Regional commodity flow estimation for circular economy monitoring based on the integration of several official statistics

Project overview, methods, results and recommendations

Chris de Blois, Anne-Peter Alberda, Harm Jan Boonstra

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Overview

- Project history
- Circular economy
- Scope
- Data, methods
- Results
- Conclusions and recommendations
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Project history

Project history

Period	Project	Cooperation	Goals
2006-2012	Integration of trade and transport	Free University Amsterdam, Eurostat	- Make trade and transport data consistent - Estimate transit trade - Increase quality of trade and transport data
2013-2024	Import, export and transit trade statistics*	Ministry of Infrastructure and Water Management	- Make annual statistics of consistent trade and transport data, including transit trade
2009-2013	Regional commodity flows (Sustainable Accessibility Randstad)**	Free University Amsterdam, TNO	- Estimate regional commodity flows by NUTS 3 region - Origin-destination data for logistics model - Insight in transport chains
2021-2023	Circular economy / regional commodity flows	Provinces of North Holland and Utrecht, Amsterdam	- Quantify regional commodity flows for monitoring transition to circular economie (by NUTS 3 region)
2022	Circular economy / commodity flows 12 provincies	Province of Limburg	- Quantify provincial commodity flows for monitoring transition to circular economie
2022, 2024	Circular economy Amsterdam / commodity flows by use category	Municipality of Amsterdam	- Quantify regional commodity flows Amsterdam by use category for monitoring transition to circular economie
2023	Circular economy Rotterdam / commodity flows by use category	Municipality of Rotterdam	- Quantify regional commodity flows Rijnmond by use category for monitoring transition to circular economie

* CBS (2024), International trade and transit trade; value, weight, goods, transport mode. StatLine, Statistics Netherlands: Heerlen/Den Haag. https://opendata.cbs.nl/statline/#/CBS/en/dataset/84668ENG

** Lankhuizen, M.B.M., Boonstra, H.J en De Blois, C.J. (2020). "Unpacking freight – Identifying conditions driving regional freight transport in statistics" in Transport Research Part A 132 (2020), pp.415-435. https://doi.org/10.1016/j.tra.2019.11.025

Project history, April 2024

- News article (in Dutch)
  - https://www.cbs.nl/nl-nl/nieuws/2024/15/driekwart-aangevoerde-goederen-verlaat-zuid-holland-weer
- Background paper (in Dutch)
  - https://www.cbs.nl/nl-nl/longread/diversen/2024/de-goederenstromen-van-de-provincies-in-2015-2022
- Dataset provincial commodity flows 2015-2022
  - https://www.cbs.nl/nl-nl/maatwerk/2024/15/regionale-goederenstromen-per-provincie-2015-2022

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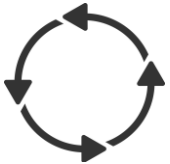
Circular economy

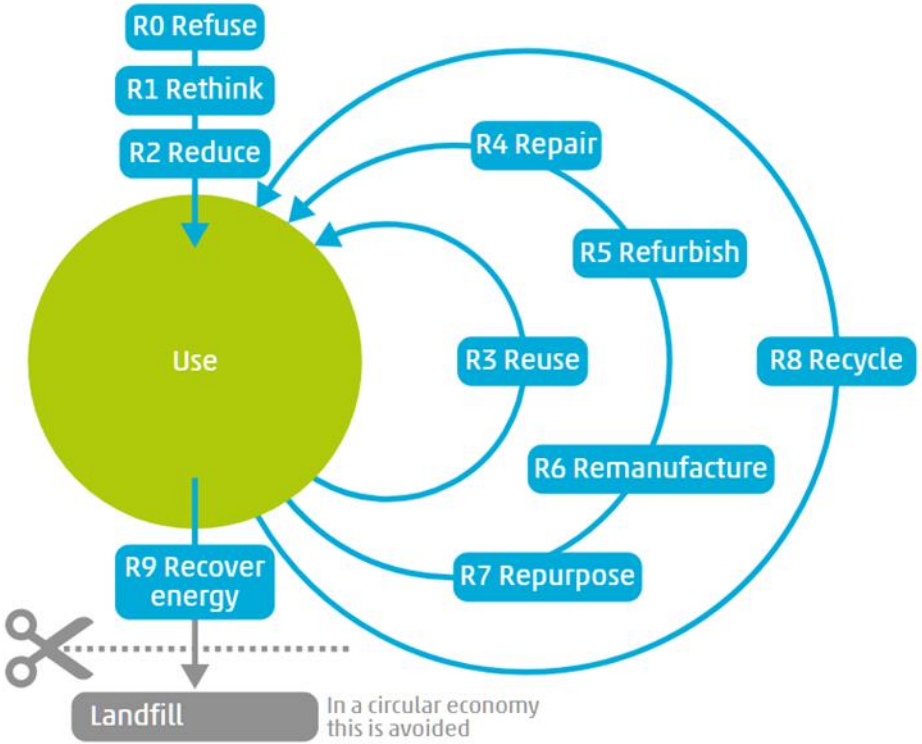
Circular economy



- The Dutch economy must run entirely on reusable raw materials by 2050
- National Program Circular Economy
  - Cooperation government, companies and social organizations
- Transition agenda for 5 sectors:
  - Plastics
  - Consumer goods
  - Construction (50 percent of raw material use)
  - Manufacturing industry
  - Biomass and food
- Specific goals for product groups with highest impact:
  - In consumer goods, for example: electrical and electronic appliances, packaging and disposable products, textiles, furnitures
- Monitoring
  - National Conference Circular Economy (annual)
  - Integral Circular Economy Report (ICER, every other year)

Circular economy: R-ladder

- Different strategies
- Level of circularity / saving on raw materials
- R0 is the highest step



Source: PBL Netherlands Environmental Assessment Agency, 2019

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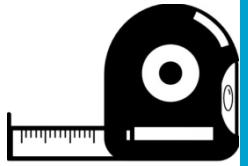
Scope

Statistical concept: what do we measure?



The regional commodity flow statistics measure:

- The international and national, physical commodity flows that are unloaded, loaded, delivered or shipped on Dutch territory in Europe, in value and gross weight and by year, flow type, region, commodity group and possibly use category.

Not included:

- Services
- Electricity, data
- Transport in the Caribbean Netherlands

Dimensions final tables

- Year (2015-2022)
- Value and gross weight of the goods
- Flow type
  - Imports/exports from/to foreign countries, imports/exports from/to rest of Netherlands, re-exports, transit trade, production for use in own region, distribution
- Provinces and NUTS 3+ regions*
- Commodity group (CE25)
- Only for Amsterdam and Rijnmond: use category
  - Production, services provided by companies, consumption households, consumption government / investments
- Including confidence intervals

* With further breakdown of some of the NUTS 3 regions leading to 52 regions in total.

Provinces and NUTS 3+ regions

12 provinces

40 NUTS 3 regions
(52 NUTS 3+ regions)

Source: www.regioatlas.nl

Commodity groups (CE25)

1	Agricultural and horticultural products
2	Forest products
3	Livestock, hunting and fishing products
4	Food, vegetable
5	Food, animal
6	Food, other
7	Coal, lignite, natural gas and crude oil
8	Coke and petroleum products
9	Ores
10	Salt, sand, gravel, clay
11	Other mineral products
12	Chemical products and fertilizer
13	Pharmaceutical and chemical products
14	Plastics, rubber
15	Basic metals and basic metal products
16	Metal products
17	Machines for industry
18	Other machines
19	Transport equpment
20	Textiles
21	Clothing, fur and leather
22	Wood and cork products, paper and pulp
23	Furniture
24	Waste and secondary raw materials
25	Other goods

Output table, per year and value/weight

Province	CE25	Flow type						
		Transit trade		Imports national		Imports international		…
		Estimate	Standard error	Estimate	Standard error	Estimate	Standard error	…
Groningen	1							
Groningen	2							
Groningen	…							
…	…							
Fryslân	1							
…	…							

Output table with use categories, per year and value/weight

Variable	Commodity group	Use category	Unit	Agricultural and horticultural products	Forest-products	Livestock, hunting and fishing products	Food, vegetable	Food, animal	Food, other	Etc.
Estimated weight	Supply for own region	Total	x mln kg	250	6	24	57	70	609	...
Estimated weight	Supply for own region	Production of goods	x mln kg	57	1	15	3	6	71	...
Estimated weight	Supply for own region	Services provided by companies	x mln kg	40	3	2	9	17	160	...
Estimated weight	Supply for own region	Consumption households	x mln kg	150	1	4	40	43	361	...
Estimated weight	Supply for own region	Consumption governments and investments	x mln kg	4	0	3	0	0	0	...
Estimated weight	Supply for own region	Change of stocks	x mln kg	-1	1	0	5	4	18	...
Estimated weight	Imports national	Total	x mln kg	805	12	45	773	282	1.662	...
Estimated weight	Imports national	Production of goods	x mln kg	181	3	29	37	26	194	...
Estimated weight	Imports national	Services provided by companies	x mln kg	128	6	4	126	69	438	...
Estimated weight	Imports national	Consumption households	x mln kg	485	2	9	594	179	987	...
Estimated weight	Imports national	Consumption governments and investments	x mln kg	13	0	5	0	0	0	...
Estimated weight	Imports national	Change of stocks	x mln kg	-1	2	-1	16	8	43	...
Estimated weight	Imports international	Total	x mln kg	3.138	23	80	615	271	1.812	...
Estimated weight	Imports international	Production of goods	x mln kg	746	6	50	30	26	217	...
Estimated weight	Imports international	Services provided by companies	x mln kg	386	12	7	102	68	490	...
Estimated weight	Imports international	Consumption households	x mln kg	1.970	5	15	482	177	1.105	...
Estimated weight	Imports international	Consumption governments and investments	x mln kg	36	0	9	0	0	0	...
Estimated weight	Imports international	Change of stocks	x mln kg	0	0	0	0	0	0	...
Estimated weight	Imports for re-exports	Does not apply	x mln kg	440	0	1	169	67	439	...
Estimated weight	Exports national	Does not apply	x mln kg	248	14	26	4.207	237	1.159	...
Estimated weight	Exports international	Does not apply	x mln kg	423	0	13	1.471	137	886	...
Estimated weight	Re-exports	Does not apply	x mln kg	440	4	12	169	67	439	...
Estimated weight	Distribution	Does not apply	x mln kg	376	1	2	23	7	120	...
Estimated weight	Transit trade	Does not apply	x mln kg	455	0	5	554	43	422	...

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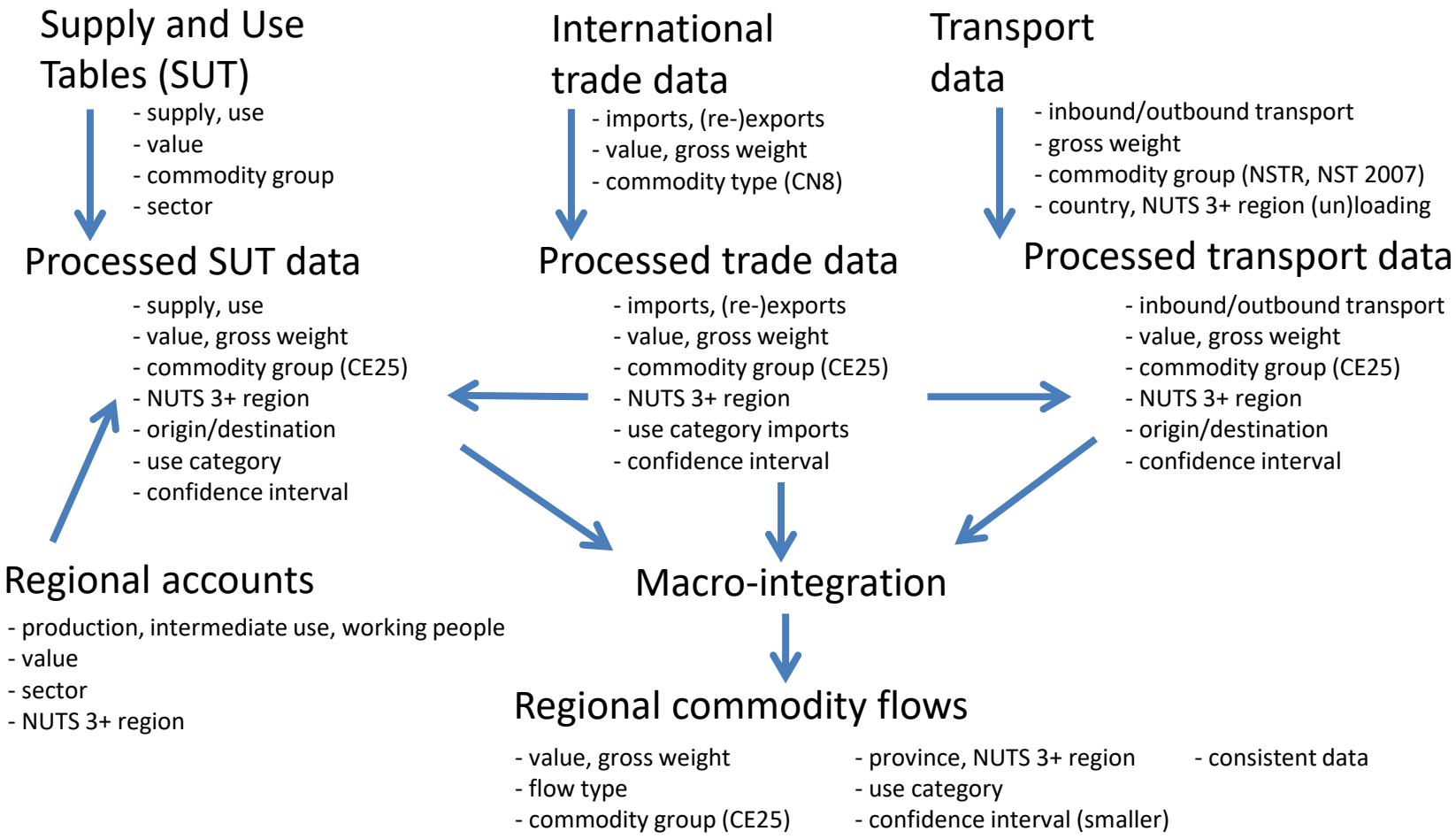
Data, methods

Integration trade and transport data



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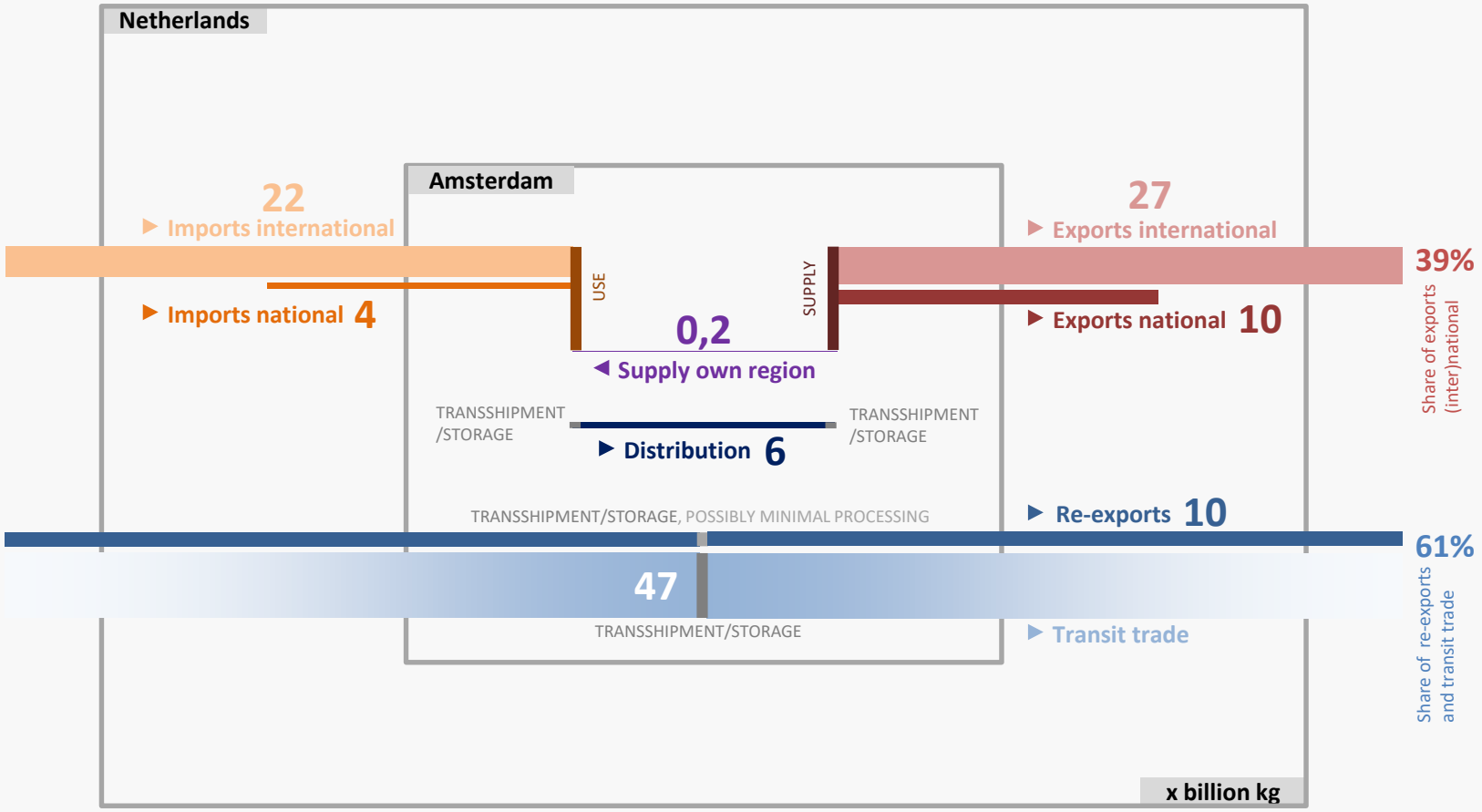
Results

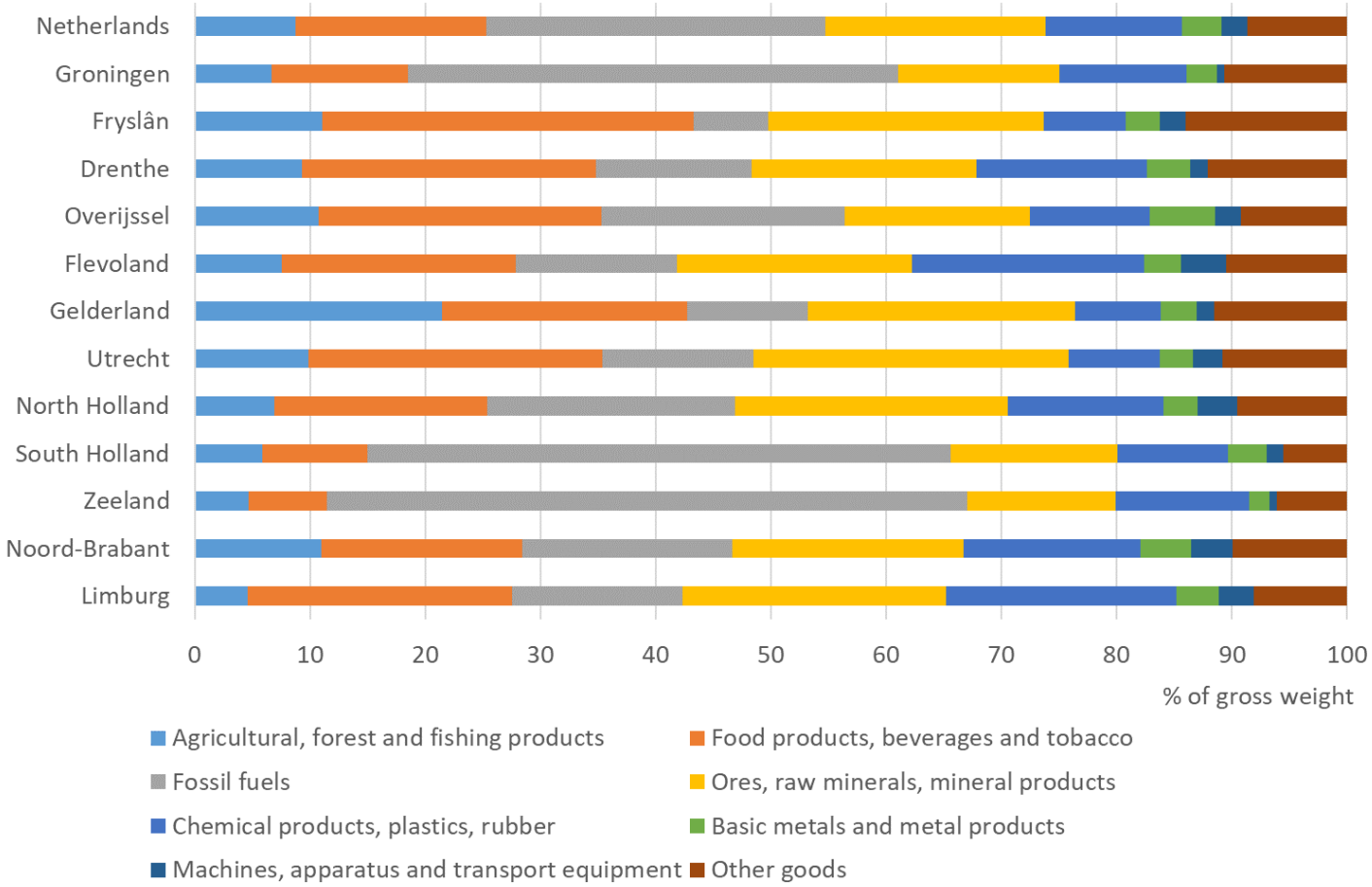
Questions which can be answered

- What are the most important commodity groups in the use of goods in a region?
- Or: what commodity groups are mainly produced?
- Is a region mainly internationally or nationally oriented with regard to the use of a commodity group?
- How is transit trade developing in a region?
- What are the estimated DMI and DMC for biomass, fossil, metals and minerals?
- Are goods in a region mainly used for production, services or consumption?
- Etc.

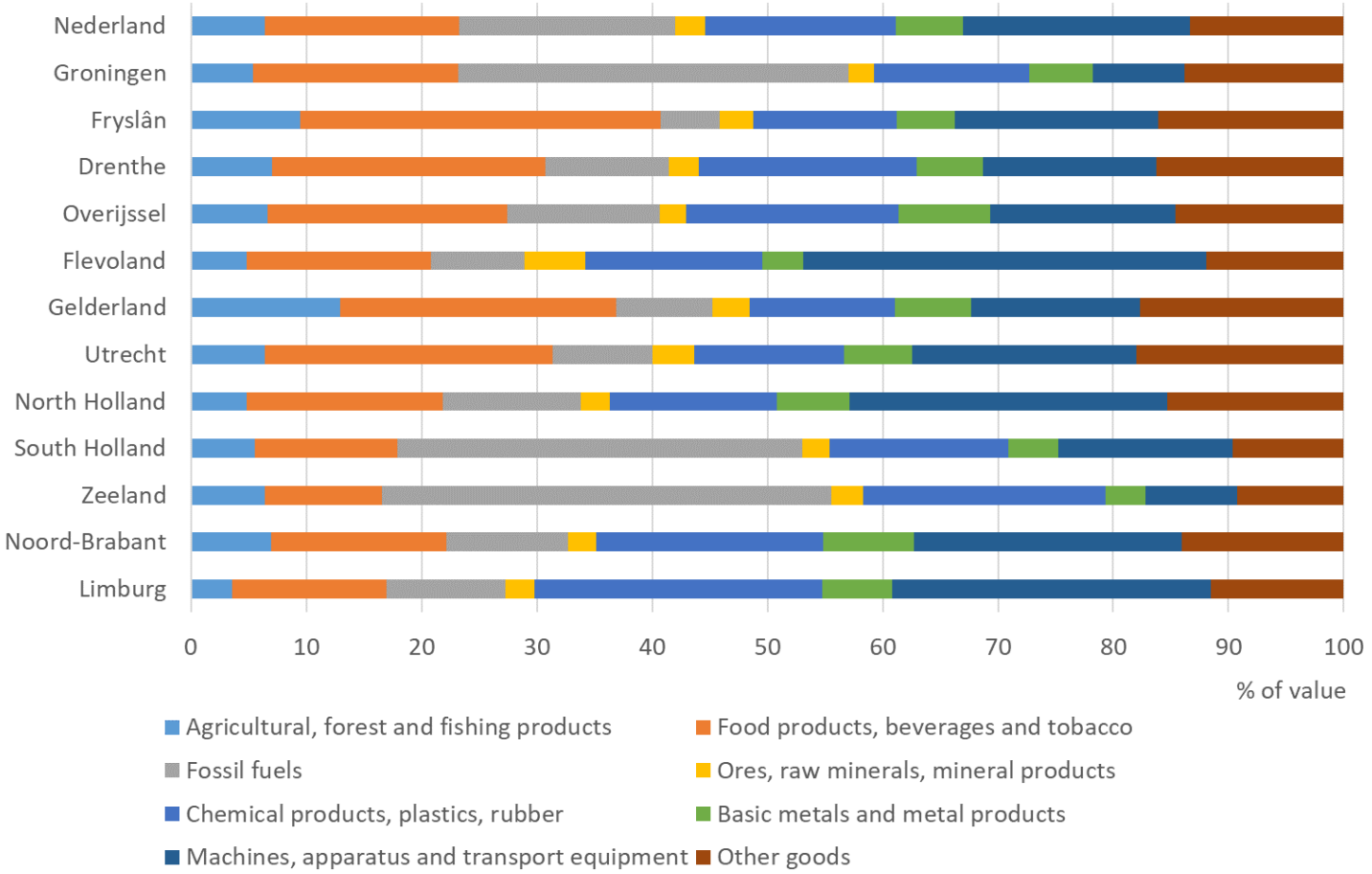
Gross weight regional commodity flows Amsterdam 2022



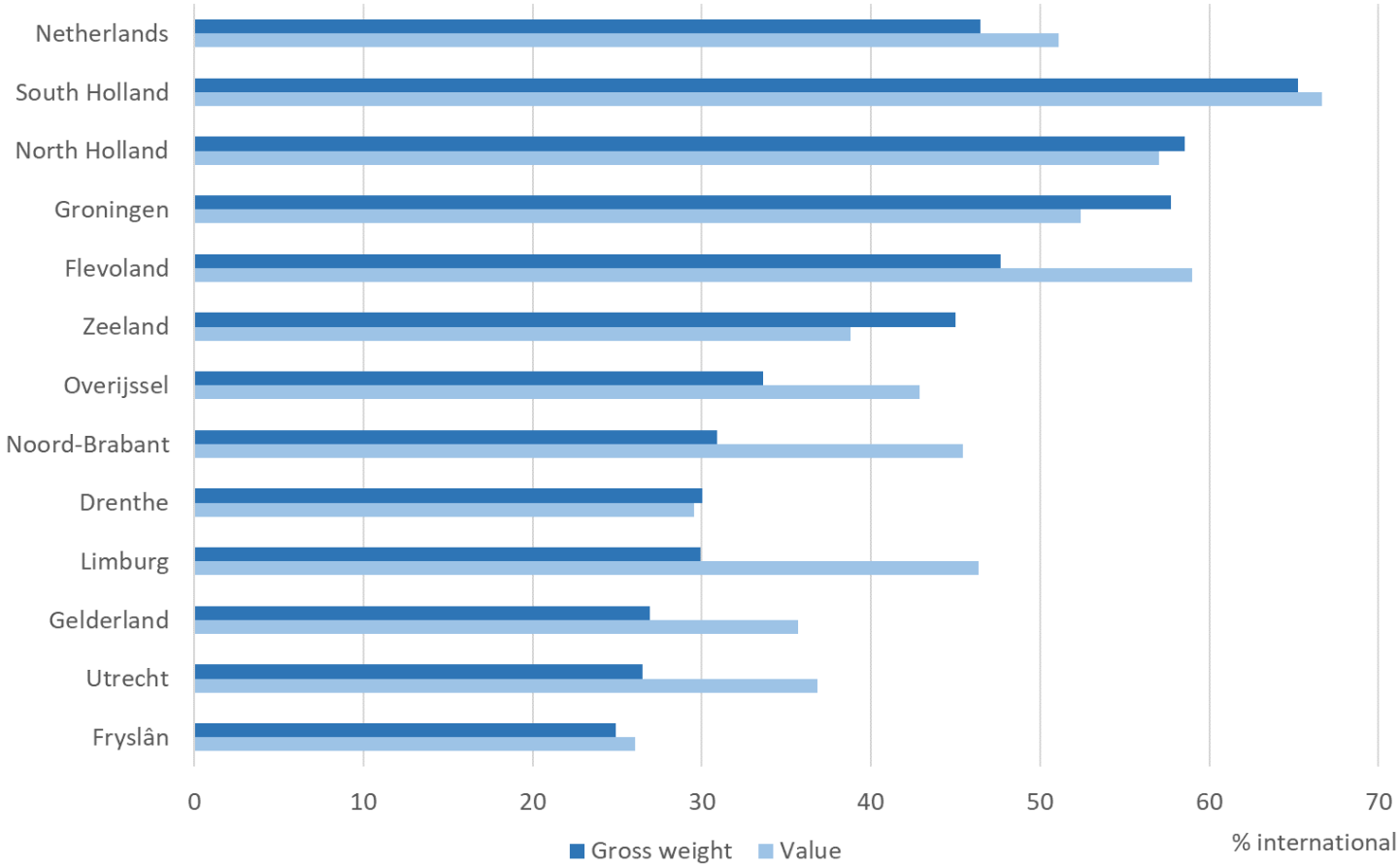
Share of commodity groups by province (% of gross weight)



Share of commodity groups by province (% of value)



Share of used goods with origin abroad



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Conclusions

- Estimation of regional commodity flows 2015-2022, for provinces/NUTS 3+ regions and 25 commodity groups
- Sources: supply and use tables, international trade and transport statistics, regional accounts
- Integration model -> consistency with restrictions
- Uncertainty margins
- Data at the basis of important indicators for monitoring the transition to a circular economy (DE, DMI, DMC)
- Methods transferable to other countries/regions

*DE = Domestic Extraction; DMC = Domestic Material Consumption; DMI = Direct Material Input.

Recommendations

- Add information:
  - Regional data and knowledge: validation!
  - Light utility vehicle transport and domestic pipeline transport
  - Physical supply and use tables (in kg)
  - Container chain data
- Improve method:
  - Improved regionalization international trade data
  - Model-based integration of value and weight at the same time
- Visualize results

Possible extensions

- Annual update: 2023, 2024, etc.
- Refinement to municipal level (large municipalities)
- More detailed classification of commodity groups
  - For example: secundary raw material separate
- Subdivision by (groups of) economic sectors
- Estimation of flows between provinces
- Emissions of CO_2, NO_x, PM, etc. related to transport

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Questions?

c.deblois@cbs.nl

Questions

Does "circularity" in your project refer more about economic self-sufficiency and sustainability in terms of resource use, rather than the traditional focus of a circular economy on minimizing waste and reusing materials?

The policy surrounding the circular economy has various strategies, represented by the R-ladder (see slide 8 of this presentation). At the highest level (refuse, rethink, reduce), the use of materials is reduced, e.g. by making products redundant, encouraging the shared use of products and organizing production processes in such a way that fewer materials are needed. Lower on the R ladder are the reuse of (parts of) products (re-use, repair, refurbish, remanufacture, repurpose), processing into new products (recycle) and incineration with energy recovery (recover). See:

https://ikwilcirculairinkopen.nl/de-r-ladder-wat-is-het-en-wat-kun-je-ermee/ (in Dutch)

https://www.circles.fm/en/news/research-developments/823445654/the-r-ladder-strategyfor-circularity

https://circulareconomy.europa.eu/platform/sites/default/files/pbl-2019-outline-of-the-circular-economy-3633.pdf

(Chapter 2 describes the R-ladder)

With the statistics on regional commodity flows, we can provide regional governments with insight into the size and composition of the flows of raw materials and end products in their region and the reason why those flows are there, that is: for use in the region, due to production or extraction in the region or due to transit, re-export or distribution. We can then divide the use into use for production purposes, use by service companies (e.g. in the construction sector), consumption by households and consumption by governments or investments in fixed assets. With this annually updated data, regional authorities can monitor the use of materials in their region and better set priorities based on the estimated composition of the goods flows. In addition to circularity, security of supply is also a point of attention for national and regional governments. Then, it helps to know where the goods come from, i.e. on which other regions or countries a region or country is dependent.