GHG emissions reduction through urban organic waste utilization: cases of Cambodia and Thailand

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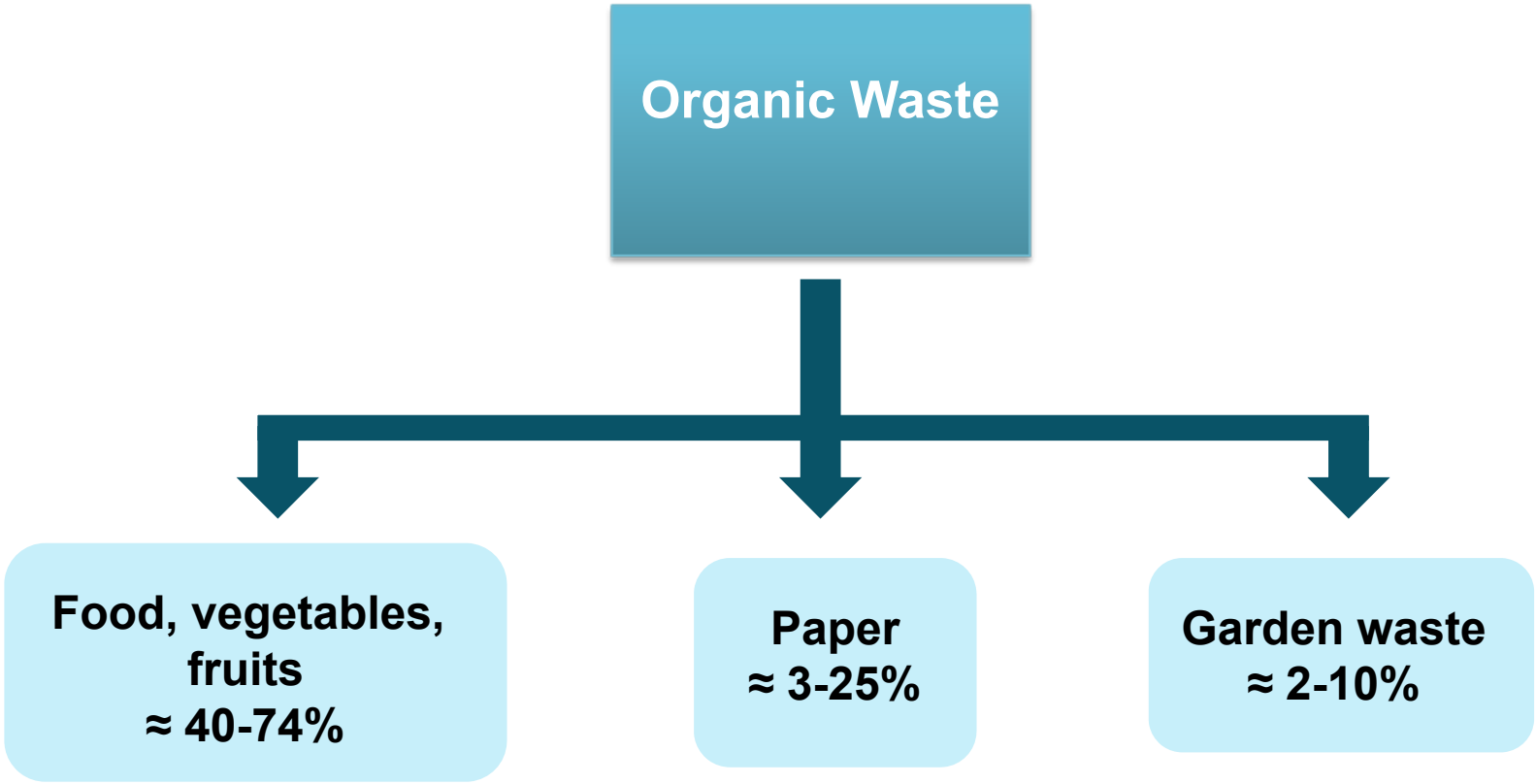
Composition of organic waste in MSW



Organic waste management and GHG emissions

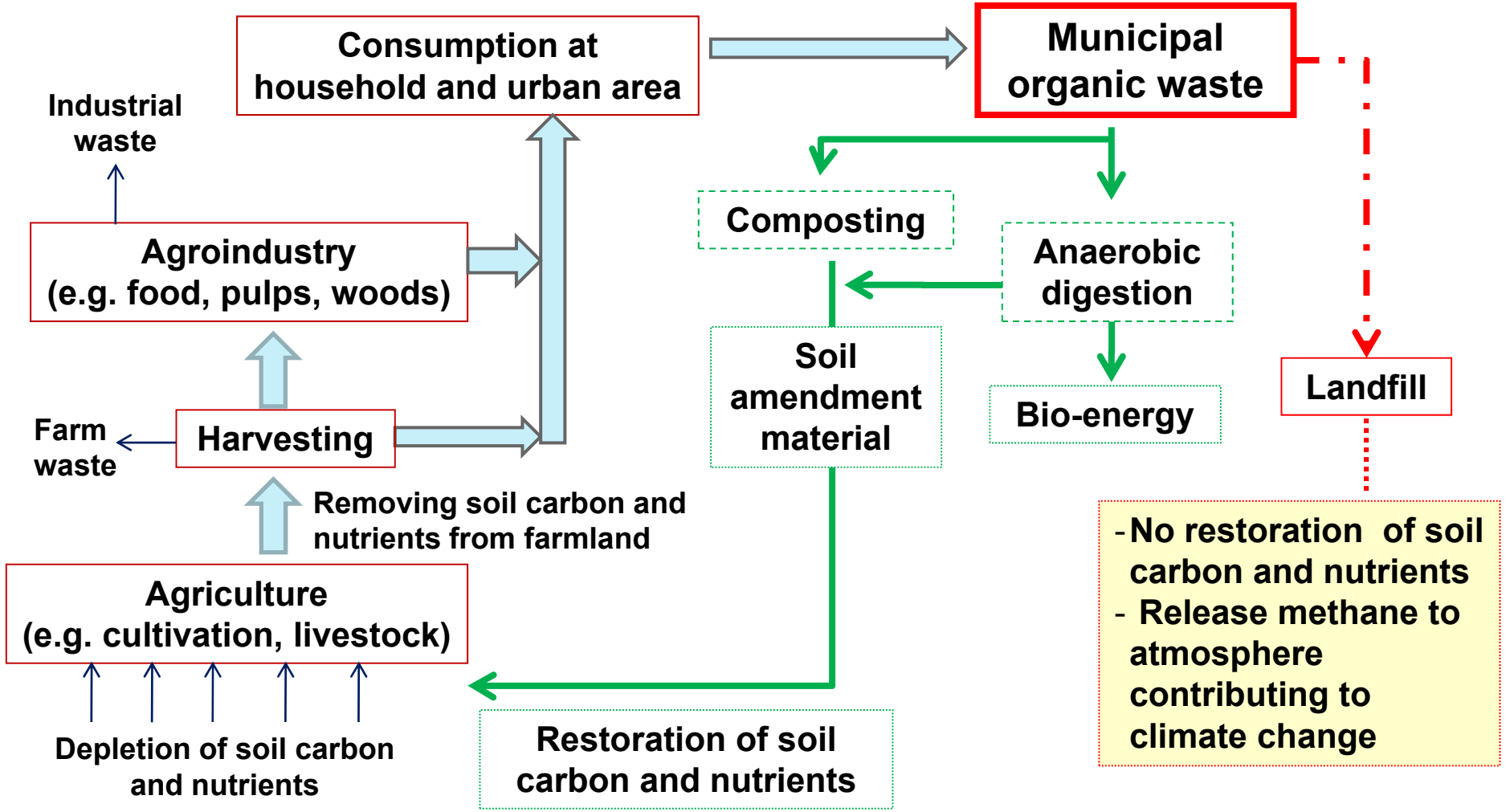
Negative

- Degradation of organic waste under anaerobic condition (e.g. landfill) release methane to atmosphere, the largest source of GHG emissions from the waste sector.
- Composting and anaerobic digestion may release GHGs such as methane and nitrous oxide, but its balance is lower than landfill.

Positive

- Use of compost, biosolids and biogas can help restoring soil carbon and nutrients, and avoid GHG emissions from the industrial, energy, and forestry sectors.

Restoration of soil carbon and nutrients through urban organic waste utilization



Potential GHG emission reduction from composting and anaerobic digestion

- **20-98% reduction by composting**
- **60-100% by anaerobic digestion of food waste**

Utilization	Compare to poor managed shallow landfill (0.42 tCO_2eq/ton of waste)	Compare to well managed deep landfill (1.05 tCO_2eq/ton of waste)
Composting		
- poor management	0.07	0.70
- well management	0.40	1.03
Anaerobic digestion		
- poor management	0.25	0.88
- well management	0.42	1.05

Co-benefit from separation of organic waste

- **Separation of organic waste help increase recycling rate of other recyclable waste**

- **GHG emissions reduction from recycling**

  - **94% by recycling of plastic.**
  - **80% by recycling of steel.**
  - **56-64% by using 50% recycled aluminum.**
  - **22% by increasing use of recycled glass from 25% to 59%.**

Overview of urban organic waste utilization in developing Asian countries

- Generally, urban organic waste management is open dumping in designated area. Sometimes, open burning is applied to reduce volume of waste.
- Urban organic waste utilization is being promoted in some cities, but its implementation is found only in project area.
- Therefore, it is essential to improve waste management practice and to enhance utilization of urban organic waste which can contribute to the national agenda on food, energy, socio-economic development and climate change.

National policies on urban organic waste utilization

- **Climate change mitigation plan**
  - Composting: China, India, Thailand, Bangladesh
  - Anaerobic digestion: China, India
  - Landfill gas recovery: China, Bangladesh

- **National 3Rs Strategic Plan**
  - Bangladesh, Cambodia, Indonesia, Malaysia, Philippines, Thailand, Viet Nam

Example of urban organic waste utilization projects in Cambodia and Thailand

Market waste composting in Phnom Penh, Cambodia

Collection of organic waste from food market

5 tons/day

Transportation to composting facility

Composting

Screening

Sell compost to farmers

75 USD/ton

Use compost for cultivation

Sell crops to market

≈1.4 ton CO_2 emission reduction per day

Bangkok Composting project, Thailand

Consumption

Municipal solid waste

1,000 tons/day

Waste screening at composting plant

Fermentation in vessel

Maturity of compost

Sell compost to farmers

62.5 USD/ton

Use compost for cultivation and gardening

Sell crops product to market

≈455 ton CO_2 emission reduction per day

Wood waste composting in Bangkok, Thailand

Wood waste from public area

Composting plant

Investment and operation by BMA

Compost used for greenery area

Mixed with toilet wastewater from time to time

Food waste digester at Wat Pradudhammathipat School, Bangkok

School lunch

Food waste in school

Food waste digester

Effluent is collected by a school technical officer

Used at a sugar cane farm

Biogas collection

Use biogas for cooking school lunch

Biogas project in Rayong, Thailand

Consumption

Separation at household

Collection

Cultivation

≈24.6 ton CO_2 emission reduction per day

Sell to grid

Onsite separation

Distribution to residents

Electricity generation

Digester

Composting

Mixed with urban compost

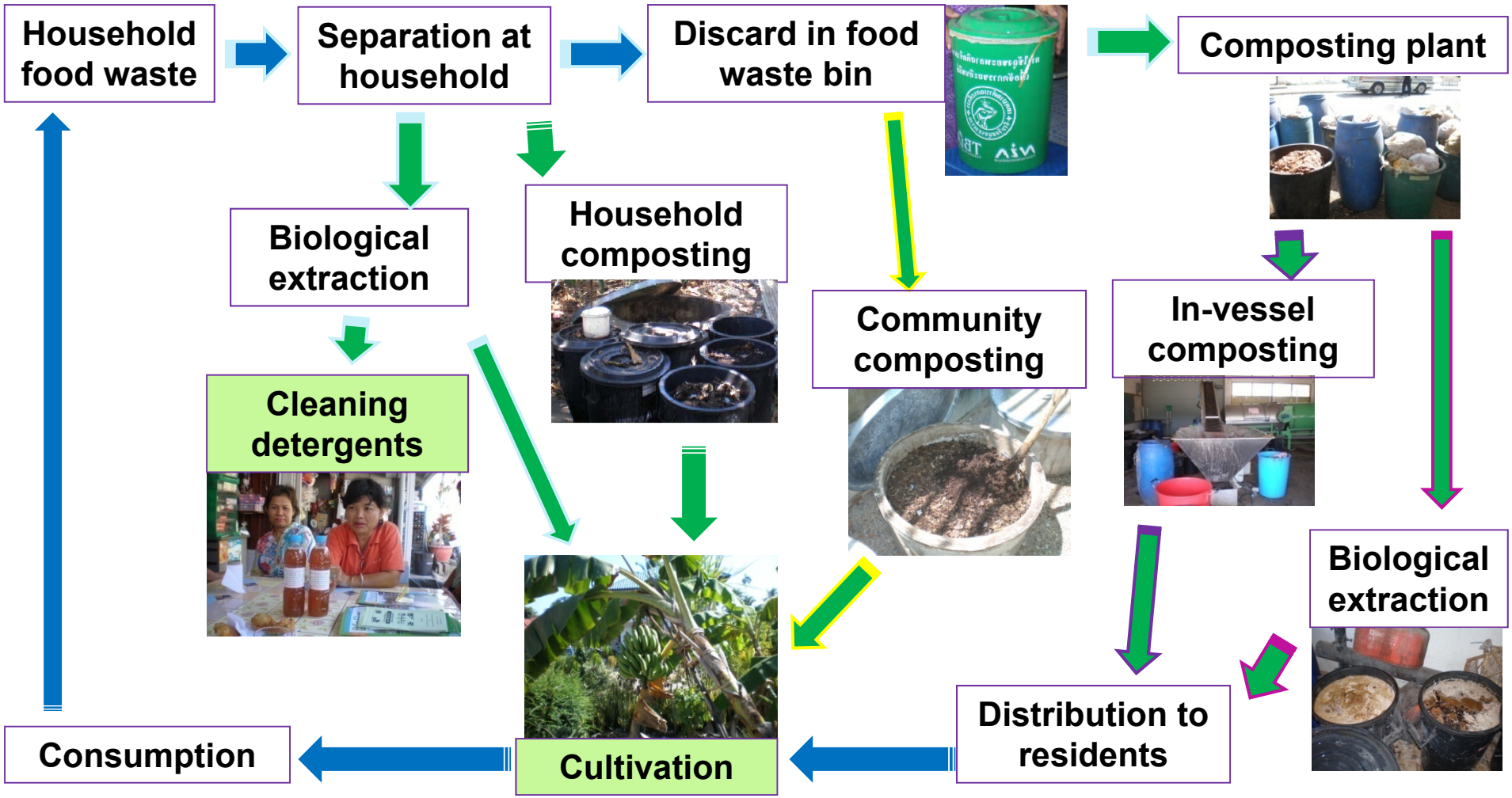
Biogas collection

Compression

Biosolids

Wastewater mixed with new waste

Organic waste management at Kradang-Nga sub-district, Samutsongkram



Challenges and obstacles disrupting scale up and extension of urban organic waste utilization projects

Challenges	Composting at Phnom Penh	Composting at Bangkok	Biogas at Rayong
Capital investment	√	√	√
Maintenance and operation cost	√	√	√
Quantity of waste input	√	√	√
Quality of waste input	√	√	√
Efficiency of waste separation	√	√	√
Cooperation with residents and communities	√	-	√
Cooperation with waste collector	√	-	√
Cooperation between local governments and facility operator	√	√	√
Quality of products	√	√	√
Dependent on marketing of products	√	-	-
Change in policy	√	-	√
Termination of contract	-	√	√

Policy recommendations

- Increase accessibility to capital investment.
- Strong support by local governments: land, budget, policy, etc.
- Starting with small scale but preparing for extension and scaling up.
- Active cooperation among relevant stakeholders: facility operator, local government, waste collector, and residents.
- Starting separation at source program with large waste generators such as market, restaurants, hotel, schools.
- Improving waste collection system suited with waste separation program.
- Conducting stakeholder consultation from time to time to identify problems and solutions for better management.
- Improving market compatibility through quality control of waste input and product output.

Conclusions

- Urban organic waste utilization can reduce GHG emissions from both the waste and non-waste sector and contribute to national agenda such as food and energy security and socio-economic development in developing Asian countries.
- Urban organic waste utilization should be promoted as a climate change mitigation measure, however modification to suit with local condition are recommended.
- External supports may be required for infrastructure development, institutional setting and starting up of activities in developing countries.
- Benefits sharing among stakeholders are a key of success especially where local governments have only little money for this activity.

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