Closed-loop supply chain network optimization for Thailand motorcycle industry

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Background of study

- Recently, logistics have been increasing rapidly. However logistics network is still not advanced and transportation is still ineffective.
- In addition, number of the scraped equipment also increased which can be considered as environmental problem.
- To deal with these problems, Closed-loop supply chain investigation which both forward and reverse logistics are needed.

Objectives of study

- In Thailand, there is no much data about logistics which make it difficult to figure out the real current situation.
- The objective of this study is to propose, the reverse logistics by allocating the facility in the network.

Current motorcycle transportation in Thailand

- Recently, the environmental issue has become more concerned, in developed country there is a law that manufacturer must take responsibility to collect the product at the end of life.
- Japan：Automobile（2002～）、Motorcycles（2004～）
- EU：（2002～）
- Korea：3Rs
- Thailand：no regulation currently but the tendency is high.

Current motorcycle transportation in Thailand

Factory → Warehouse → Dealer → User → 2nd hand centre → Maintenance

Part Maker

Material

Used part

Scraped material

Waste

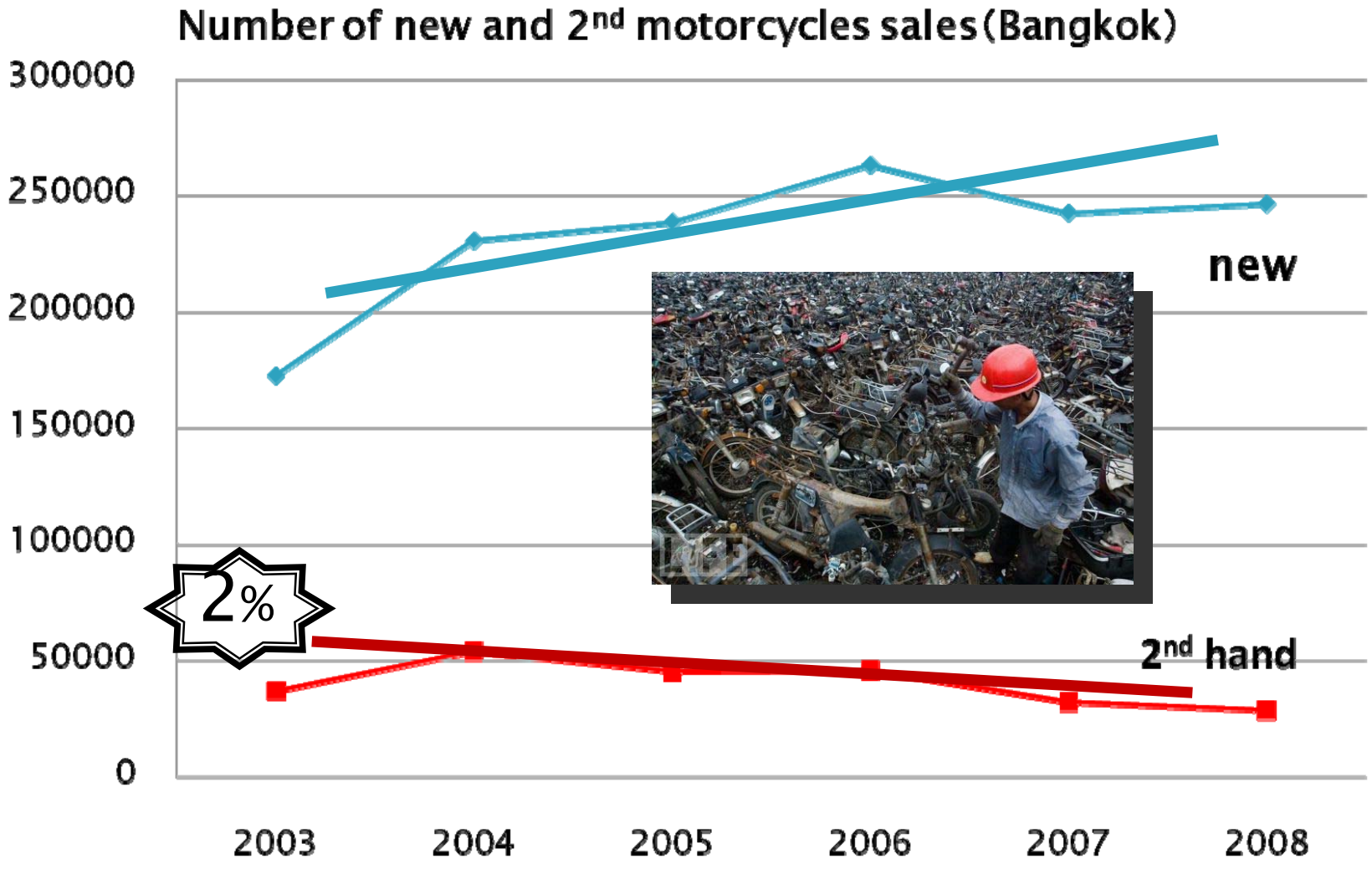
Disposal company

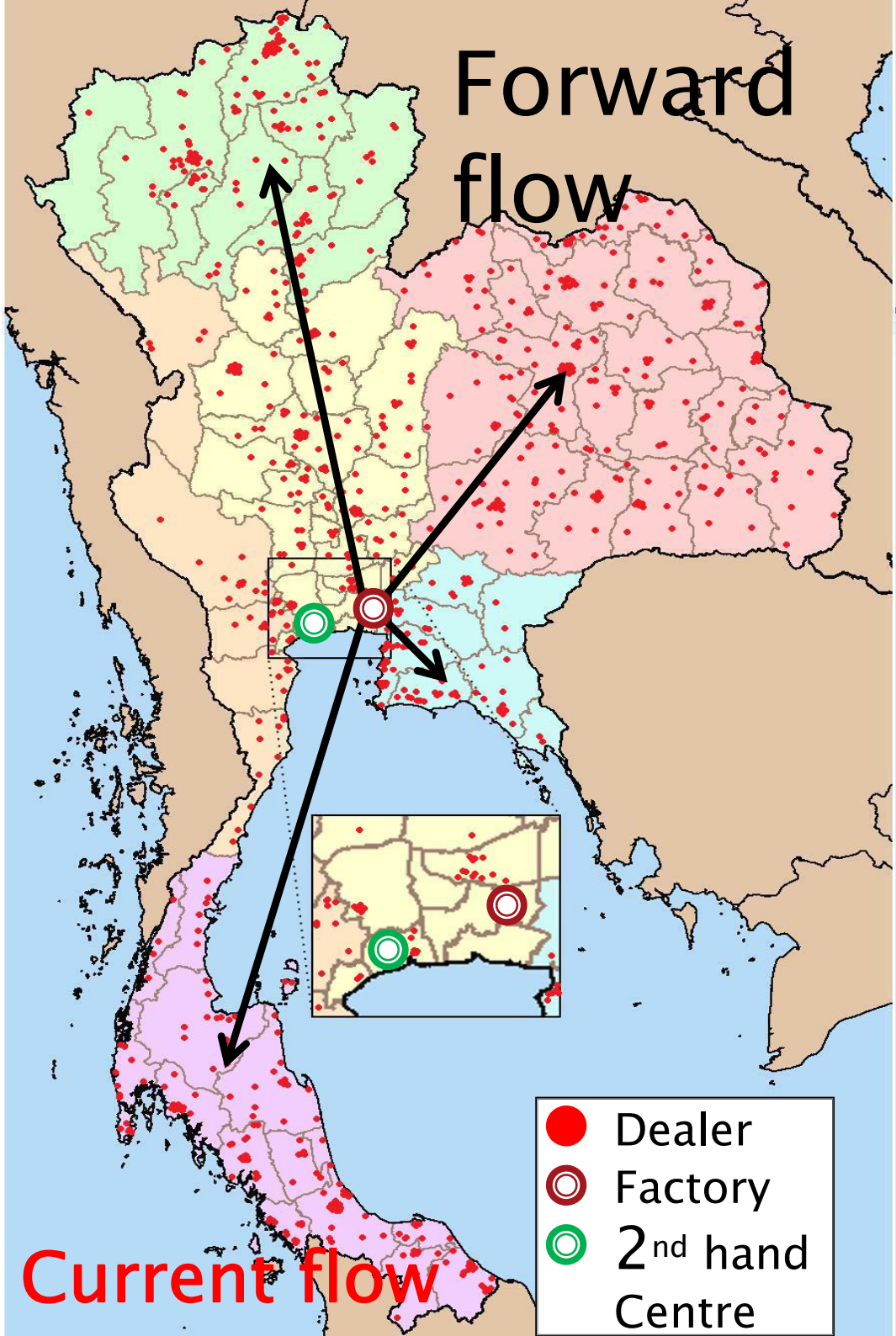
Land filling

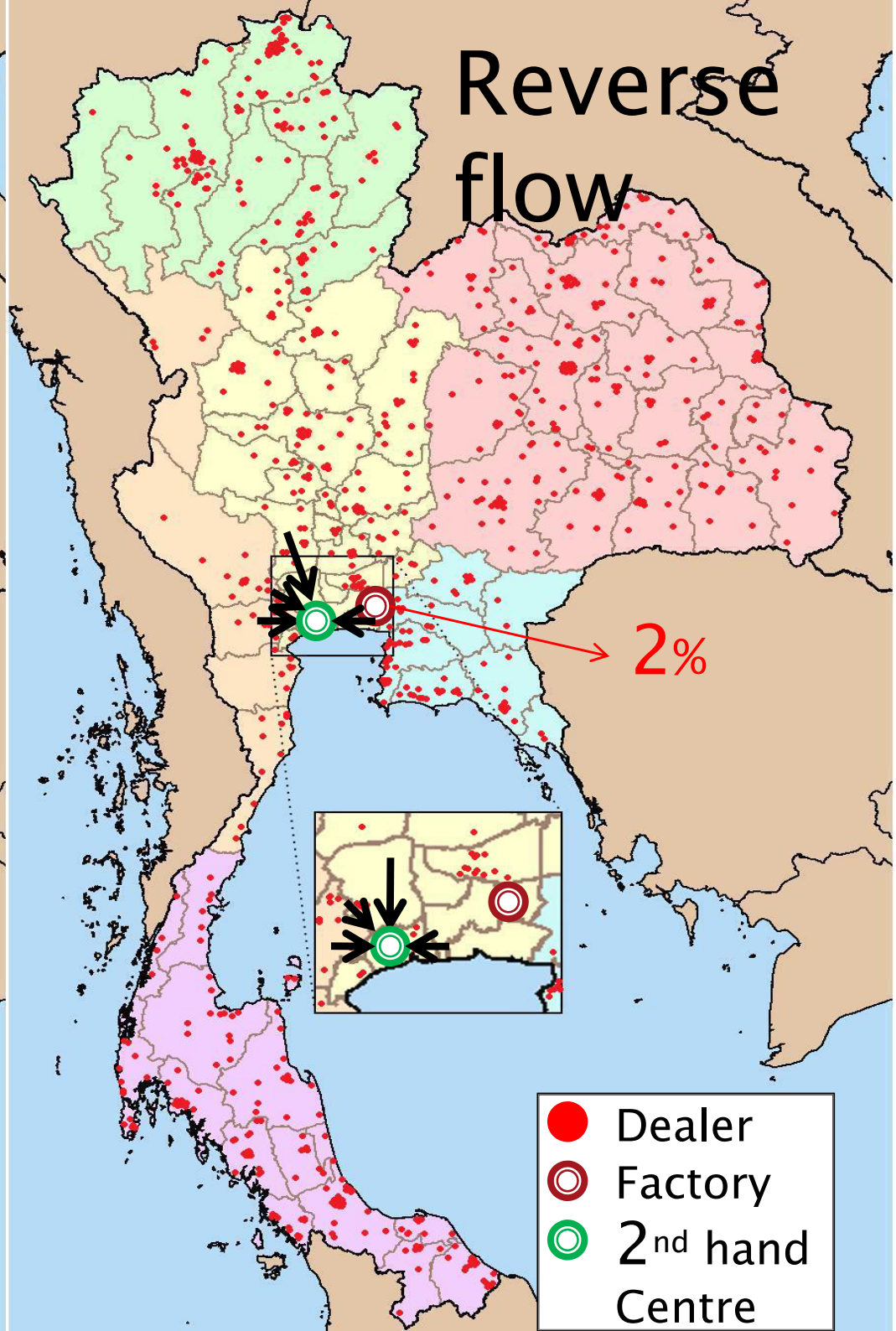
Incineration

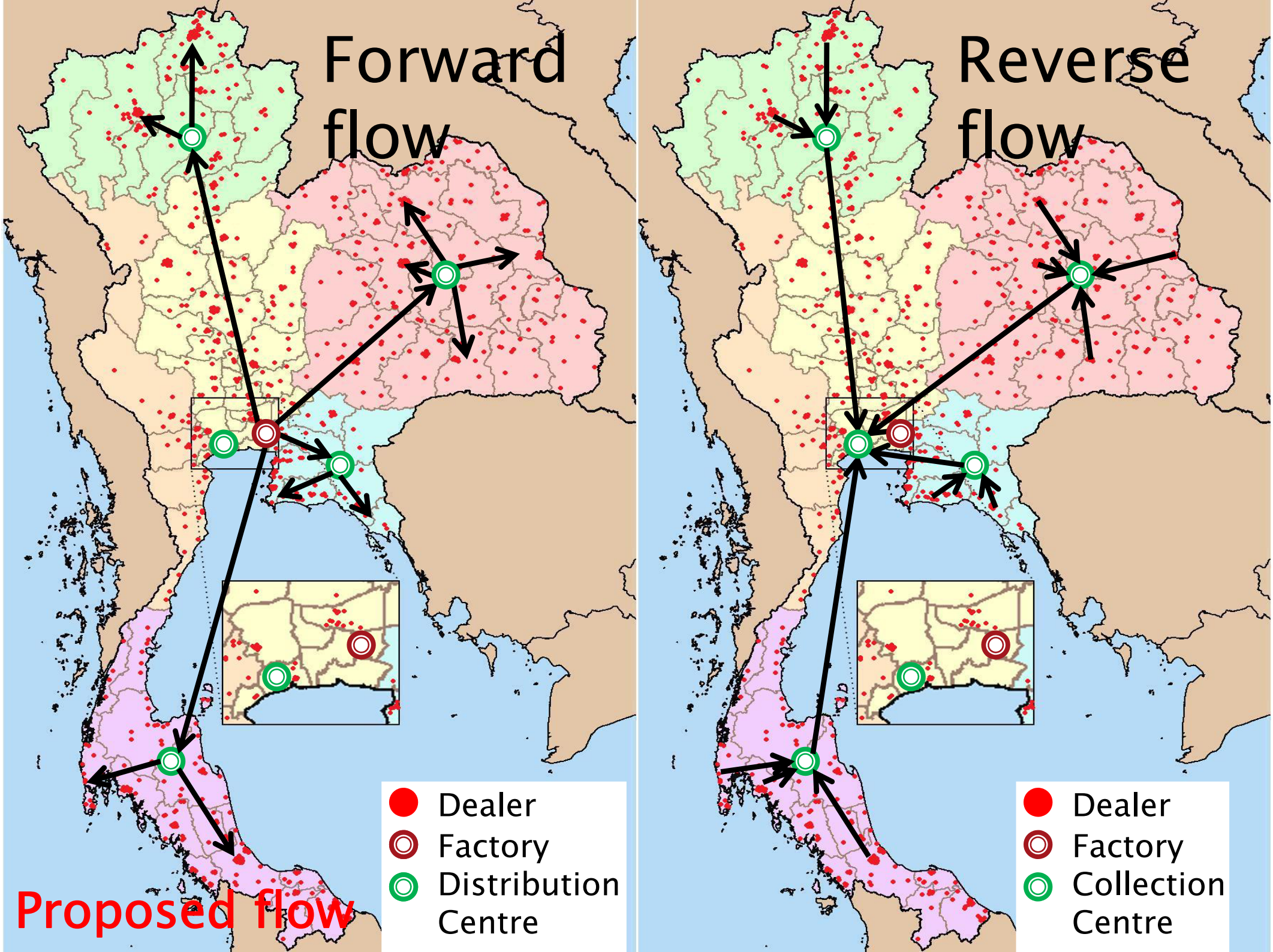
Recycle

Current motorcycle transportation in Thailand




Forward flow
Dealer
Factory
2nd hand Centre
Current flow


Reverse flow
2%
Dealer
Factory
2nd hand Centre


Forward flow
Reverse flow
Proposed flow
Dealer
Factory
Distribution Centre
Dealer
Factory
Collection Centre

ESTIMATION OF MOTORCYCLE TRANSPORTATION DEMAND IN THAILAND

$$P_t = (P_{t-1} + N_t) - \left(N_{t-1} + \sum_{n=1}^{n} \propto_n N_{t-n-1}\right) + \sum_{n=1}^{n} \propto_n N_{t-n} - (S_t + C_{per,t} + C_{temp,t}) + T_t$$

suspended

Currently possessed

New registered

Survival rate

Transferred

Wh re

t : year

: vehicle ac

re r *t*

va

hicle fe n ye

P_t : Number being ear *t*

S_t : Vehicle that suspended in year due to being unable to pay the tax for consecutive 3 years, enacted in year 2004

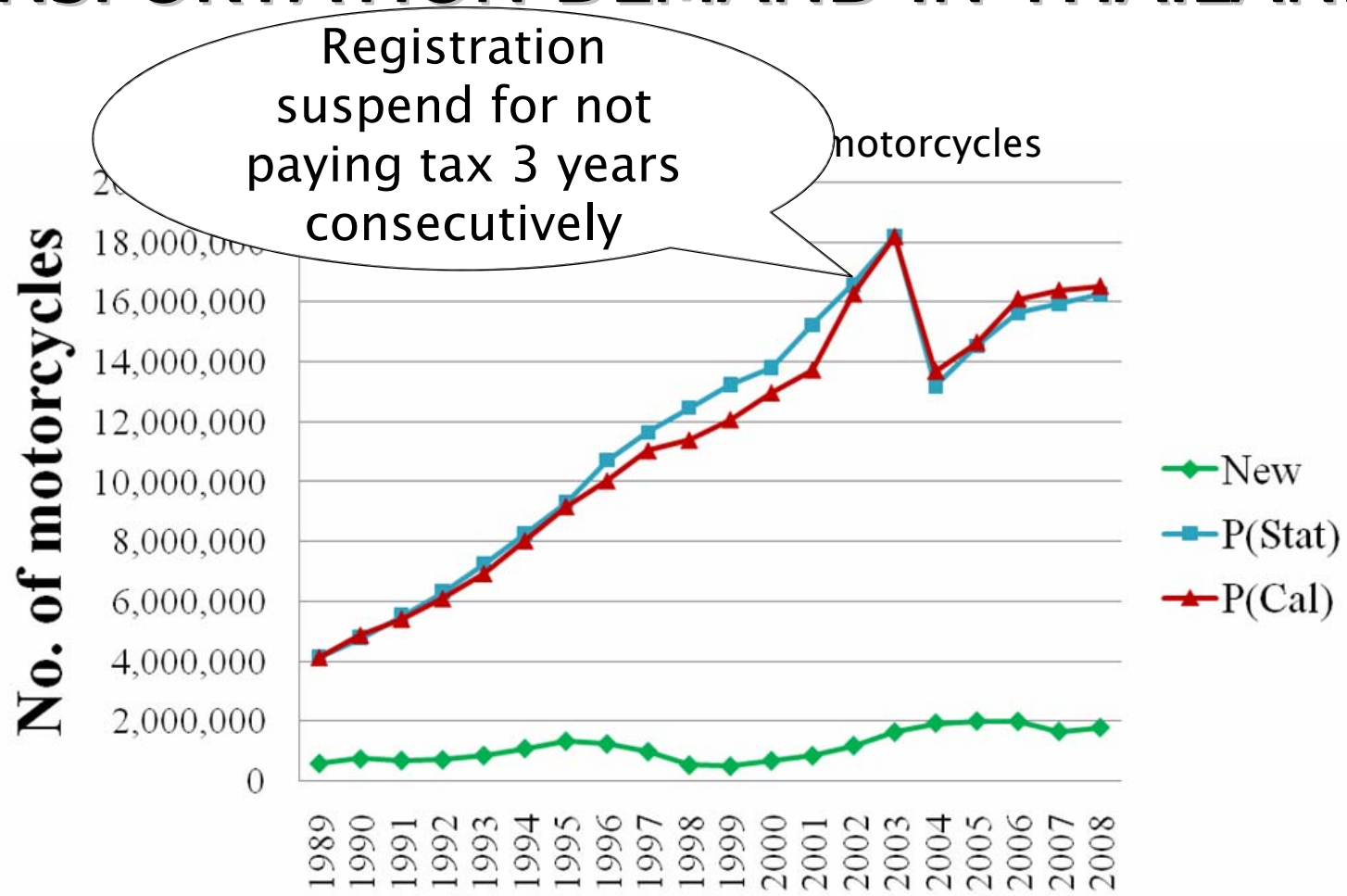
$C_{per,t}$: Vehicle that registration was inquired to cancel from user permanently in year *t*

$C_{temp,t}$: Vehicle that registration was inquired to cancel from user temporarily in year *t*

ESTIMATION OF MOTORCYCLE TRANSPORTATION DEMAND IN THAILAND

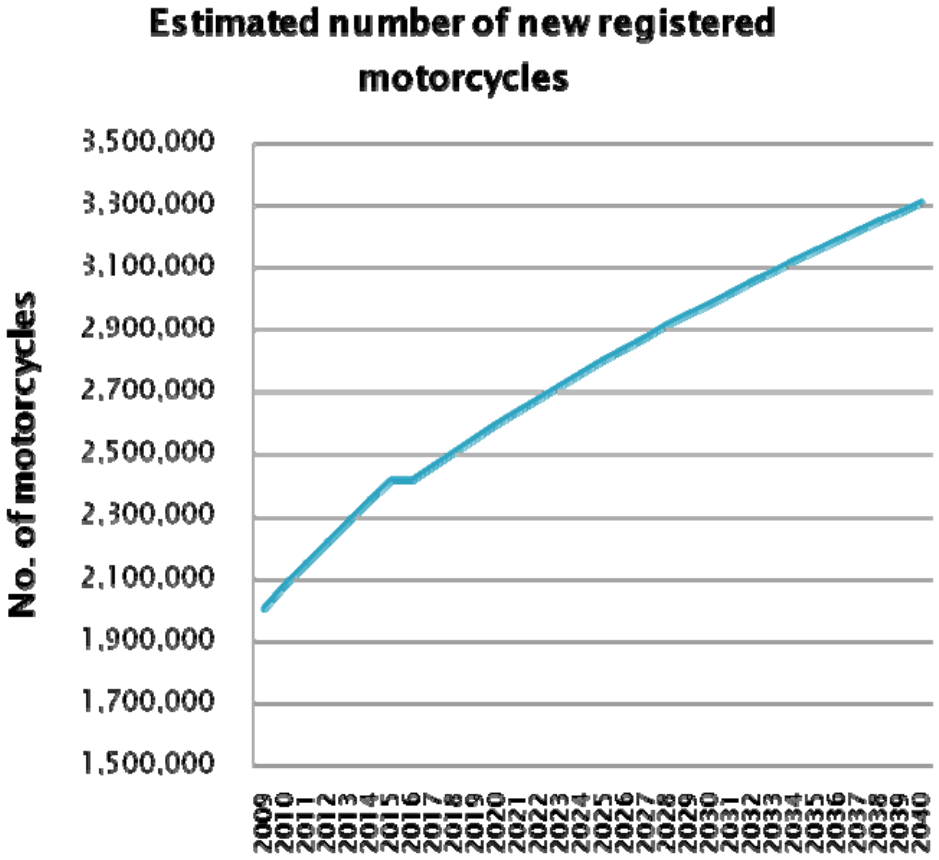
Survival rate

Survival rate α_n		1-α_n
α_1	1	0
α_2	0.95	0.05
α_3	0.85	0.15
α_4	0.85	0.15
α_5	0.8	0.2
α_6	0.8	0.2
α_7	0.7	0.3

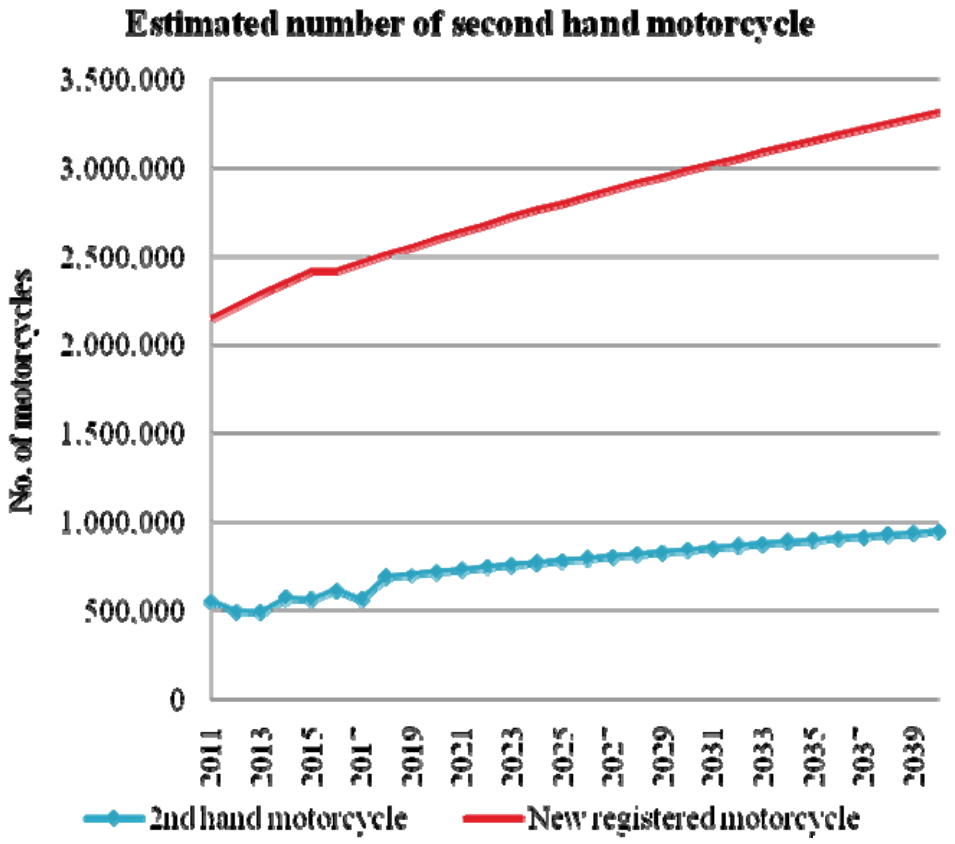


- Minimum error = 1.8%.
- The sudden drop in year 2004 is caused by the regulation that suspend the registration for those who do not pay tax for consecutive 3 years was first started.

ESTIMATION OF MOTORCYCLE TRANSPORTATION DEMAND IN THAILAND

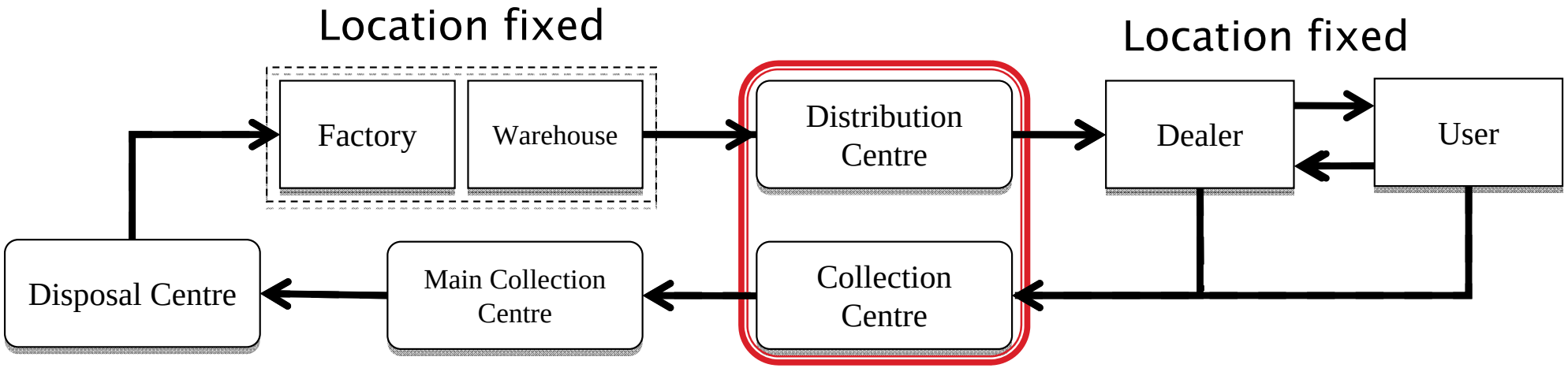


New registered motorcycles



2nd hand motorcycles

Development of evaluation model for reverse logistics network



Design variable : Location and number of facilities

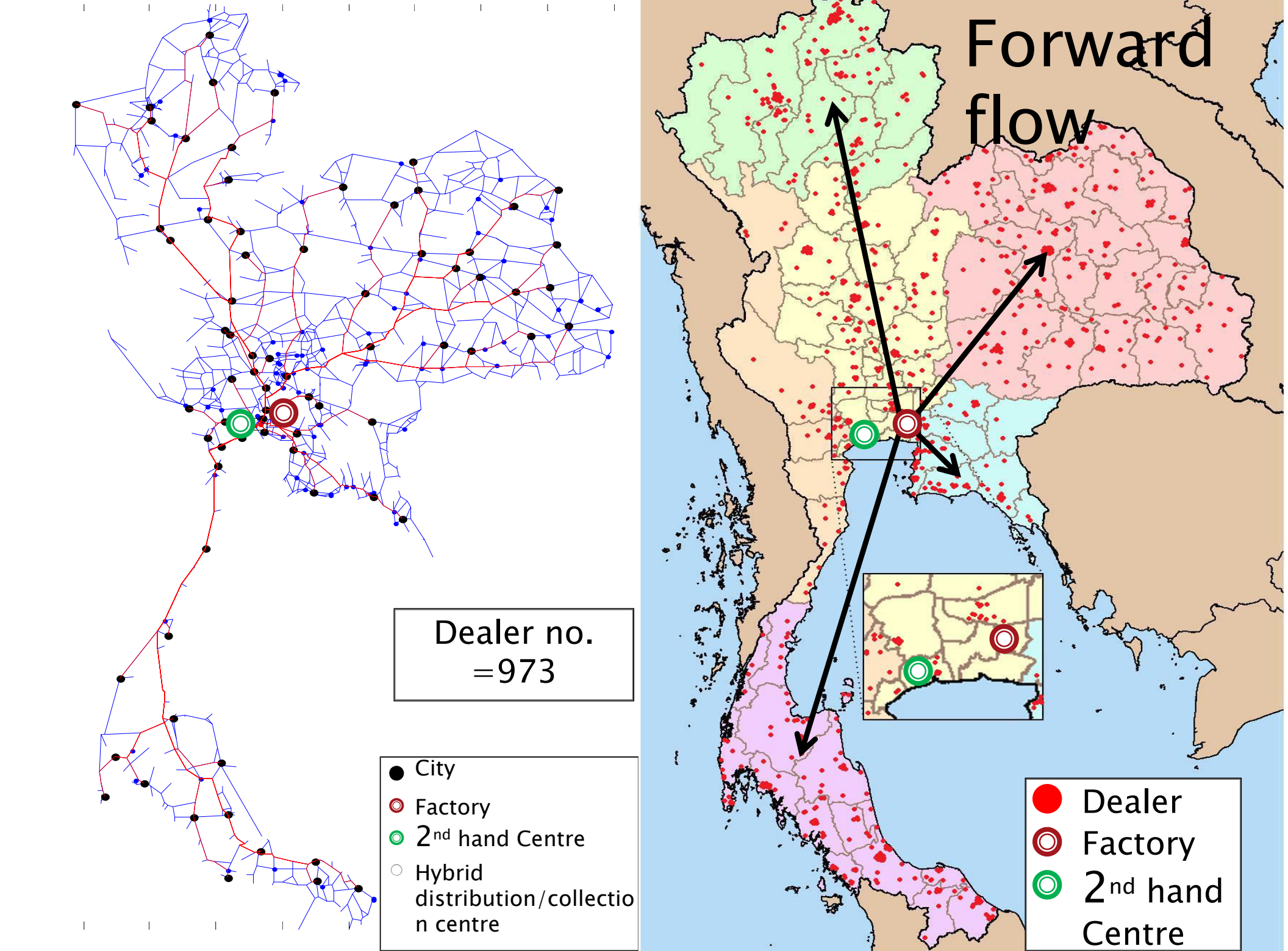
$$\sum_{t\in T}\sum_{d\in D} T_{wd}X^{f_1}_{wdt} + \sum_{t\in T}\sum_{d\in D}\sum_{s\in S} T_{ds}X^{f_2}_{dst} + \sum_{t\in T}\sum_{s\in S}\sum_{c\in C} T_{sc}X^{r_1}_{sct} + \sum_{t\in T}\sum_{c\in C} T_{cC_0}X^{r_2}_{cC_0t} + \sum_{i\in I} C_i Y_i + \sum_{t\in T}\sum_{i\in I} f_t Y_i$$

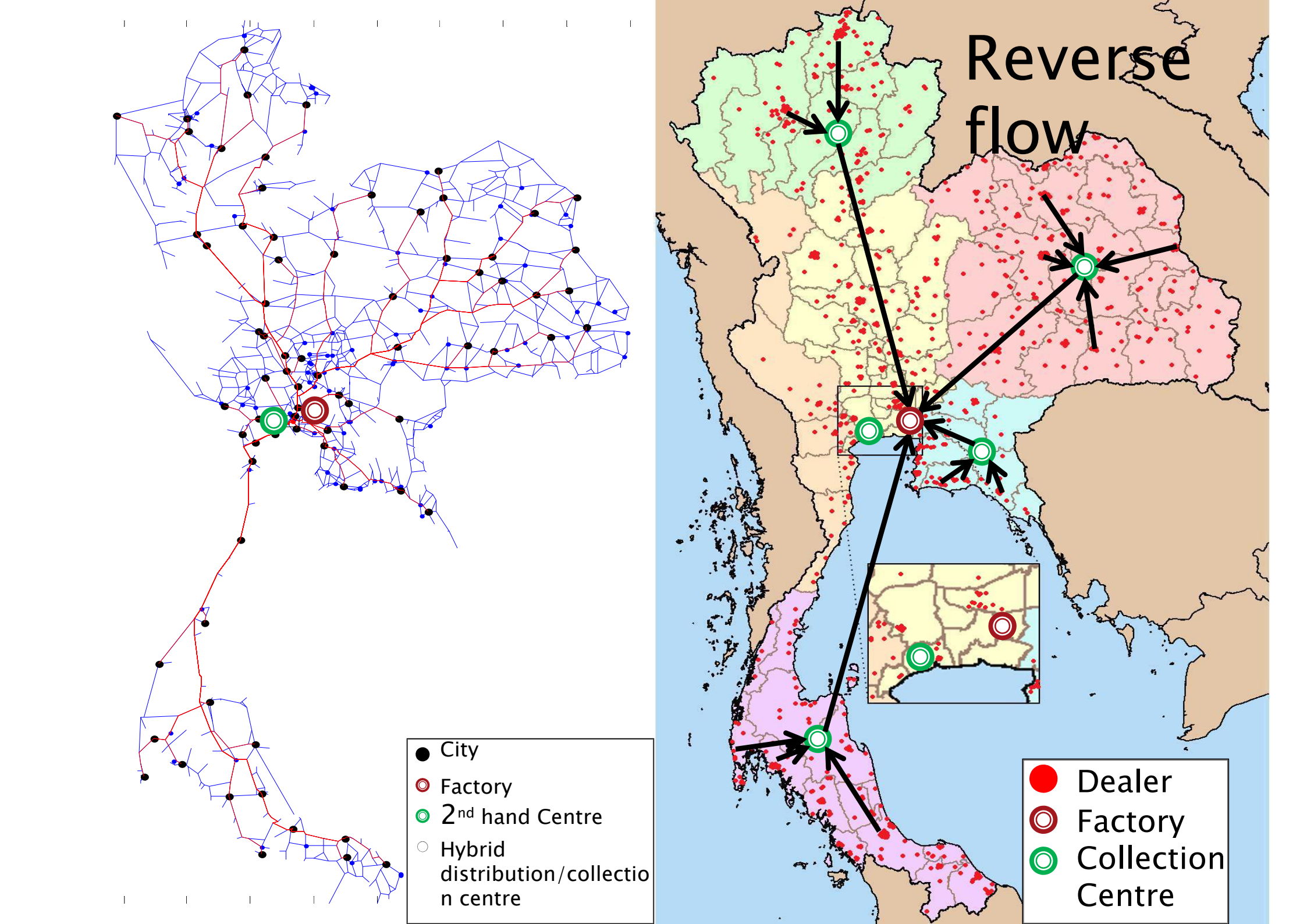
Forward transportation cost

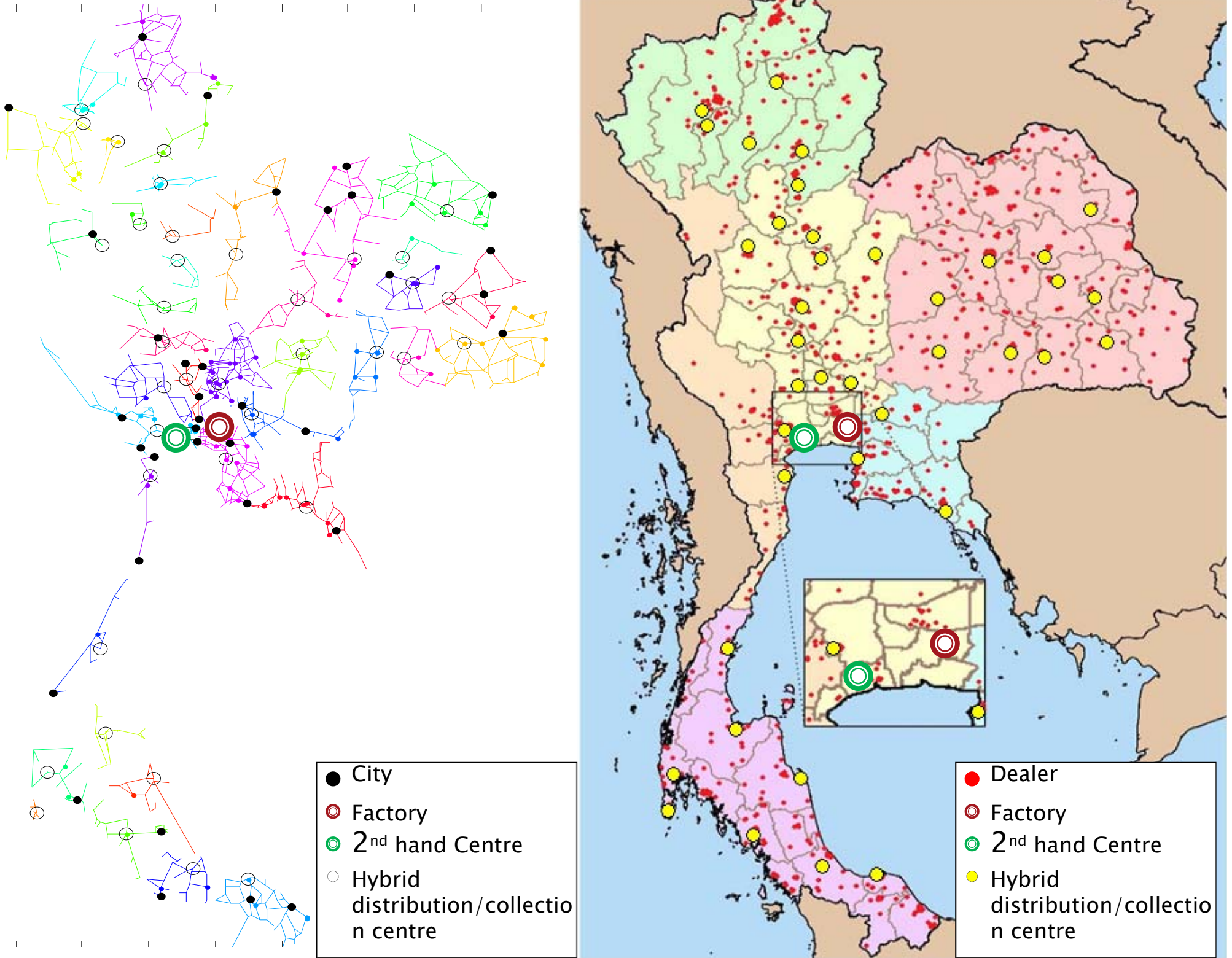
Reverse transportation cost

Construction cost

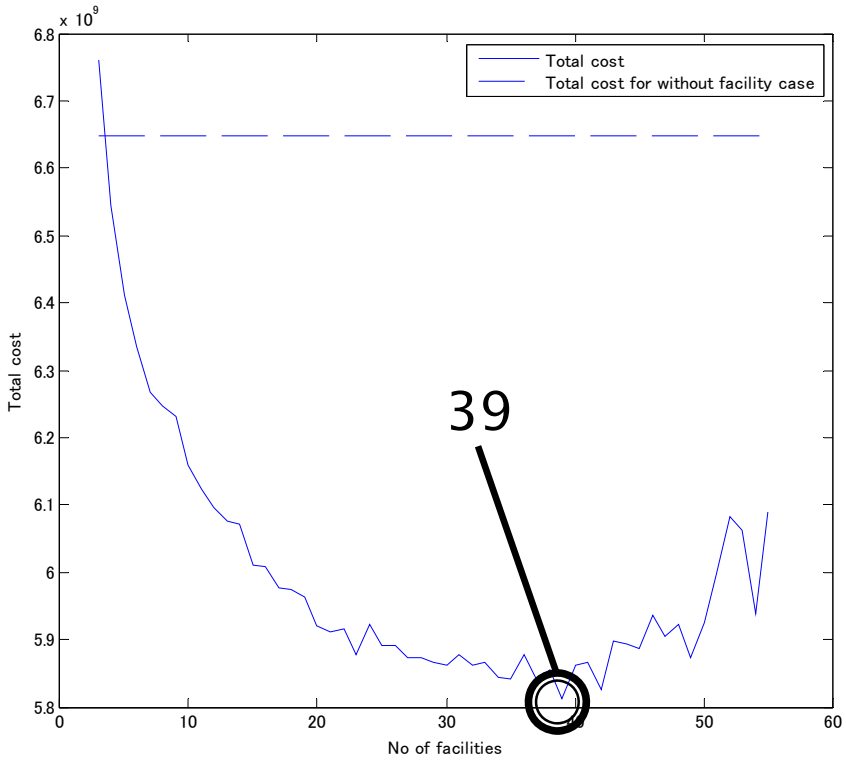
Operation cost

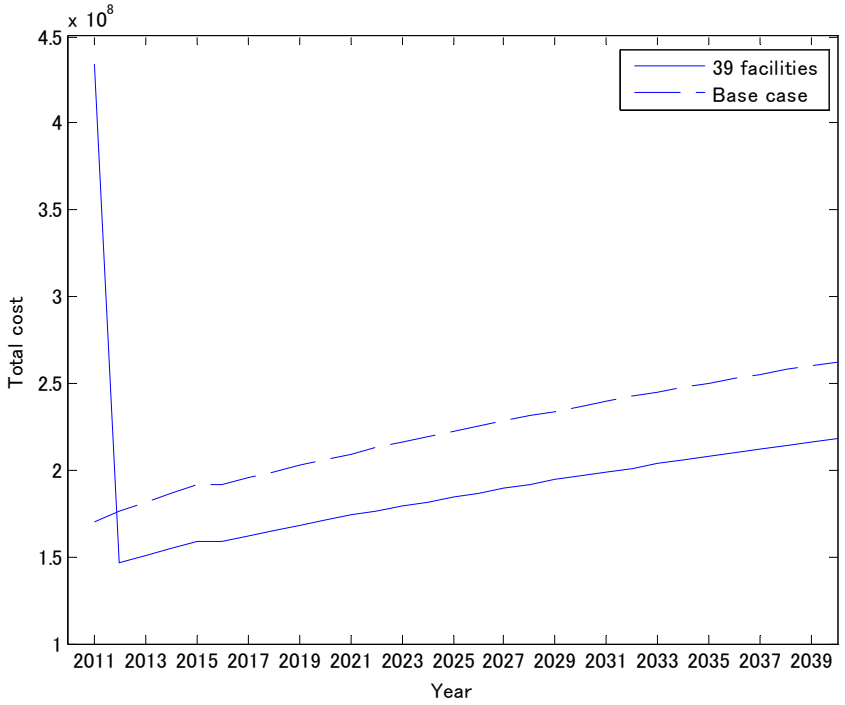

Forward flow
Dealer no. =973
City
Factory
2nd hand Centre
Hybrid distribution/collection centre
Dealer
Factory
2nd hand Centre


Reverse flow
City
Factory
2nd hand Centre
Hybrid distribution/collection centre
Dealer
Factory
Collection Centre


City
Factory
2nd hand Centre
Hybrid distribution/collection centre
Dealer
Factory
2nd hand Centre
Hybrid distribution/collection centre

RESULTS





- The optimal number of Hybrid distribution/collection centre was found to be 39.
- Comparing with the current system, with Hybrid distribution/collection being established the total cost are reduced and more benefit can be gained.

SUMMARY

- In this study, for motorcycle transportation as a case study, it has been found that by introducing distribution/collection facility in the logistics network , the cost can be reduced.
- As a further study
  - Regional cohort model should be performed
  - Stochastic demand should be applied

Thank you for your attention

Scope of study

The following tasks are investigated

① Clarifying the actual situation of the motorcycle transportation

②Demand estimation for motorcycle transportation. Also, the number of scraped, recycled and 2nd hand motorcycle.

③Facility allocation to the logistics network.

ESTIMATION OF MOTORCYCLE TRANSPORTATION DEMAND IN THAILAND

- To estimate the demand, the number of new registered motorcycles are also needed therefore the number of new registered motorcycles are also forecasted.
- To forecast the number of new registered motorcycles, GDP are used for forecasting.