



## Monitoring the Bioeconomy

**What are emerging bio-based industries and products for  
being monitored and integrated in statistics?**

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Myrna van Leeuwen (Wageningen Economic Research), on behalf of BioMonitor Consortium



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- Background
- What is the problem?
- How is it solved?
- What is expected result?



- **Background and Problem:**

- Especially **traditional bioeconomy sectors** and **traditional bio-based products (food and feed, paper & pulp)** are registered in the ISCS and yearly monitored
- There are **hybrid bioeconomy sectors and materials**, which are partly fossil-based and partly bio-based. However, difference between the sorts is not transparent in statistics!



- **Aim:** to establish a better filled and robust database with bioeconomic aspects (socio-economic and environmental) on the longer run (2023 - )



- **Preferred result:** a monitoring and analysis system that is operational and specified for

- Traditional **and** innovative bioeconomy **sectors**; and
- Traditional and innovative bio-based **products**, i.e. food, feed and materials



## BioMonitor Data Platform

Concepts  
Compatibility  
Collection  
Management  
Monitoring

Timeframe new bio-based data become available for Monitoring and Analysis  
Short run (1<sup>st</sup> project year)    Medium run (3<sup>rd</sup> project year)    Long run (> 4 years)

Data derived from PRODCOM, Structural Business Statistics, Labour Force survey, EXIOBASE multi-regional IO model, national IO models

Approach builds upon partners' experiences

Data immediately applicable for monitoring and measuring of the bioeconomy

Material Flow Monitor linked to environmental accounts, PRODCOM, Structural Business Statistics

Approach of Dutch CBS is enhanced and enrolled to other national statistical offices

Data applicable in 3<sup>rd</sup> project year; it will provide better information for monitoring and measuring of the bioeconomy

Data for new bio-based products and industries is integrated in National Accounts

Approach starts with proposing codes for new bio-based industries (NACE) and products (CPA) with market potential, followed by trajectory of collecting data and implementing these in standardized national accounts systems

Data applicable after project duration; it will enable an accurate and enduring monitoring and measuring of the bioeconomy

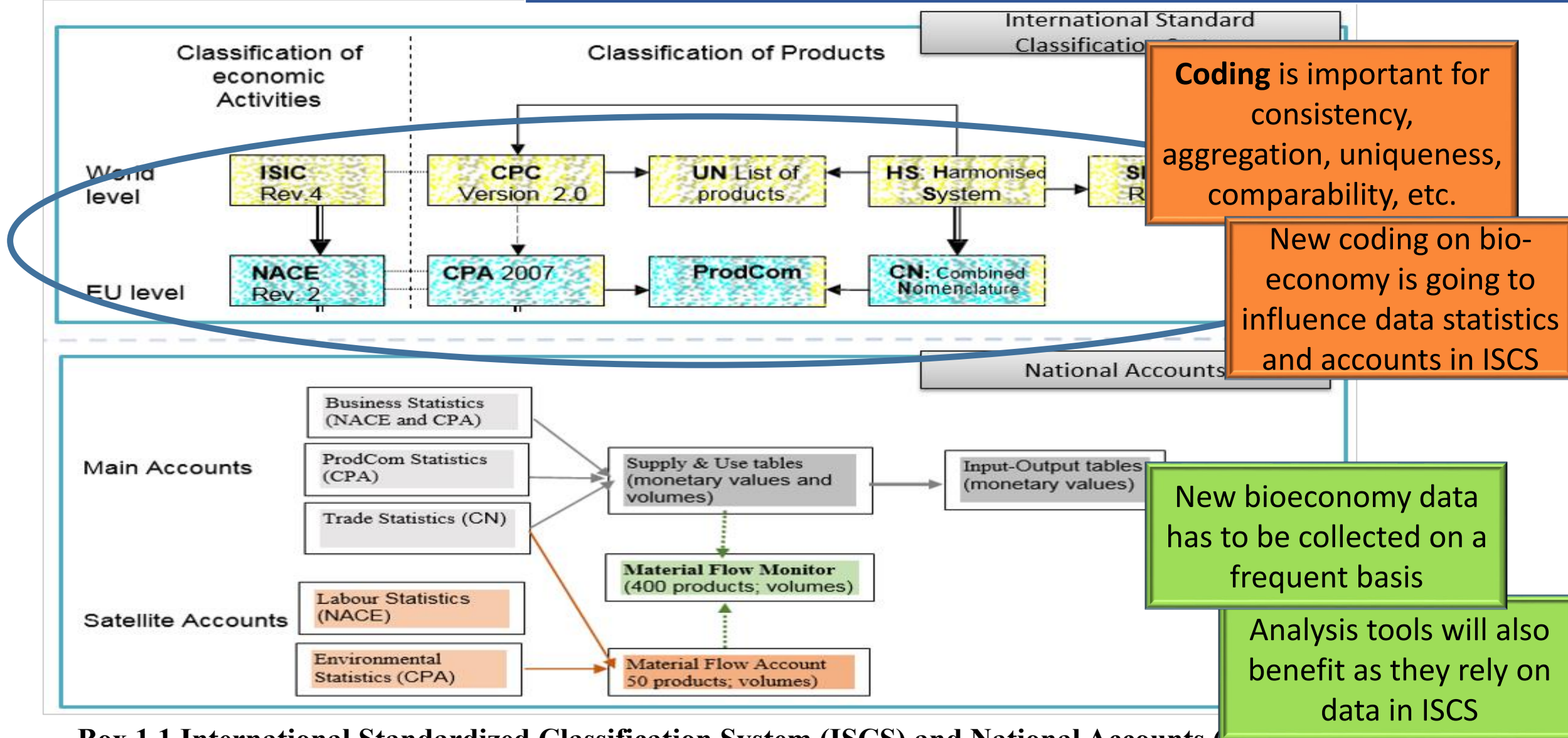
Increasing Robustness Level of pertinent data availability



- Procurement takes time
  - to get acceptance on the new or revised CPA and NACE codes for the bio-based products and sectors
  - to get a common understanding among industries, statistical offices and customs
  - to get the **data on bio-based sectors and products embedded in existing ISCS framework**: making surveys, data collecting and managing, developing tests to measure carbon contents, etc.

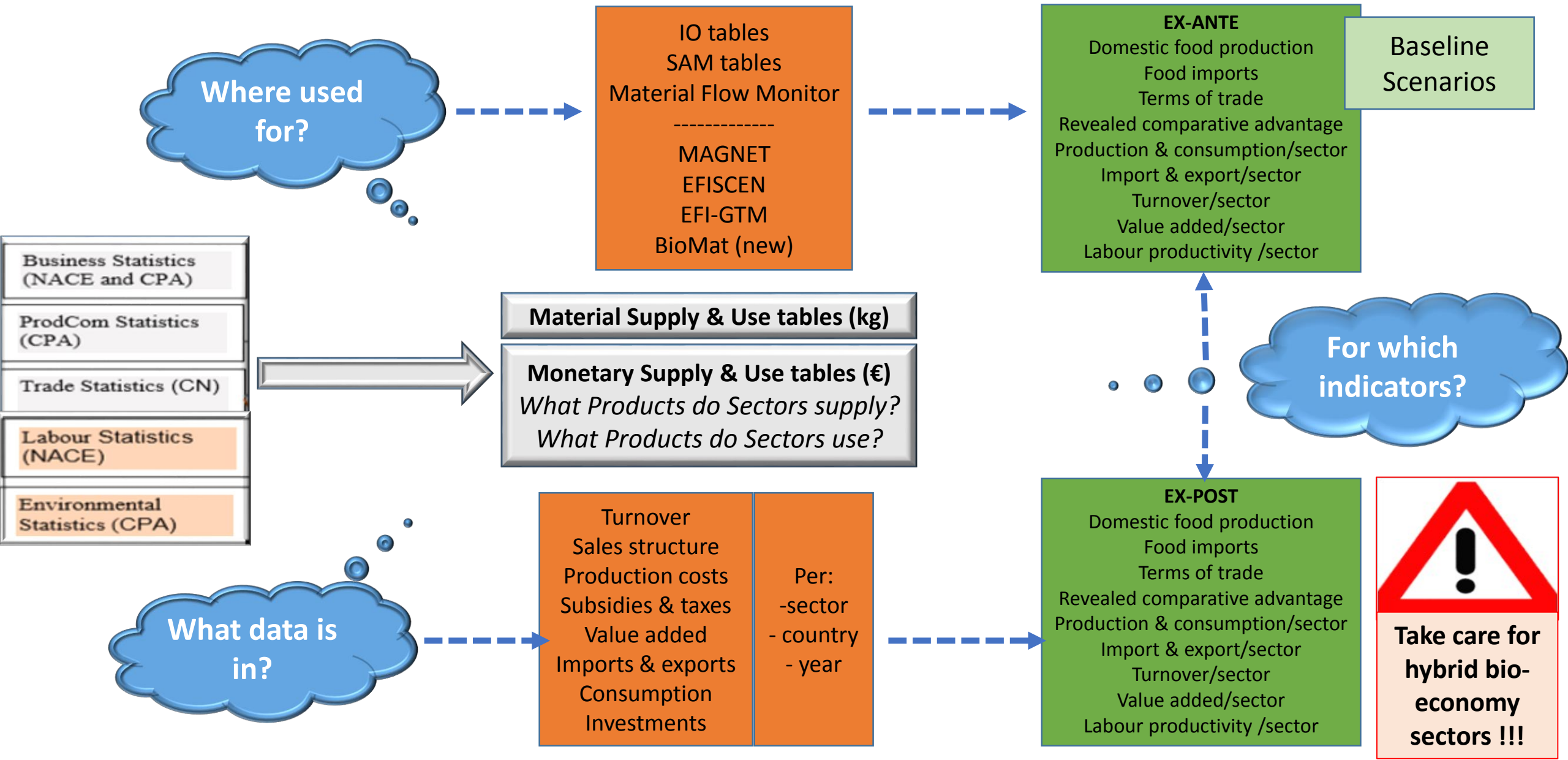


# METHOD: extending ISCS framework with more bioeconomy data detail



Box 1.1 International Standardized Classification System (ISCS) and National Accounts (NA)

# INDICATORS obtained from current statistical and analysis framework



# What is BIOECONOMY SECTOR detail to be monitored?

- BioMonitor has identified the sectors that (potentially) belong to the bioeconomy:
  - **Traditional (100% bio-based) bio-based sectors** (agro, forestry, maritime, food & feed, paper & pulp): **have unique NACE codes**
  - **Innovative bio-based sectors** (textile, plastics, chemistry, pharmaceutical, construction, energy): these sectors are mixed-up with their fossil-based counterparts: **don't have unique NACE codes yet**
- In statistics the NACE codes link to specific CPA product codes (see previous slide)
- A sector (unique NACE code) can produce multiple products (each with unique CPA code)

**APPROACH:** identifying changes in NACE codes to Eurostat/national statistical offices; **AIM:** robust monitoring of innovative bio-based industries



## Bioeconomy Sectors

# Current and required bioeconomy sector detail in statistical framework; spatial and temporal

## NOW: hybrid bioecon sector detail

NACE	Sectors (hybrid)
A01	Crop, animal prod., hunting
A02	Forestry and logging
A03	Fishing and aquaculture
C10	Manufacture of food
C11	Manufacture of beverages
C12	Manufacture of tobacco
C13	Manufacture of textiles
C14	Manufacture wearing apparel
C15	Manufacture of leather
C16	Manufacture wood products
C17	Manufacture paper prod.
C20	Manufacture of chemicals
C21	Manufacture pharmaceuticals
C22	Manufacture rubber/plastic
C31	Manufacture of furniture
D35	Electricity, gas, steam
D3511.	Production of electricity
F41	Construction of buildings

## REQUIRED bioeconomy sector detail

NACE	Bioeconomy Subsectors (100% bb)	Countries	Years
A01	Crop and animal production, hunting	Austria	2008
A02	Forestry and logging	Belgium	2009
A03	Fishing and aquaculture	Bulgaria	2010
C10	Manufacture of food	Croatia	2011
C11	Manufacture of beverages	Czech R.	2012
C12	Manufacture of tobacco	Germany	2013
C13.x	Manufacture of <b>bio-based</b> textiles	Denmark	2014
C14.x	Manufacture of <b>bio-based</b> wearing apparel	Estonia	2015
C15.x	Manufacture of <b>bio-based</b> leather	Spain	2016
C16	Manufacture of wood, products of wood	Finland	2017
C17	Manufacture of paper and paper products	Greece	2018
C20.x	Manufacture of <b>bio-based</b> chemicals	Hungary	.....
C21.x	Manufacture of <b>bio-based</b> pharmaceuticals	Ireland	
C22.x	Manufacture of <b>bio-based</b> rubber, plastics	Italy	
C31.x	Manufacture of <b>bio-based</b> furniture	Lithuania	
D35.x	Bio-Electricity, gas, steam, air conditioning	Latvia	
D3511.x	Production of <b>bio-based</b> electricity	Portugal	
F41.x	Construction of <b>bio-based</b> buildings	.... etc	

Scope of  
REQUIRED  
bioeconomy



**Only bio-based part of  
hybrid sectors counts**

# PRELIMINARY suggestions for revision of NACE codes

Current NACE codes	Proposed NACE sub-codes
<b>13.10</b> Preparation and spinning of textile fibres	<b>13.11</b> Preparation and spinning of <b>bio-based textile fibres</b> <b>13.12</b> Preparation and spinning of <b>man-made textile fibres</b>
<b>13.20</b> Weaving of textiles	<b>13.21</b> Weaving of <b>bio-based textiles</b> <b>13.22</b> Weaving of <b>man-made textiles</b>
<b>20.52.10.80</b> Prepared glues and other adhesives, n.e.c (has highest share in 20.52 group 'Manufacture of glues')	<b>20.52.10.81</b> <b>Bio-based glues</b> and other adhesives <b>20.52.10.82</b> <b>Fossil-based glues</b> and other adhesives
<b>21.10</b> Manufacture of basic pharmaceutical products)	<b>21.11</b> Manufacture of basic <b>bio-based pharmaceutical products</b> <b>21.12</b> Manufacture of basic <b>fossil-based pharmaceutical products</b>
<b>21.20</b> Manufacture of pharmaceutical preparations	<b>21.21</b> Manufacture of <b>bio-based pharmaceutical</b> preparations <b>21.22</b> Manufacture of <b>fossil-based pharmaceutical</b> preparations
<b>41.20</b> Construction of (non-)residential buildings	<b>41.21</b> Construction of <b>bio-based (non-)residential buildings</b> <b>41.22</b> Construction of <b>fossil-based (non-)residential buildings</b>

## **Candidate bio-based products**



# What are new BIO-BASED PRODUCTS to be monitored?

- **Examples of indicators** to be monitored in BioMonitor project:
  - **Production** and **consumption** of emerging bio-based products (kind, quantity,
  - **Import** and **export** of bio-based (raw) materials and products (volumes, euros)

**BUT...Which are these biobased products??**

??

**APPROACH in BioMonitor project:** set of criteria (*TRL, market potential, % bio-based contents, feedstock use, position in value chain, expected CAGR, etc.*) serves as base for selecting high potential bio-based products; literature review and stakeholder consults

The candidate bio-based product is not yet in statistics **or** only in a hybrid form (no own code yet)

# Step 1: Key criteria for selecting candidate bio-based products

**There are more criteria in our review process (next slide)**

Criteria – score 3	Remarks
There are at least 3 producers/production capacity sites of the product in Europe	Firms will not reveal their production data
There is some data on market potential in terms of trade volume or expected yearly growth rate (CGAR)	Important indicator for successful path in future; also by looking at fossil-based version potentially be substituted by biomass
Product has TRL > 9	With TRL 9, the product has been proven in an operational environment; about stage in innovation pipeline
Product doesn't have a ProdCom code yet, OR is part of a hybrid code	Gives info if it is a dedicated product (no identical fossil-based version) or a drop-in (substitute of existing fossil-based version)
Criteria – score 2	Remarks
There is already a test available that can measure the bio-based carbon content of the product	Standardisation can speed up the market uptake
There is data on global production of the product	EU could import the bio-based product instead of own production; in this way EU's bioeconomy can also develop
Type of data availability: primary data (interviews; surveys), secondary data (statistics)	Quality aspect; degree of data robustness

Criteria – score 1	Remarks
LCA info for product on energy use, water use, land use	Sustainability aspects
Production costs of product compared to costs of its fossil-based counterpart	Competitiveness between bio-based and fossil-based
Position in value chain	Raw biomass material; intermediate chemical product; chemical platform; end product
Specific functionality	Lightness, heat resistance, strong, health care, recyclable, durable

### Examples of literature

**COWI, Bologna and Fraunhofer: New wood products:** Chains of  $\beta$ -D-glucopyranose (already biobased code); *Self-binding composite non-woven plant fibres* (code unclear); *Lignin-based carbon fibres* (fossil-based code only)

### Spekreijse/JRC report (2019): biobased chemical products

**\*COWI, Bio-based World News and Ecologic Institute (2019)** Bio-based products – from idea to market: e.g. *Bio-based 1.4-Butanediol* (already specific code in prodcom); *PLA* (hybrid code in prodcom), *Scale inhibitor (antiscalant) used for detergents* (hybrid code in prodcom); *Desmodur® eco N is a bio-based hardener for lightfast polyurethane coatings for automotive, plastics, wood and industrial applications* (only code for fossil product); enz.

**nova** market reports on polymers; various

Reports on **new wood-based products**



ProdCom group (hybrid)	Candidate bio-based polymers
20.16.40.30 Epoxide resins	Bio-based epoxy resin (adhesive)
20.16.40.90 Polyesters in primary form	Polyhydroxyalkanoates (PHA), Polylactic acid (PLA) and starch blends
20.16.40.15 Polyethylene glycols and other polyether alcohols, in primary forms	Natural oil polyols (NOP) for bio-based polyurethane
20.16.54.50 Polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	Bio-based polyamides
20.16.54.90 Polyamides, in primary forms (excluding polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12)	Bio-based polyamides

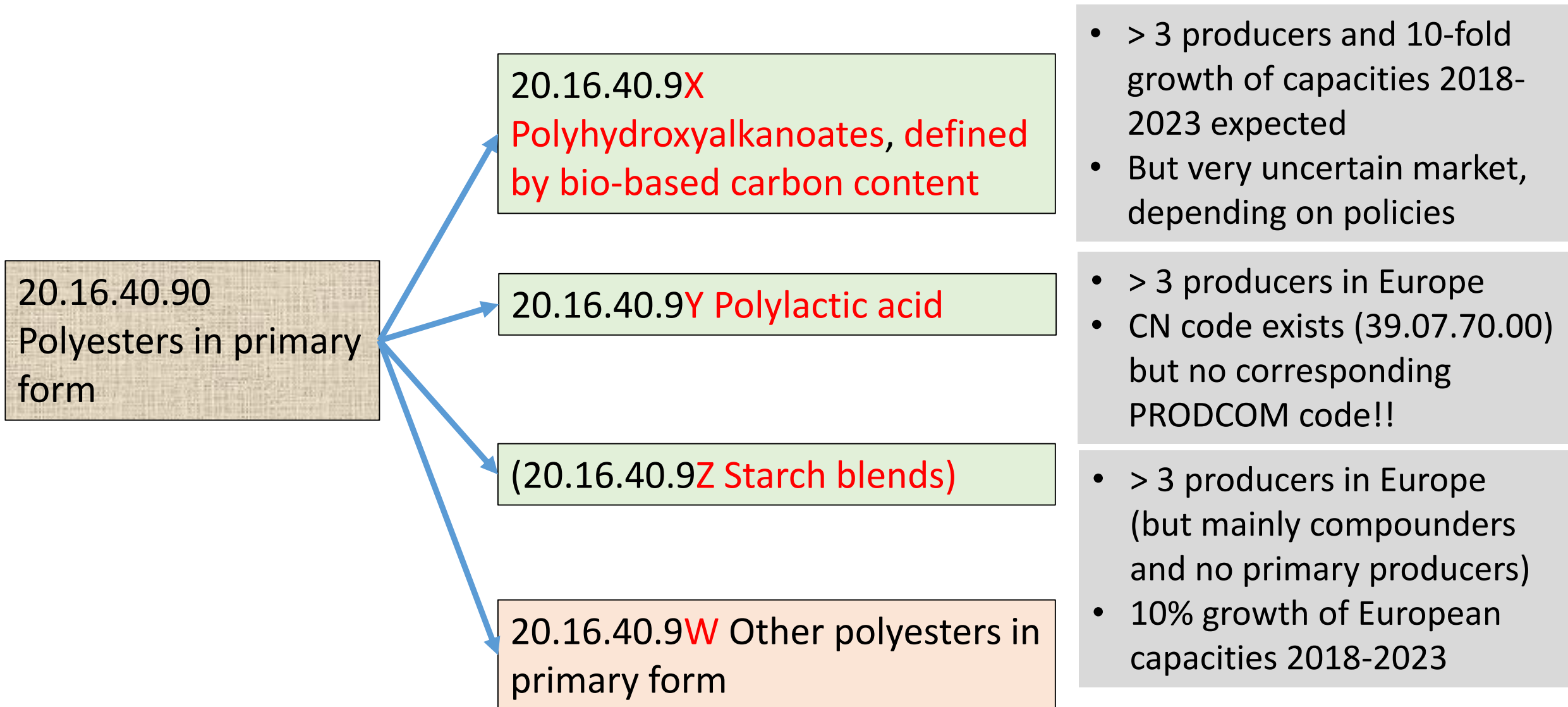
**Proposals for splitting the hybrid ProdCom codes (next slides)**

20.16.40.30 Epoxide resins

20.16.40.3X Epoxide resins (from glycerine), defined by bio-based carbon content

20.16.40.3Y Epoxide resins, excluding 20.16.40.3X

- The fossil-based epoxy resin market is around 5 million t/a and the current bio-based epoxy resin share is between 17 and 26%.



# Natural oil polyols (NOP) for bio-based polyurethane

20.16.40.15  
Polyethylene glycols  
and other polyether  
alcohols, in primary  
forms

20.16.40.1X Natural oil polyols  
(NOP)

20.16.40.1Y Other bio-based  
polyols

20.16.40.1Z Other Polyethylene  
glycols and other polyether  
alcohols, in primary forms,  
excluding 20.16.40.1X and  
20.16.40.1Y

- > 3 producers in Europe
- 30% increase of global production capacities 2008-2023

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- 30% increase of global production capacities 2008-2023



20.16.54.50  
Polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms

20.16.54.5X **Bio-based**  
polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms

20.16.43.5Y Polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms, **excluding 20.16.54.5X**

- > 3 producers in Europe
- 80% increase of global production capacities 2008-2023

ProdCom group (hybrid or closest option)	Candidate new wood-based products
20602200: High tenacity filament yarn of viscose rayon, n.p.r.s. (excluding sewing thread)	Lyocell (Fibres for textile)
20602320: Yarn of viscose rayon filament, including monofilament of < 67 decitex, single, n.p.r.s. (excluding sewing thread and high-tenacity yarn)	Lyocell (Fibres for textile)
20147140: Gum, wood or sulphate turpentine oils, pine oil and other alike	Wood Terpentine (solvent; paints)
16211600: Other plywood, veneered panels and similar laminated wood, of coniferous wood	Cross-laminated timber; glued laminated timber, laminated veneer lumber (Wood construction materials)
16211800: Other plywood, veneered panels and similar laminated wood, of other wood	Cross-laminated timber; glued laminated timber, laminated veneer lumber (Wood construction materials)

Prodcom group (hybrid or closest option)	Candidate bio-based chemicals
20602200: Carboxylic acid with alcohol, phenol, aldehyde or ketone functions	Lactic acid (Platform chemical)
20164050: Alkyd resins, in primary forms	Alkyd resins (paints, coatings, inks, dyes; also a polymer)
20412050: Non-ionic organic surface-active agents (excluding soap)	Ethoxylated fatty alcohols (cosmetics and personal care)
20147150: Rosin and resin acids; and derivatives; rosin spirit and oils; run gums	Tall oil resin (adhesive; paints, coatings, inks and dyes)

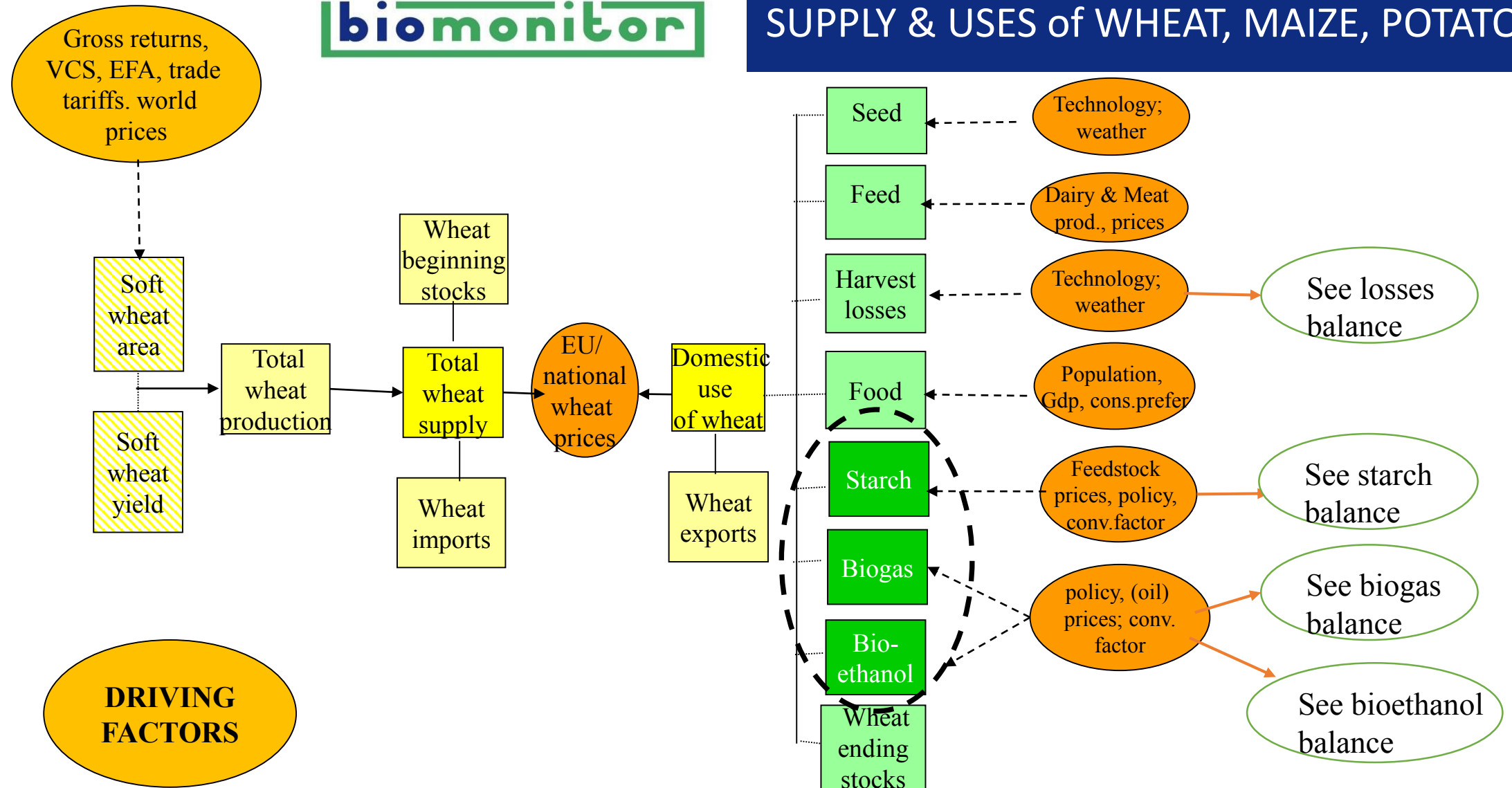
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## **Monitoring and analysing markets of innovative bio-based value chains (an example)**



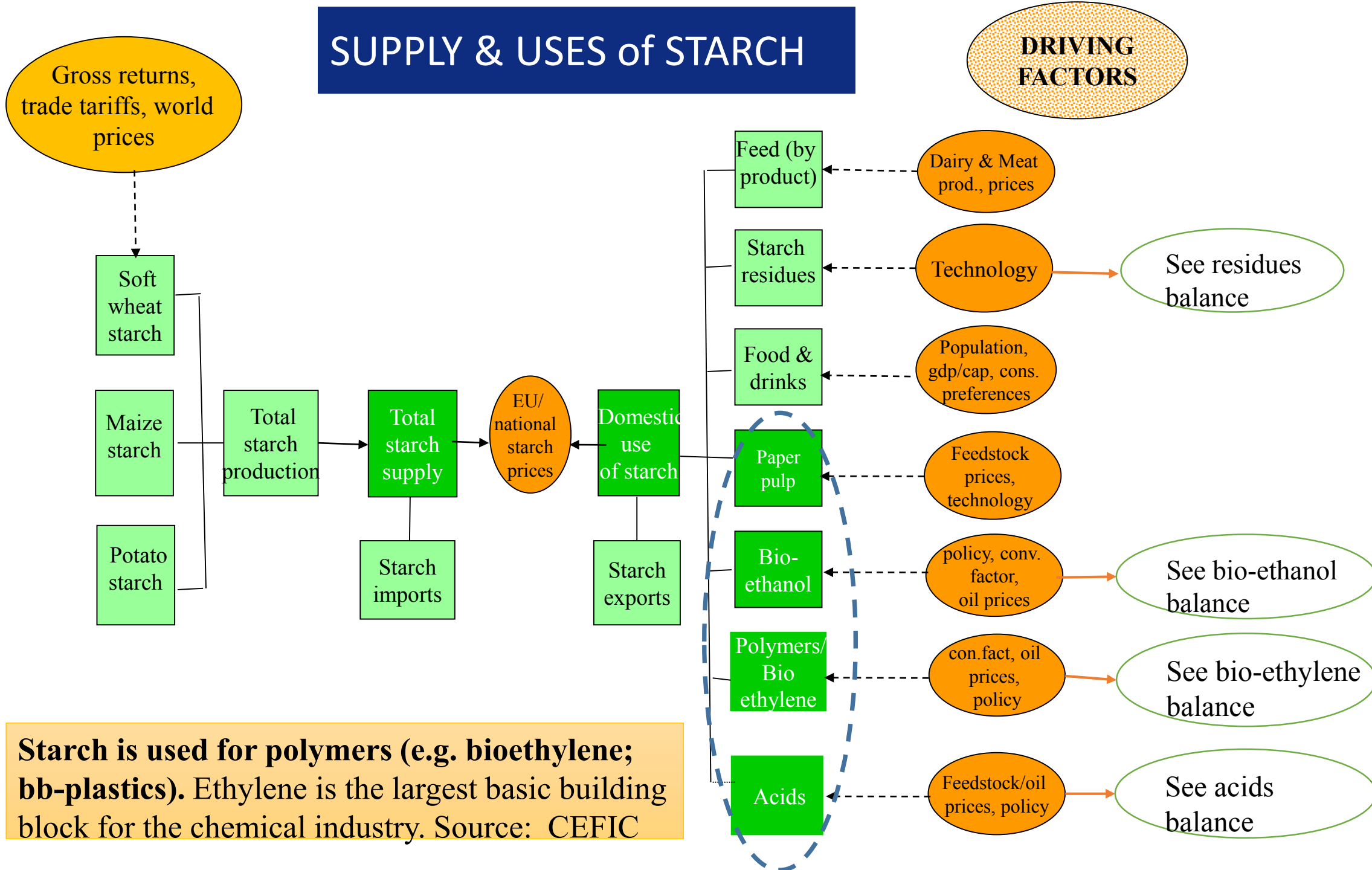
# RESULT: INDICATORS that can be obtained from an extended ISCS framework

Per BIO-BASED industry	Per BIO-BASED product
Turnover and Value added (euro)	Production and consumption (volumes)
Employment (lu)	Resource efficiency (ratio)
Labour productivity (ratio)	Import dependency (ratio)
Terms of trade (ratio)	Recycling rate (ratio)
Green House Gas emissions (CO2eq)	Biomaterial share in total material use (%)



**Starch is a carbohydrate;** it is an ideal raw material for bio-based chemical products (input for enzymes, organic acids, polymers, vitamins) – Sources: NOVA; CEFIC (represents 95% of EU chemical industry)

# SUPPLY & USES of STARCH



## Next steps

- **Selection of** (5?, 10?) candidate bio-based products
- **Stakeholder validation:** are selected products really the candidates for being integrated in statistics?
- **Recommendation** to Eurostat for getting own statistical code:
  - could be a split-off from a hybrid product code
  - could be a new product with new product code
- **Standardisation/determination** of bio-based carbon (carbon 14) in products; using liquid scintillation counting (EN 16640)
- **Statistics and Customs laboratories:** extrapolations needed in statistics; knowledge and expertise needed within labs on future new CN-codes for bio-based products. Joint efforts to improve the data.
- **Development of training program** and discussion on new CN-codes; for measuring bio-based carbon contents

**Procedures take time ...**







- **Stakeholder validation:**
  - Are preliminary selected bio-based products really the candidates for being integrated in statistics?
  - **Are there other and/or better suggestions for innovative bio-based products, and why?**
  - What are the 3 main criteria to select the candidate bio-based product?





Monitoring the Bioeconomy

Thank you.

Myrna van Leeuwen  
Wageningen Economic Research  
[myrna.vanleeuwen@wur.nl](mailto:myrna.vanleeuwen@wur.nl)



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