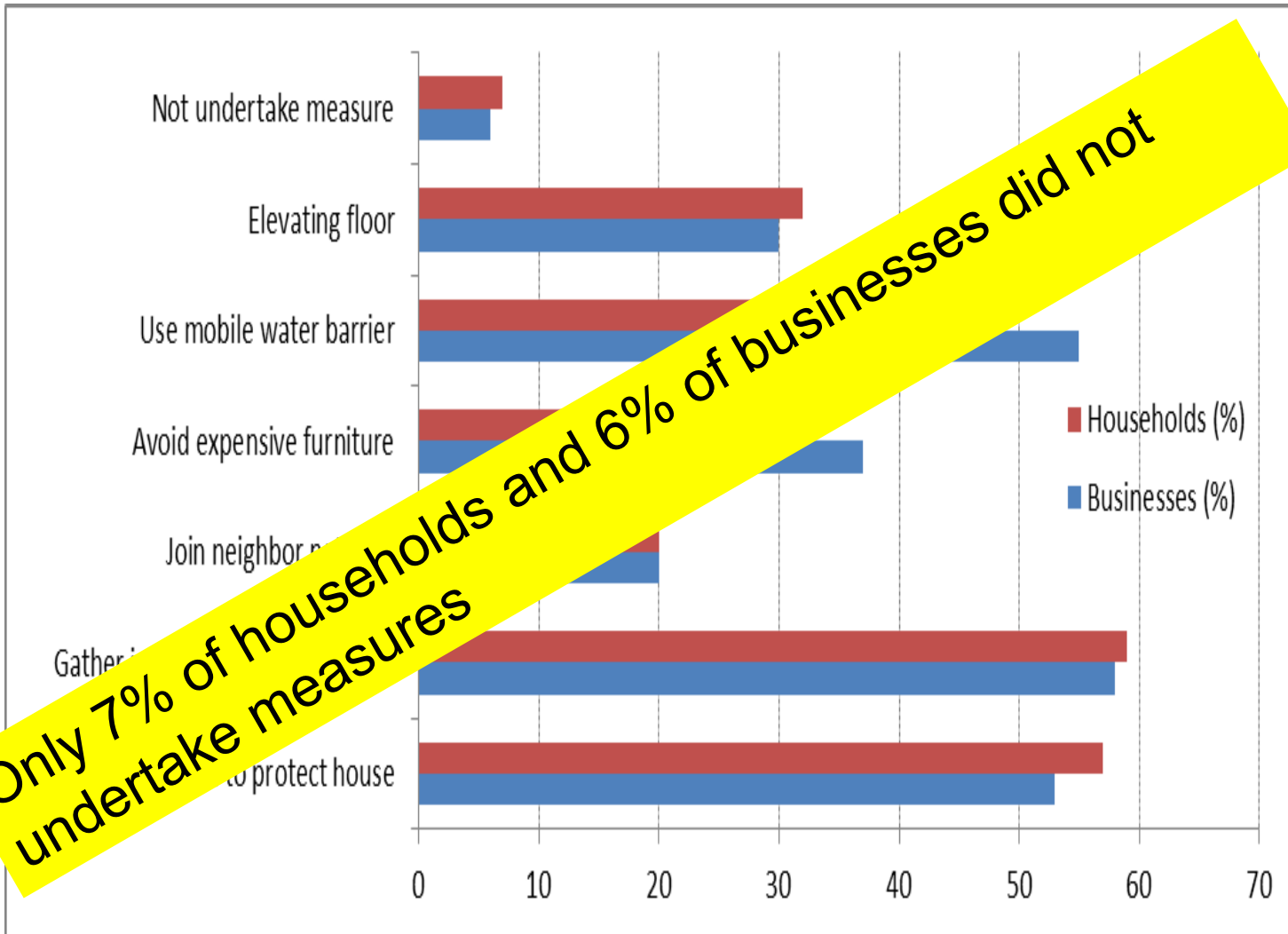


Flood damage analysis: preparedness, response, damage and recovery

Flood preparedness

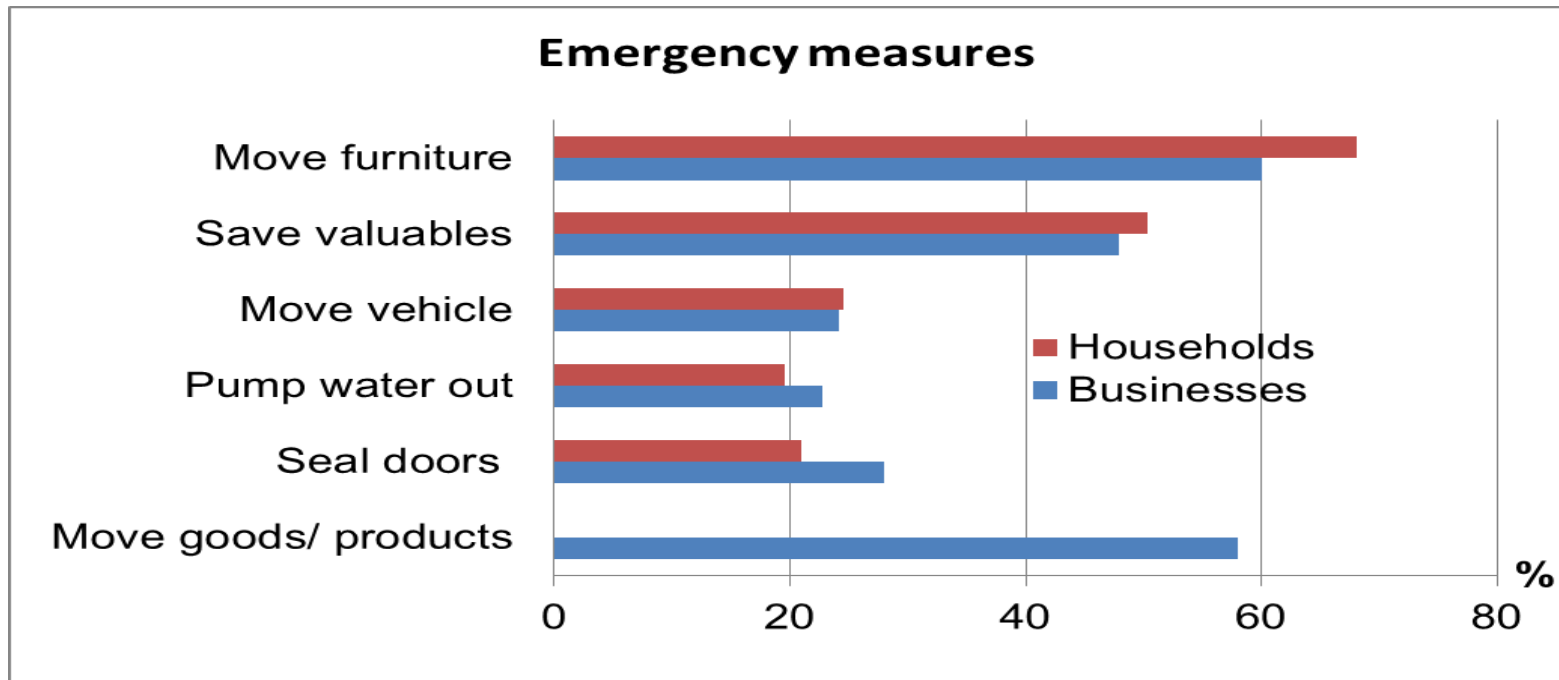


Flood preparedness



Household (%) Business (%)

Flood experience	74	65
Received warning	71	70
Applied emergency measures	86	84

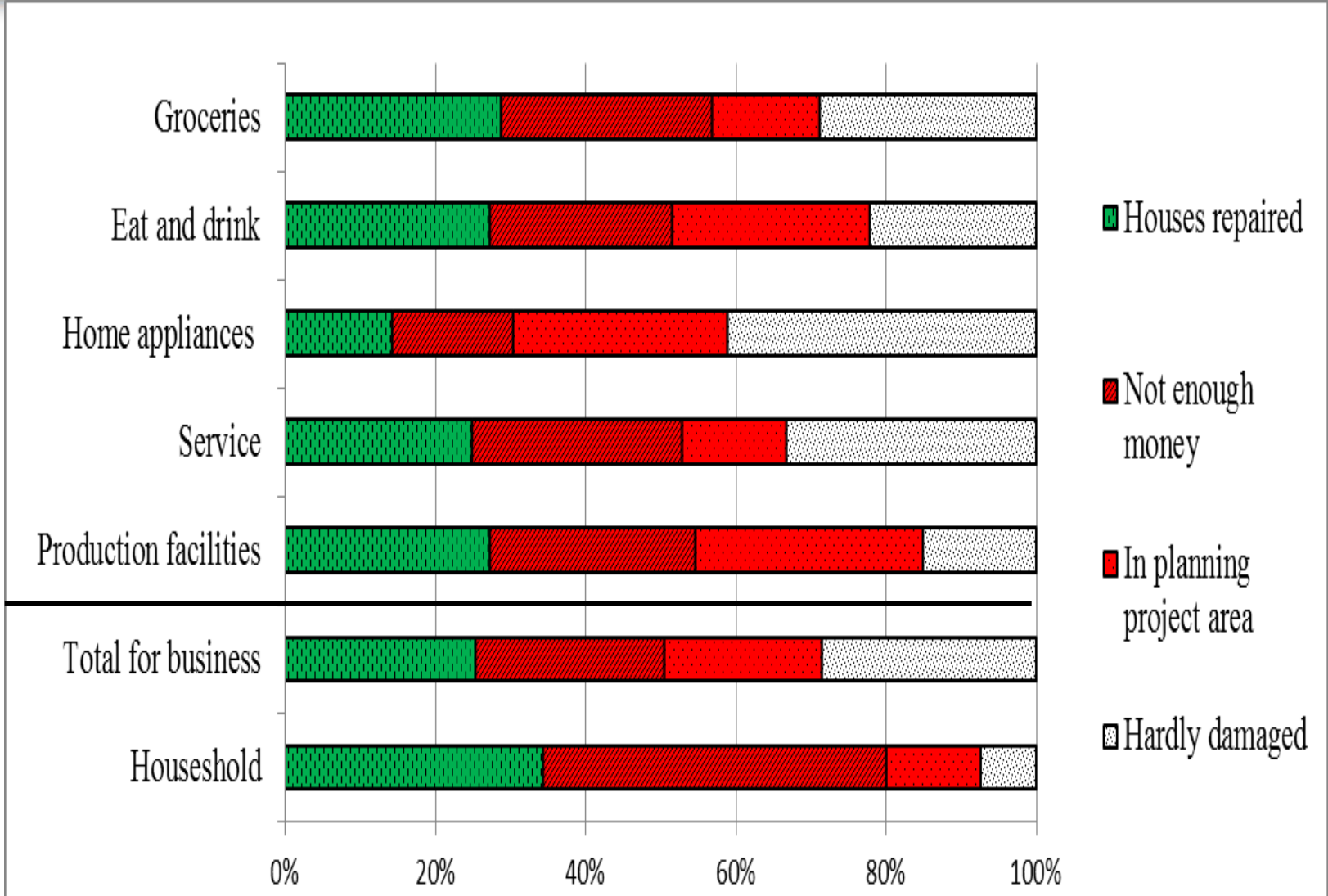


Median values	Household	Business
Water depth in house (cm)	30	20
Duration (days/month)	8	7
Distance to river (m)	10	20
Total damage (USD)	333	152

Flood damages

Data	Direct damage (median)			Indirect damage (median)		Ratio (indirect damage/ direct damage)
	Damage to structure	Damage to content	Total	Sale decrease (%)	Losses(USD)	
Groceries	48	19	157	40	200	1.3
Eat and drink	71	0	143	40	200	1.4
Home appliances	19	48	238	40	594	2.5
Service	24	0	143	40	228	1.6
Production facilities	119	14	285	30	95	0.3
Total for business	48	10	152	40	209	1.4

Recovery



Flood damage models: stage- damage function, regression trees, bagging trees

Flood characteristic

Water depth (wst)

Duration (d)

Flood velocity (v)

Contamination (con)

Preparation, Response and Emergency

Precaution (pre), Early warning (wt, wi, wte), Emergency measures (em), recovery, risk perception, flood experience

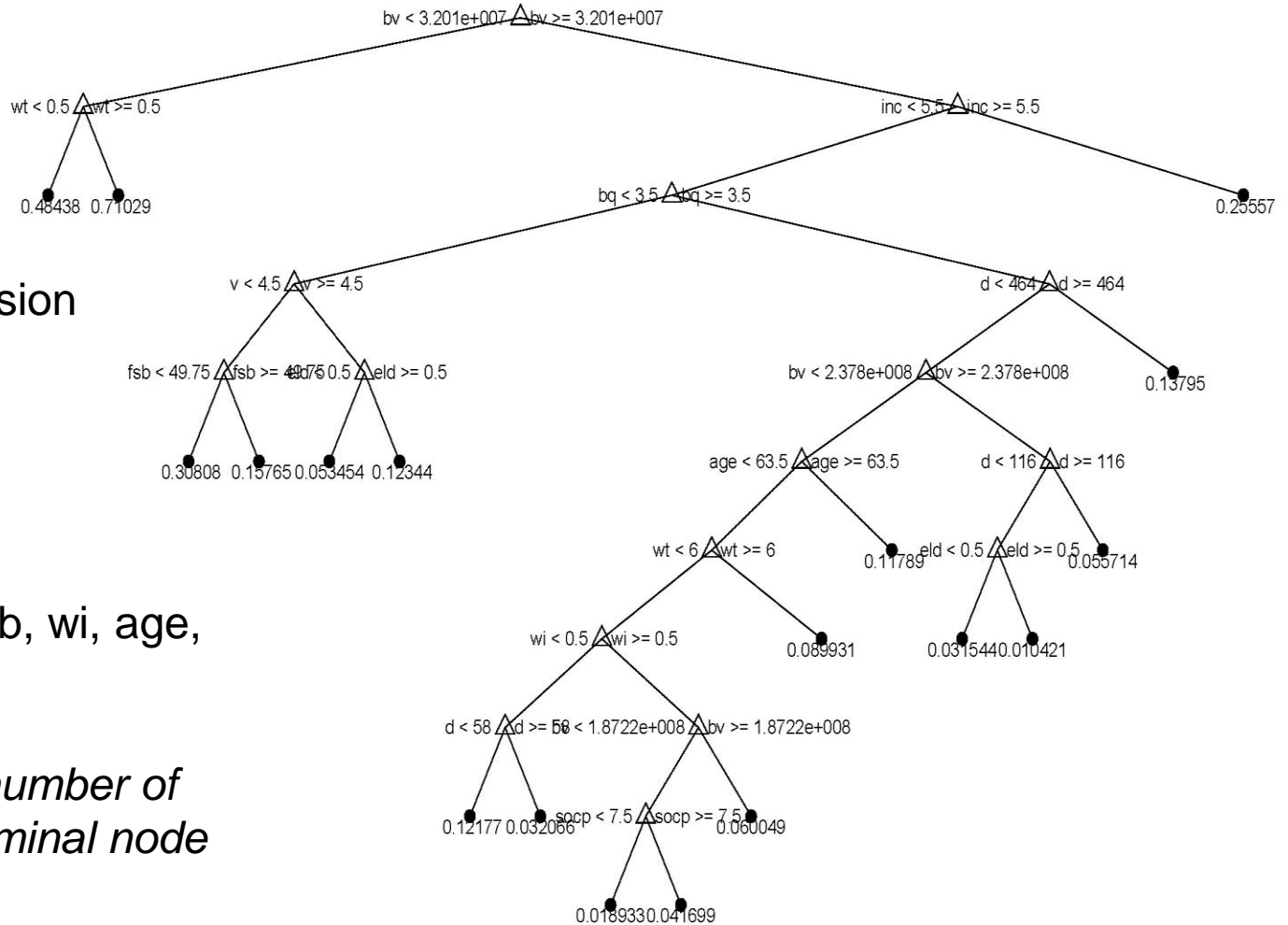
Building characteristic

Building value (bv), content value, building quality (bq), floor space of building (fsb), damage to households and businesses, loss ratio, house size

Socioeconomic status

Socioeconomic status Plapp (socp)
Age (age), income (inc), elderly person (eld), children (chi), education,

Regression tree



No. of decision nodes:

bv:3

d: 3

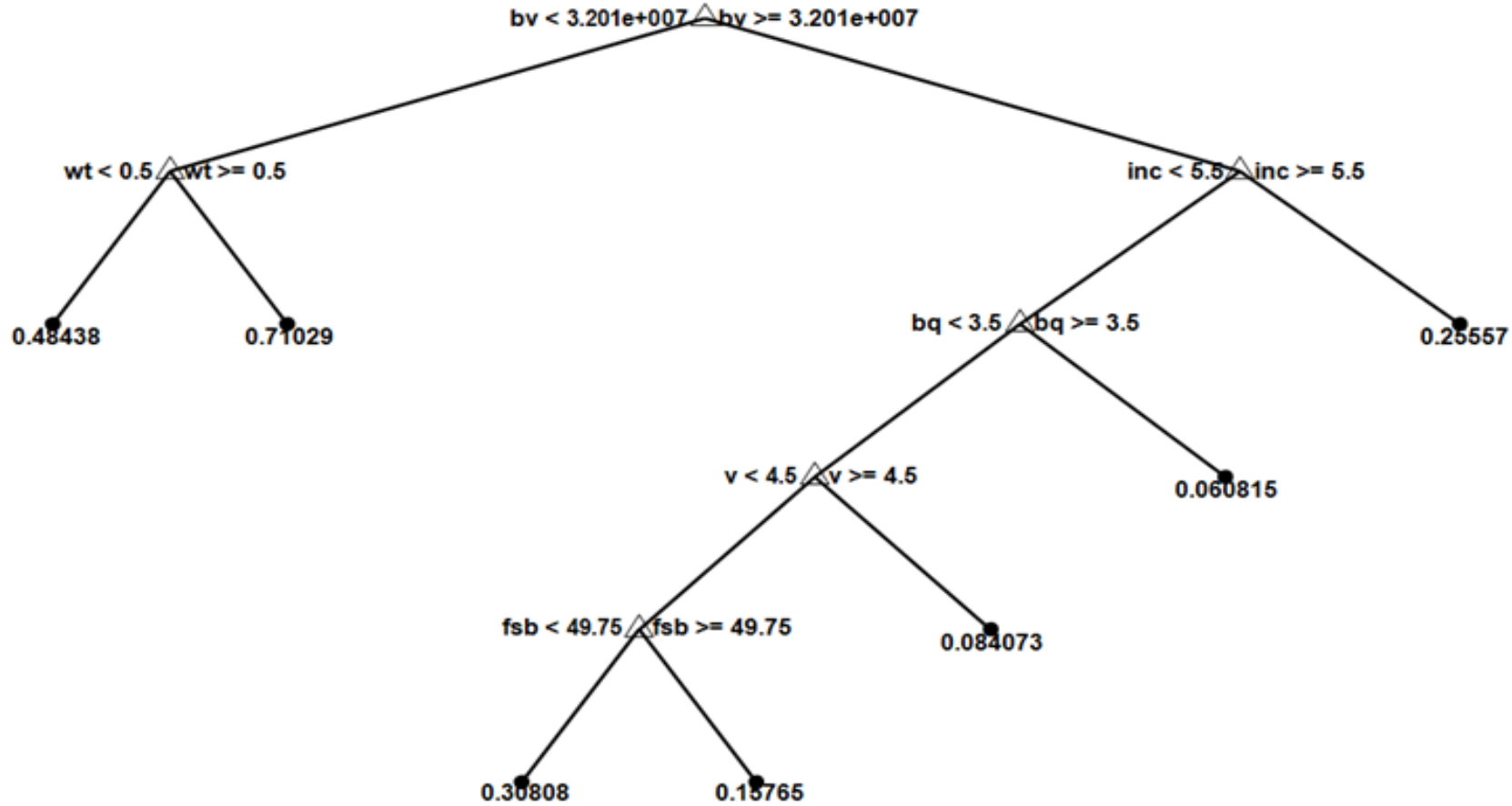
wt:2

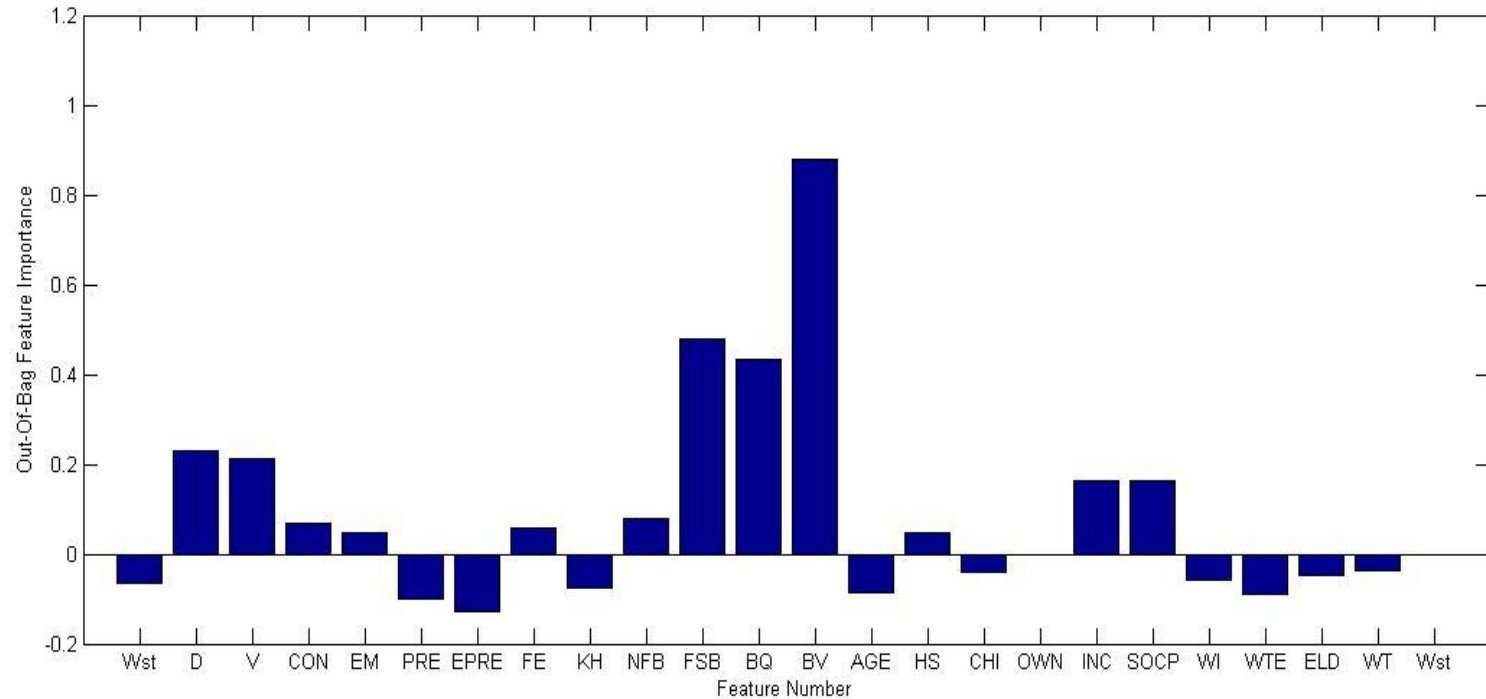
eld:2

bq, inc, fsb, wi, age, socp, v: 1

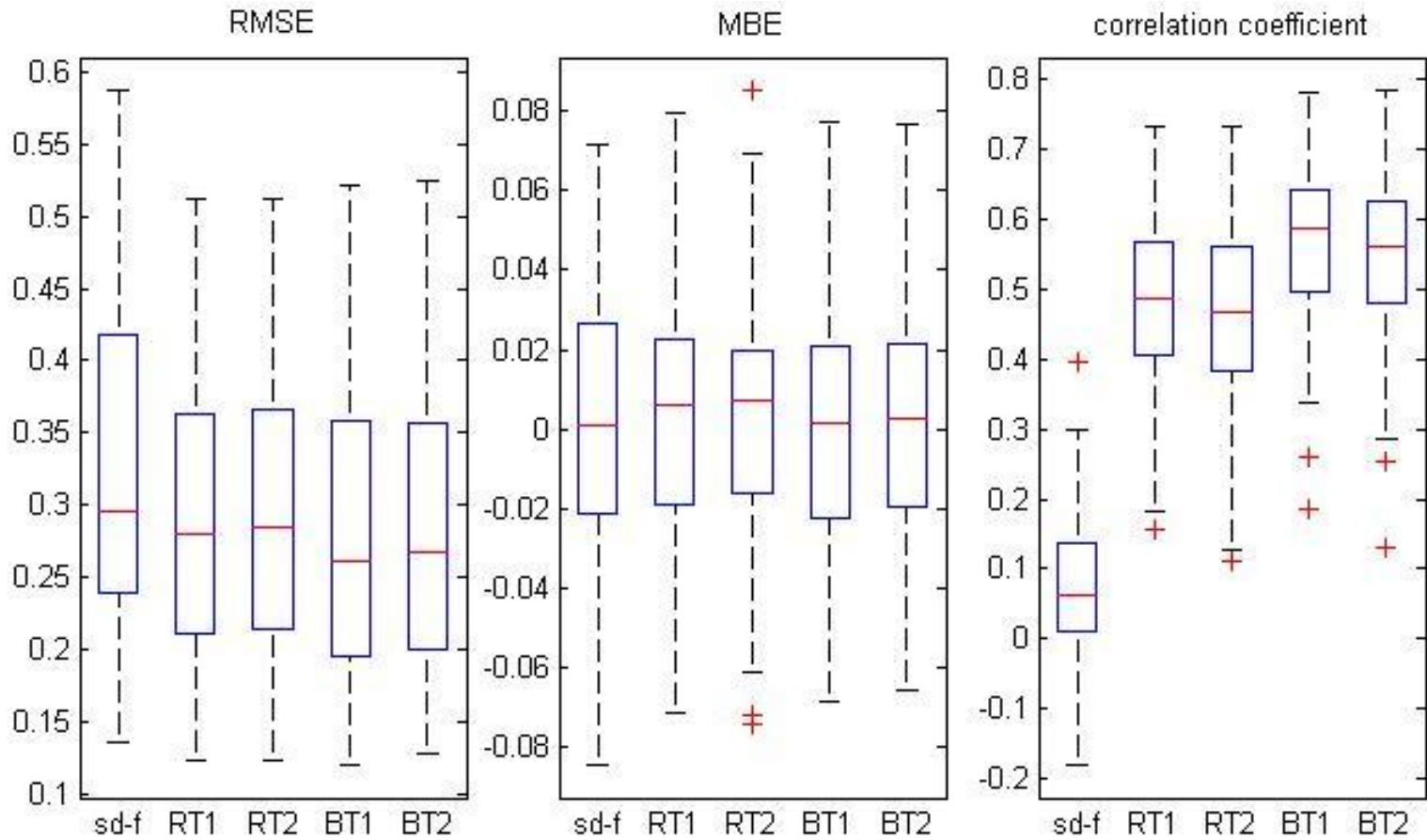
Minimum number of case in terminal node is 20

Regression tree





Feature importance variables: bv, bq, fsb, v,
d, socp, inc



- ❖ Many people in Can Tho city have flood experience and were well prepare for the flood in 2011
- ❖ However, households are more vulnerable than businesses since they live in lower quality buildings and are exposed to higher flood intensities
- ❖ Indirect damage of business is 1.4 times higher than their direct damage.
- ❖ Only 25% of businesses and 35% of households had repaired their houses 3 months after the flood
- ❖ Important damage-influencing parameter are building value, flood duration, building quality, income, floor space of building



Thank you very much for your attention!

