Agroecological symbiosis (AES)

– food system redesign for bioenergy and recycling

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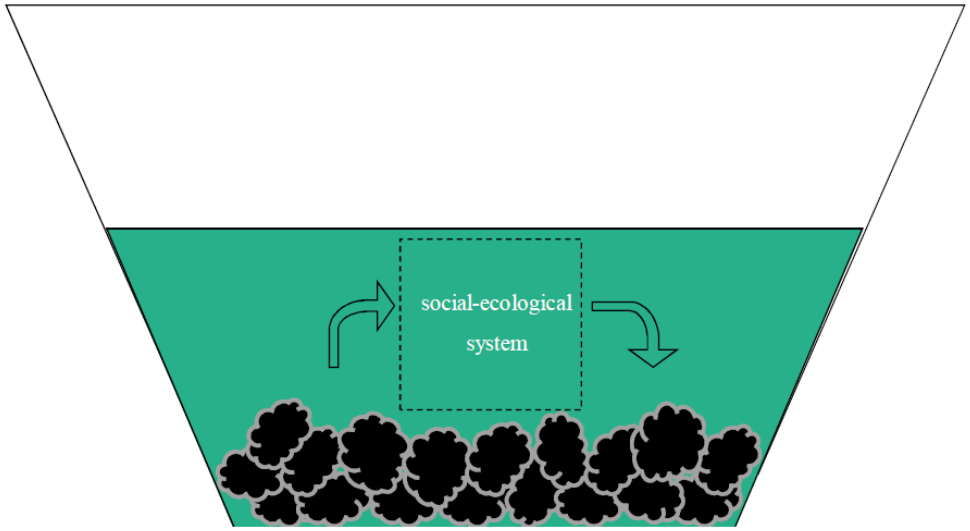
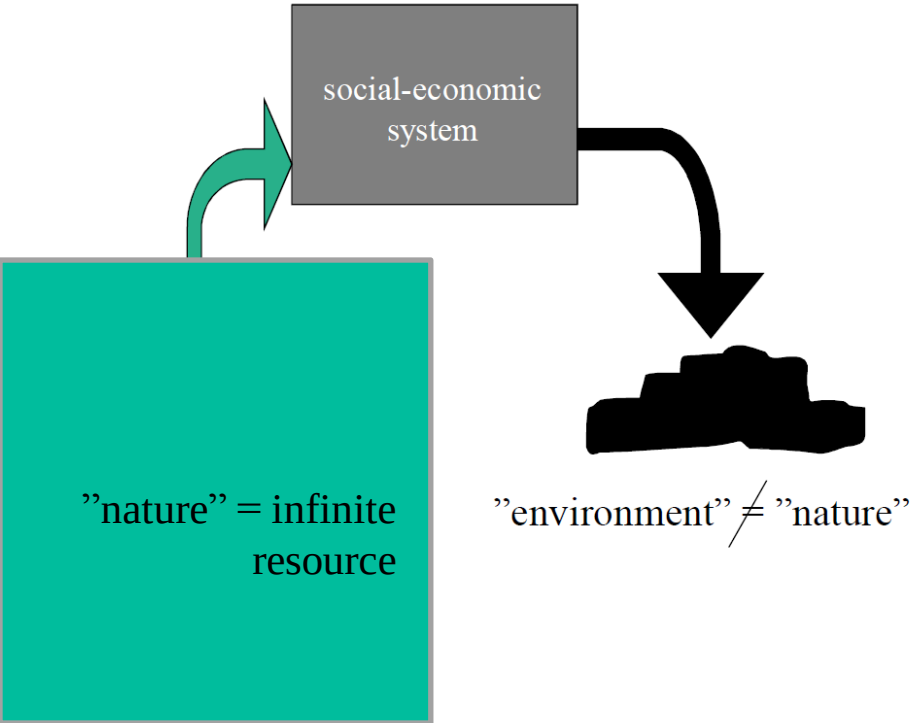
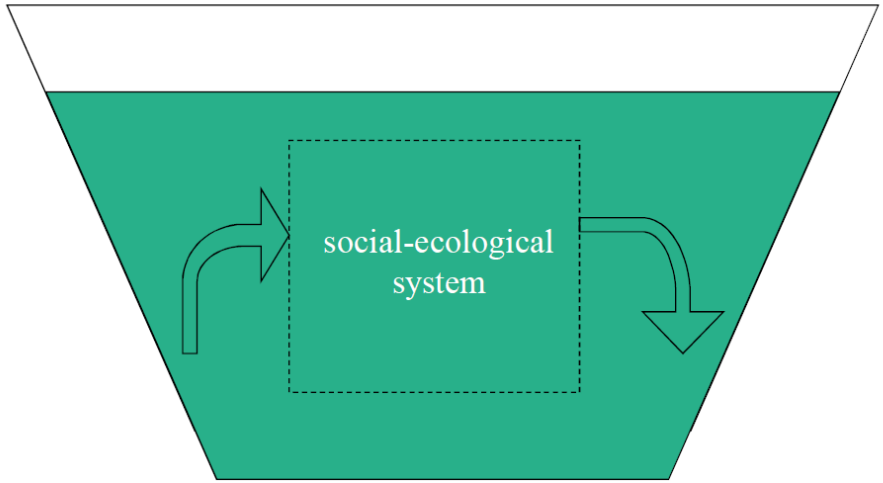
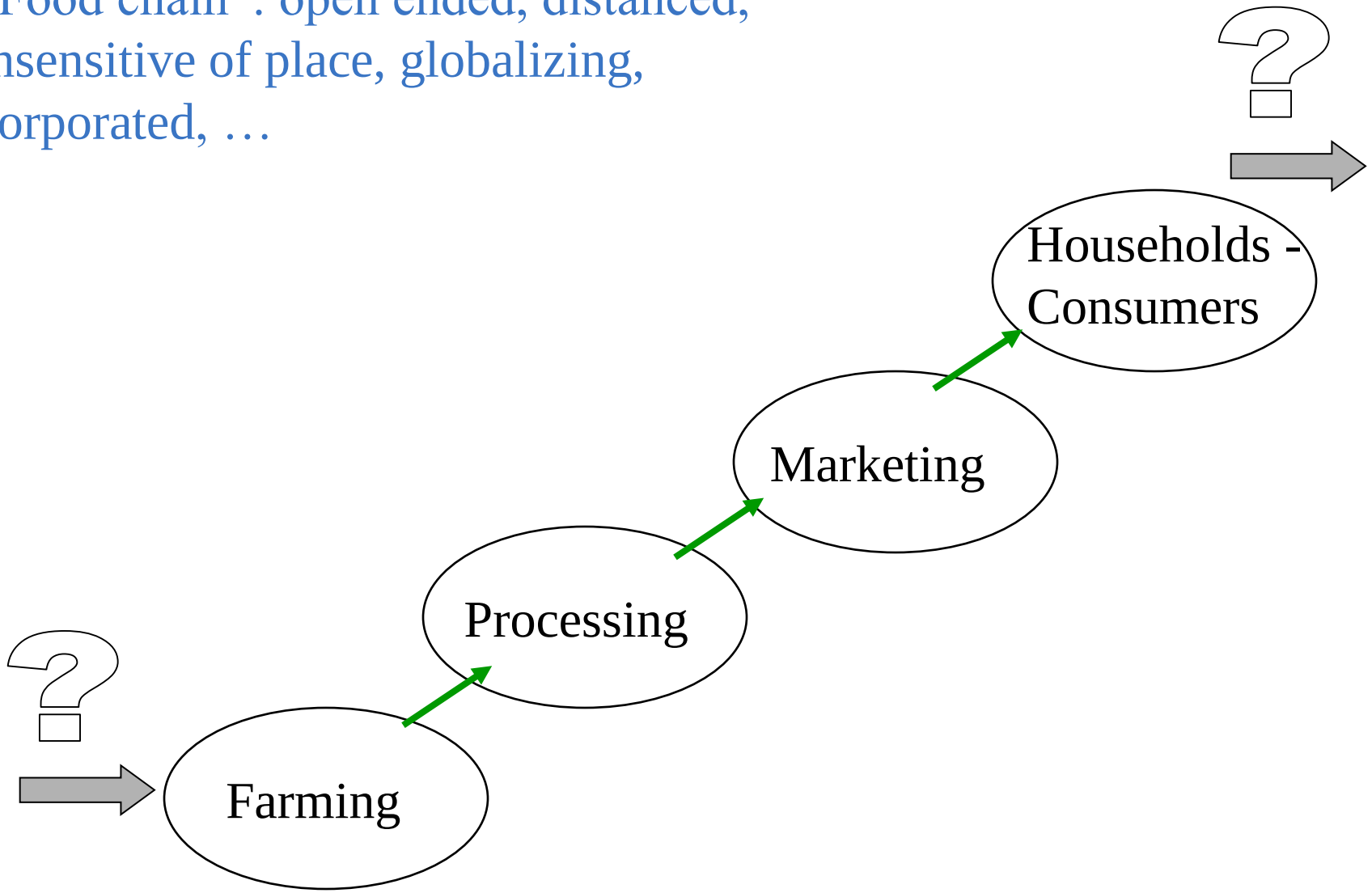
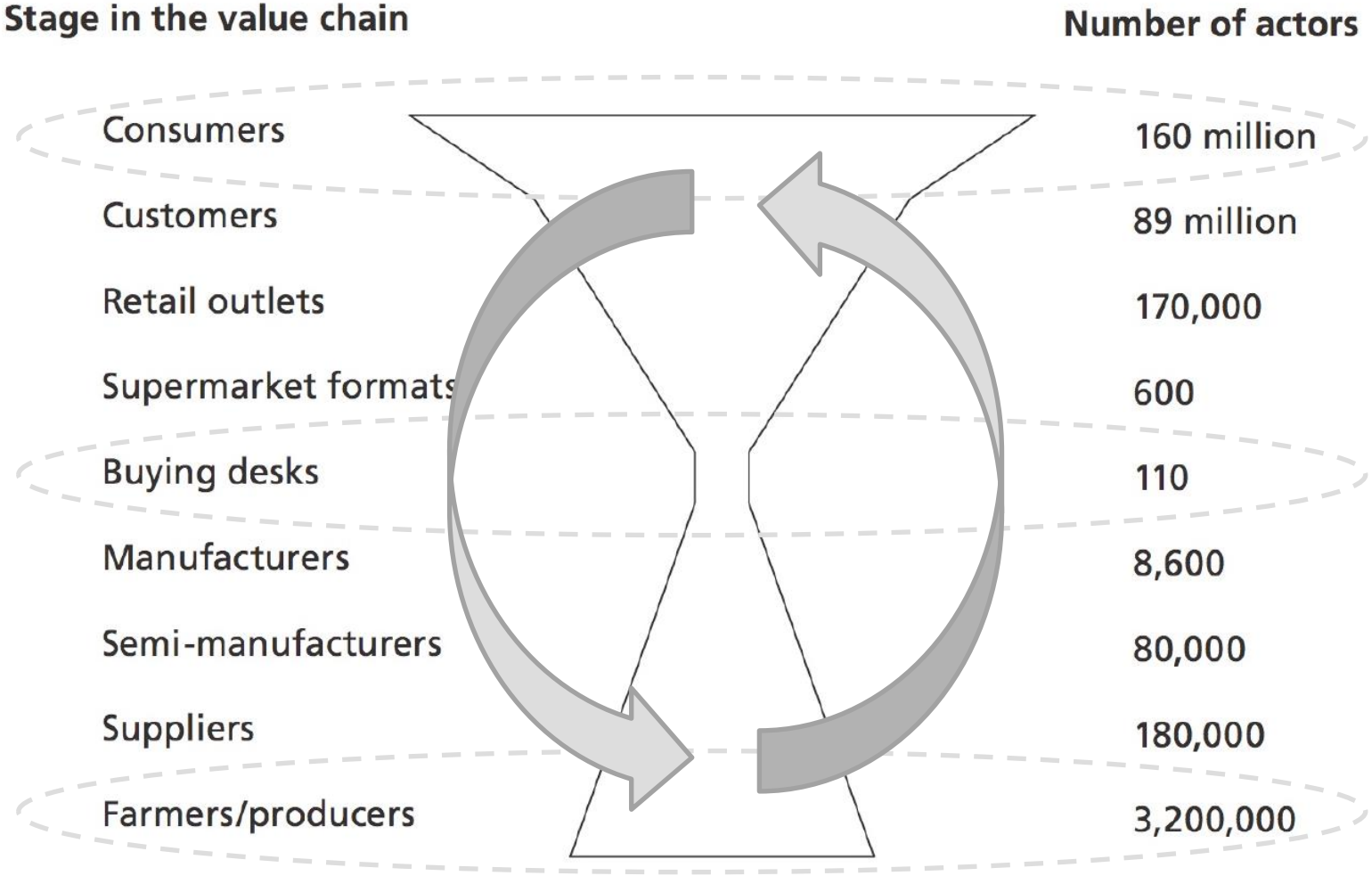

social-ecological
system


social-economic
system
”nature” = infinite
resource
”environment” ≠ ”nature”


social-ecological
system

"Food chain": open ended, distanced, insensitive of place, globalizing, corporated, …

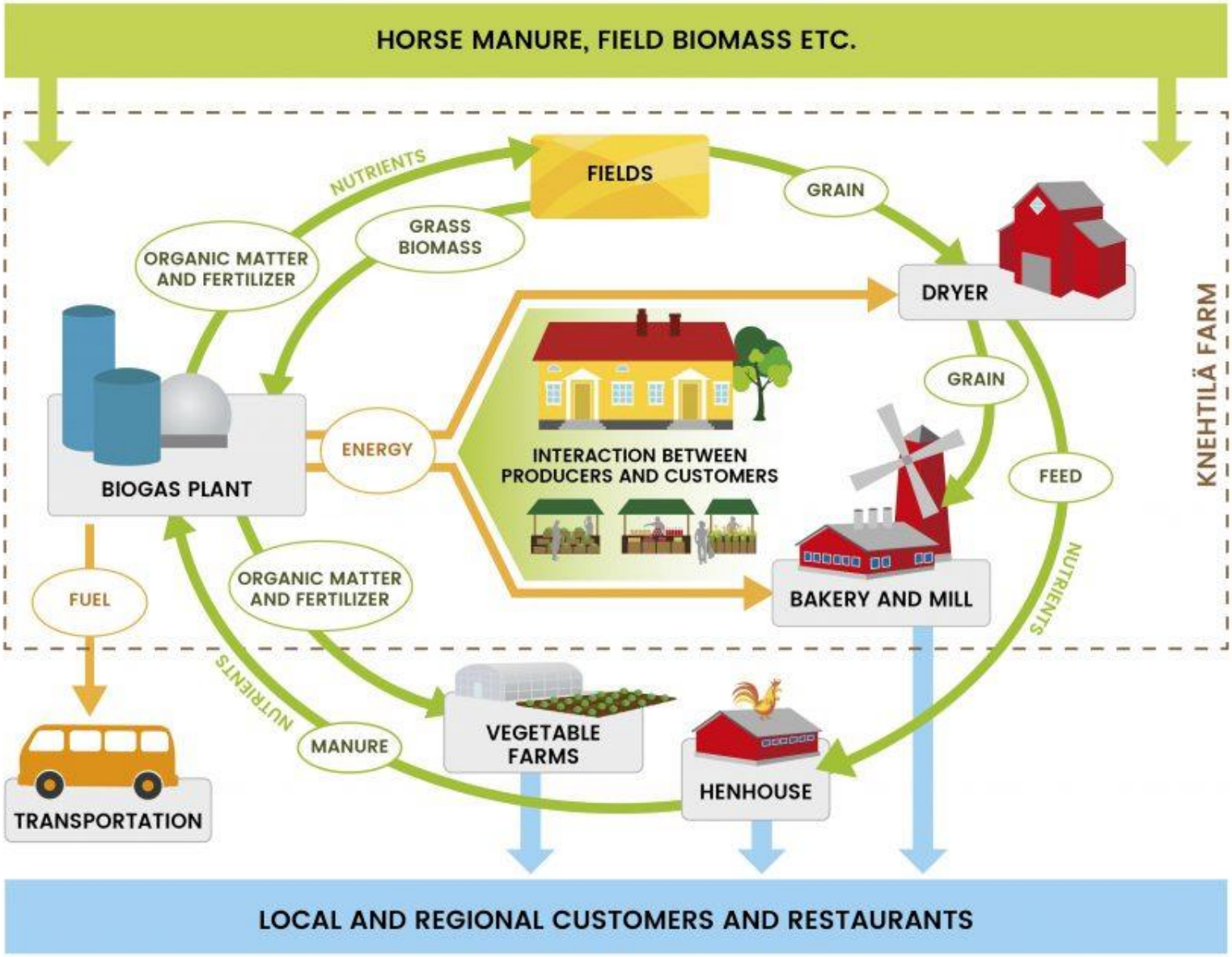




””””The European food chain funnel”

(Source: Poux et al. 2016. Transition scenarios to agroecology in Europe: relevance and challenges of a fundamental contribution to the EU debate on agriculture and environment, IDDRI & European Forum on Nature Conservation and Pastoralism. Fig. 3.

Palopuro Agroecological Symbiosis



Symbiosis

(mutually beneficial) non-obligatory co-existence

fungi + algae = lichen

Industrial Ecology

- ecosystems as models for industrial systems
- no ”waste”, only (recyclable) resources
  - by-products, material flows from one process to another
  - *form cradle to cradle*

Industrial Symbiosis

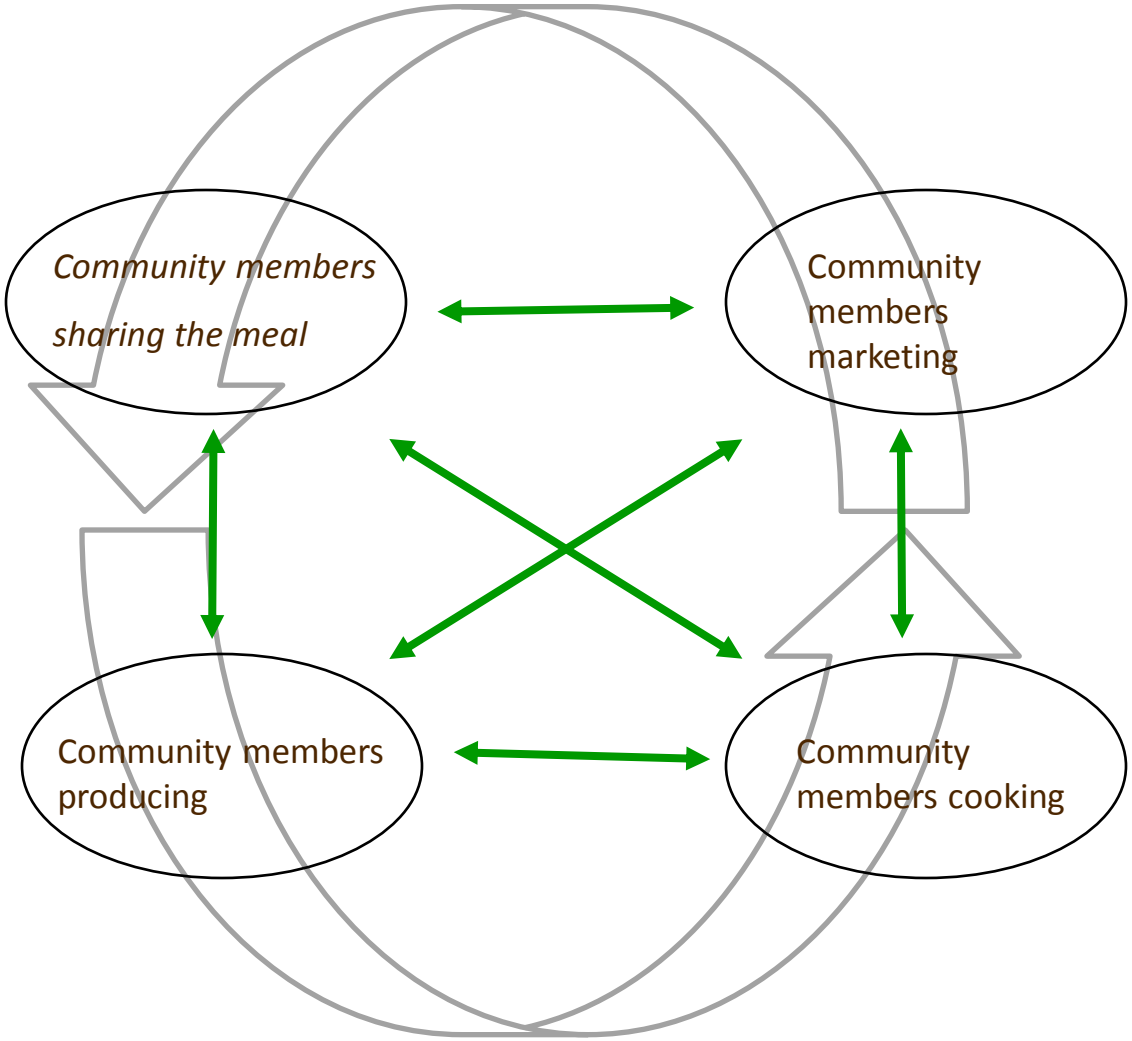
Chertow, M.R. 2000. Annual Review of Energy and Environment 25: 313-317.

- spatial proximity of production partners in an ecoindustrial system
  - possibility to maximize material and energy efficiency
  - enhanced interaction

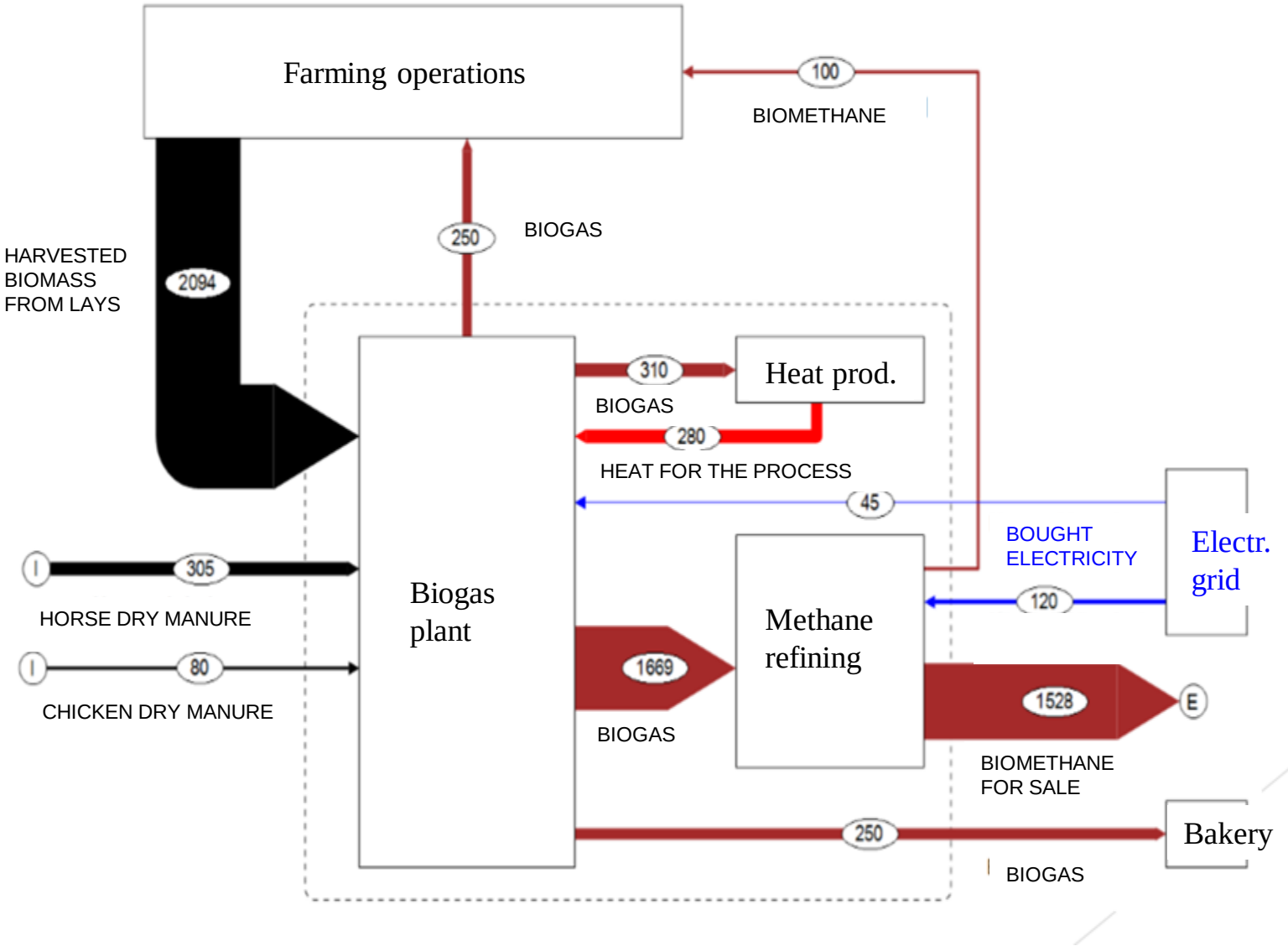
Agroecological Symbiosis (AES)

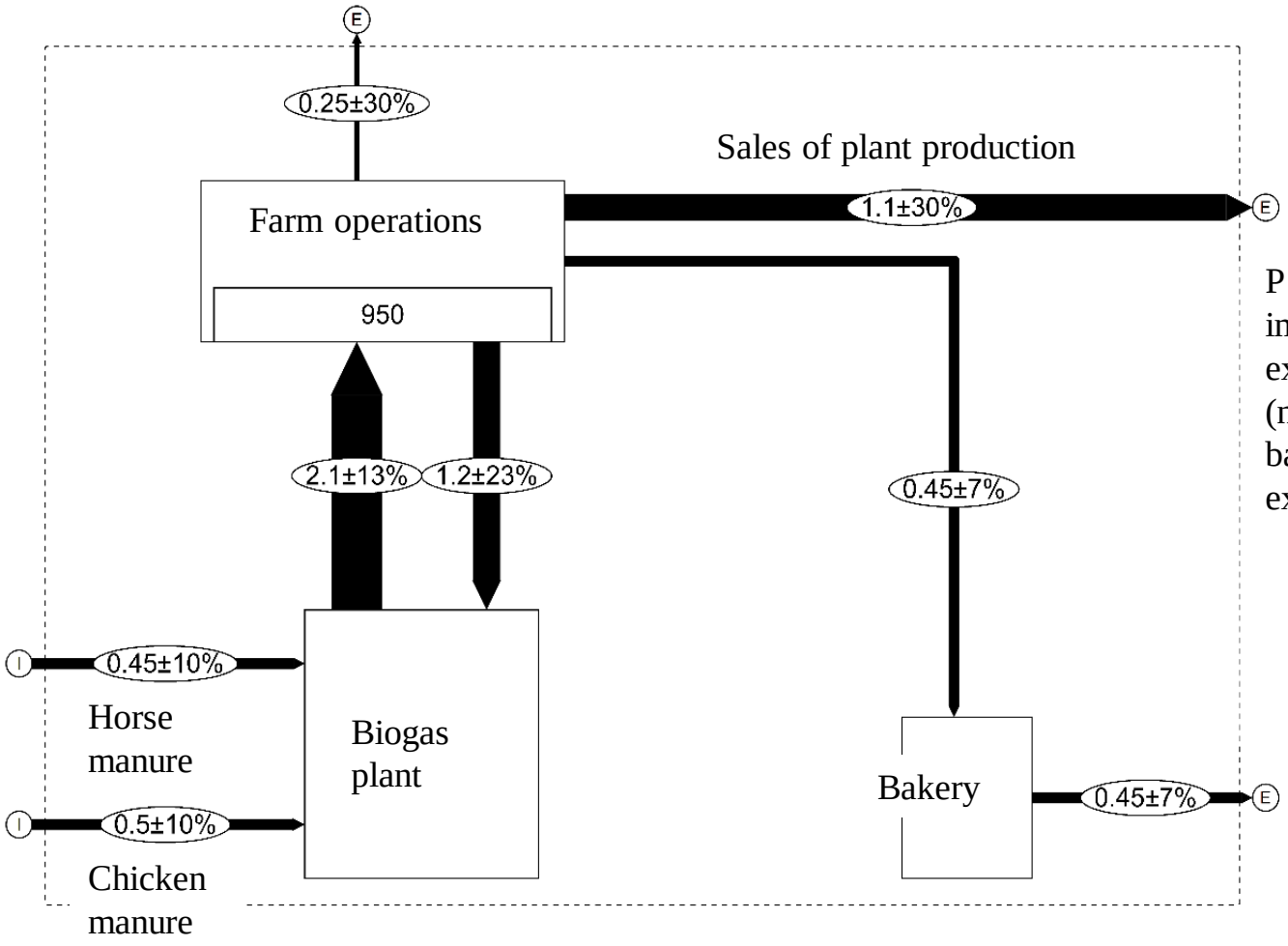
- the idea of industrial symbiosis applied in **food system**
  - **equality** among the actors
  - from linear, open-ended to **cyclic**
  - from uniformity to **diversity**
  - from centralized to **distributed**
  - from global to **local & situated**
  - from unidentifiable to **identifiable food**
  - from consumerism to **food citizenship**

*Circular food system: socio-ecologically **situated food cycle***



Units: MWh/a


Farming operations
100
BIOMETHANE
250
BIOGAS
HARVESTED
BIOMASS
FROM LAYS
2094
310
Heat prod.
BIOGAS
280
HEAT FOR THE PROCESS
45
BOUGHT
ELECTRICITY
Electr.
grid
305
HORSE DRY MANURE
Biogas
plant
Methane
refining
120
80
CHICKEN DRY MANURE
1669
BIOGAS
1528
E
BIOMETHANE
FOR SALE
250
Bakery
BIOGAS

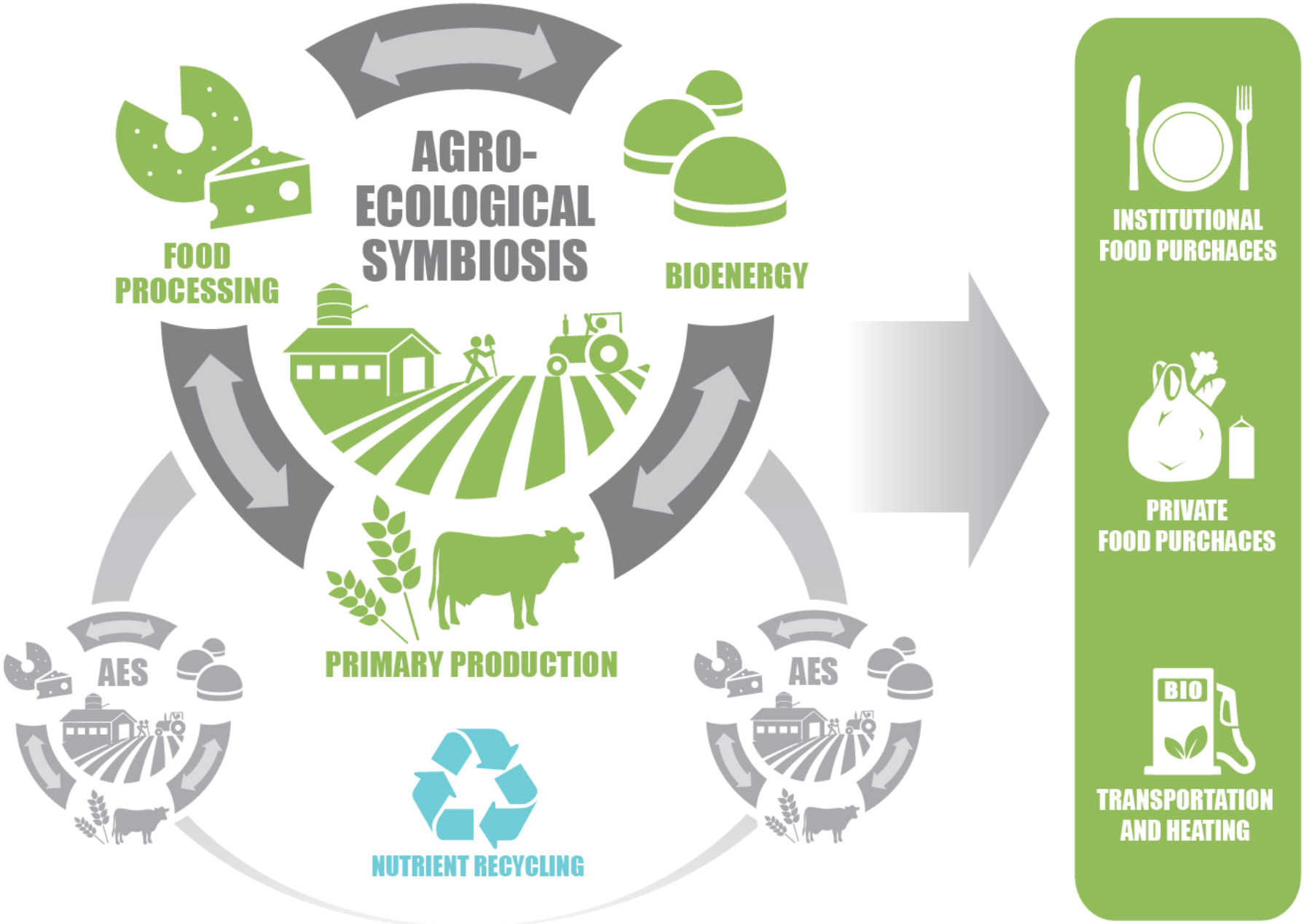


P t/a:
import 1.0,
export 1.8
(negative balance, mining excess soil P)

Nitrogen and Phosphorous balances and nutrient use efficiency for arable land in the CS and AES -models. Uncertainties in the brackets.
Source: *Koppelmäki et al.* 2018.

	N		P	
	CS	AES	CS	AES
Input	120 (95-144)	133 (110-156)	7.3 (6.4-8.1)	8.9 (8.1-9.7)
BNF	96 (76-117)	77 (63-92)		
Manure/organic fertilizers	20 (17-23)	-	7.3 (6.4-8.1)	-
Digestate		52 (44-60)		8.9 (8.1-9.7)
Nitrogen deposition	3 (2-5)	3 (2-5)		
Output in harvested products	23 (19-27)	75 (62-87)	4.0 (3.3-4.6)	9.3 (7.8-10.7)
Balance (surplus)	97 (76-117)	58 (44-72)	3.3 (4.8-1.8)	-0.3 (-2.6-1.9)

AES and environment (source: Helenius et al. 2017)	Environmental variable	Units	Effect size and direction	Reliability
Nutrient loading to waterways	Nitrogen loading	kg/ha	++	high
		kg/kg food	+/-	low
	Phosphorus loading	kg/ha	+	medium
		kg/kg food	+/-	low
	Erosion (solids)	kg/ha	+	medium
		kg/kg food	+/-	low
Biodiversity	Habitats		+	high
	Species		++	high
GHG emissions, CO_2 eq	Energy inputs	kg/ha	+++	high
		kg/kg food	++	high
	N fertilizers	kg/ha	+++	high
		kg/kg food	+++	high
	Farmland	kg/ha	+	medium
		kg/kg food	+/-	low
Soil	Soil organic matter	SOM content	+++	high
	Carbon in soil	kg/ha	++	high


AGRO-
ECOLOGICAL
SYMBIOSIS
FOOD
PROCESSING
BIOENERGY
PRIMARY PRODUCTION
AES
AES
NUTRIENT RECYCLING
INSTITUTIONAL
FOOD PURCHACES
PRIVATE
FOOD PURCHACES
BIO
TRANSPORTATION
AND HEATING

Why AES?

1. Ecological imperative: nutrient cycling, bioenergy, sustained productivity
   - genuine bio-economic and circular society model
2. Need for food security, food sovereignty
   - basic unit for a resilient, fair, and food securing global network of localized food systems
3. Desperate situation of farmers, largely also of food processors
   - prize margin keeps increasing: the circular localized model removes power inequality in the transaction chain
4. Peripherification of rural, “100 ha loneliness”
   - a model to stop rural decline; a model resilient for future de-urbanization
5. Erosion of food cultures
   - restoration of linkage to origins of food: sense of food; diversification to local products

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blog:
http://blogs.helsinki.fi/palopuronsymbioosi/english/

Thank you.

Photo: tiedebasaari.wordpress.com