

# Circular economy through the ECOOM lens: patents, R&D and innovation indicators

Julie Callaert

Machteld Hoskens

*CE Center Workshop, Leuven,  
06/06/2019*



## Background: ECOOM History & Mission

- Interuniversity consortium, participation of all Flemish universities (UA, VUB, UGent, UHasselt, KU Leuven)
- Originally established in 2002 as '*Steunpunt O&O Statistieken*', transformed to permanent center of expertise (ECOOM) in 2009. Currently at the start of its third 5-year term.
- ECOOM's mission:
  - Development of a consistent and coherent R&D indicator system,
  - for mapping and monitoring R&D efforts in Flanders and benchmark regions,
  - with the aim of providing support to the Flemish policy.

# ECOOM Leuven



# ECOOM Leuven – Activities & Structure

Structure reflects 3 main activities:



Evaluation of research performance and quantitative science studies (**Bibliometrics team**)



Evaluation of technological performance and quantitative technology studies (**Technometrics team**)



Indicators of R&D and Innovation (**Innovation team**)

# Technometric approach

- Patent-based indicators for mapping and monitoring technological development
- Based on ad hoc questions (mainly from the Flemish government), we performed several domain studies, relevant to green / circular / environmental technology:
  - LNE Vlaanderen (mapping of environmental technology, green growth)
  - Focus groups on biomaterials, food packaging, construction & textiles
  - ...

# Technometric approach

- Main challenge in domain studies: **domain delineation**
  - By technological classification schemes

1. ENVIRONMENTAL MANAGEMENT	IPC class
1.1. AIR POLLUTION ABATEMENT	All classes from 1.1.1 to 1.1.3
1.1.1. Emissions abatement from stationary sources (e.g. SO <sub>x</sub> , NO <sub>x</sub> , PM emissions from combustion plants)	
<b>Post-combustion technologies</b>	
Chemical or biological purification of waste gases ( e.g. engine exhaust gases, smoke, fumes, flue gases or aerosols; removing sulfur oxides, nitrogen oxides, etc.)	B01D53/34-72
Incinerators or other apparatus specially adapted for consuming waste gases or noxious gases	F23G7/06
Arrangements of devices for treating smoke or fumes of purifiers, e.g. for removing noxious material	F23J15
Shaft or like vertical or substantially vertical furnaces; Arrangements of dust collectors	F27B1/18
<b>Integrated technologies</b>	
Blast furnaces; Dust arresters	C21B7/22
Manufacture of carbon steel, e.g. plain mild steel, medium carbon steel, or cast-steel; Removal of waste gases or dust	C21C5/38
Combustion apparatus characterised by means for returning flue gases to the combustion chamber or to the combustion zone	F23B80
Combustion apparatus characterised by arrangements for returning combustion products or flue gases to the combustion chamber	F23C9
Apparatus in which combustion takes place in a fluidised bed of fuel or other particles	F23C10
1.1.2. Emissions abatement from mobile sources (e.g. NO <sub>x</sub> , CO, HC, PM emissions from motor vehicles)	
<b>Post-combustion technologies</b>	
Processes, apparatus or devices specially adapted for purification of engine exhaust gases	B01D53/92
...by catalytic processes	B01D53/94

Source: OECD 2015 – Environmental technology classification

# Technometric approach

- Main challenge in domain studies: **domain delineation**
  - By technological classification schemes
  - By keyword searches in patent documents



- (...) (select appln\_id from APPLN\_TITLE where upper(appln\_title) like '%BIOPOL%' or upper(appln\_title) like '%BIO-POL%' or upper(appln\_title) like '%BIOPLAS%' or upper(appln\_title) like '%BIO-PLAS%' or upper(appln\_title) like '%BIORESIN%' or upper(appln\_title) like '%BIO-RESIN%' or upper(appln\_title) like '%BIOFOAM%' or upper(appln\_title) like '%BIO-FOAM%' or upper(appln\_title) like '%BIOCOMPOSITE%' or upper(appln\_title) like '%BIO-COMPOSITE%' or upper(appln\_title) like '%POLY(LAC%' or upper(appln\_title) like '%LACTID%' or upper(appln\_title) like '%POLYHYDROXYAL%' or upper(appln\_title) like '%POLY(HYDROXYAL%' or upper(appln\_title) like '%SUCCINI%' or upper(appln\_title) like '%BIOABSORB%' or upper(appln\_title) like '%BIO-ABSORB%' or upper(appln\_title) like '%BIO-RESORB%' or upper(appln\_title) like '%BIORESORB%' or upper(appln\_title) like '%BIOCOMPATI%' or (upper(appln\_title) like '%BIOMASS%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%BIOMASS%' and upper(appln\_title) like '%PLAST%') or upper(appln\_title) like '%BIOBASED%' or upper(appln\_title) like '%BIO-BASED%' or (upper(appln\_title) like '%CELLULOS%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%CELLULOS%' and upper(appln\_title) like '%PLAST%') or (upper(appln\_title) like '%CELLULOS%' and upper(appln\_title) like '%RESIN%') or (upper(appln\_title) like '%CELLULOS%' and upper(appln\_title) like '%COMPOSITE%') or upper(appln\_title) like '%STARCH%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%STARCH%' and upper(appln\_title) like '%PLAST%') or (upper(appln\_title) like '%PLA%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%POLYLAC%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%POLYLAC%' and upper(appln\_title) like '%PLAST%') or (upper(appln\_title) like '%POLYHYDROX%' and upper(appln\_title) like '%ALKAN%') or (upper(appln\_title) like '%POLYHYDROX%' and upper(appln\_title) like '%BUTYR%') or (upper(appln\_title) like '%POLYHYDROX%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%POLYHYDROX%' and upper(appln\_title) like '%PLAST%') or (upper(appln\_title) like '%RENEWABLE%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%RENEWABLE%' and upper(appln\_title) like '%PLAST%') or (upper(appln\_title) like '%BIODEGRAD%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%BIODEGRAD%' and upper(appln\_title) like '%PLAST%') or (upper(appln\_title) like '%BIODEGRAD%' and upper(appln\_title) like '%RESIN%') or (upper(appln\_title) like '%BIO-DEGRAD%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%BIO-DEGRAD%' and upper(appln\_title) like '%PLAST%') or (upper(appln\_title) like '%BIO-DEGRAD%' and upper(appln\_title) like '%RESIN%') or (upper(appln\_title) like '%LACTIC%' and upper(appln\_title) like '%POLYM%') or (upper(appln\_title) like '%LACTIC%' and upper(appln\_title) like '%PLAST%')

# Technometric approach

- Main challenge in domain studies: **domain delineation**
  - By technological classification schemes
  - By keyword searches in patent documents
  - By patent portfolios of relevant organisations

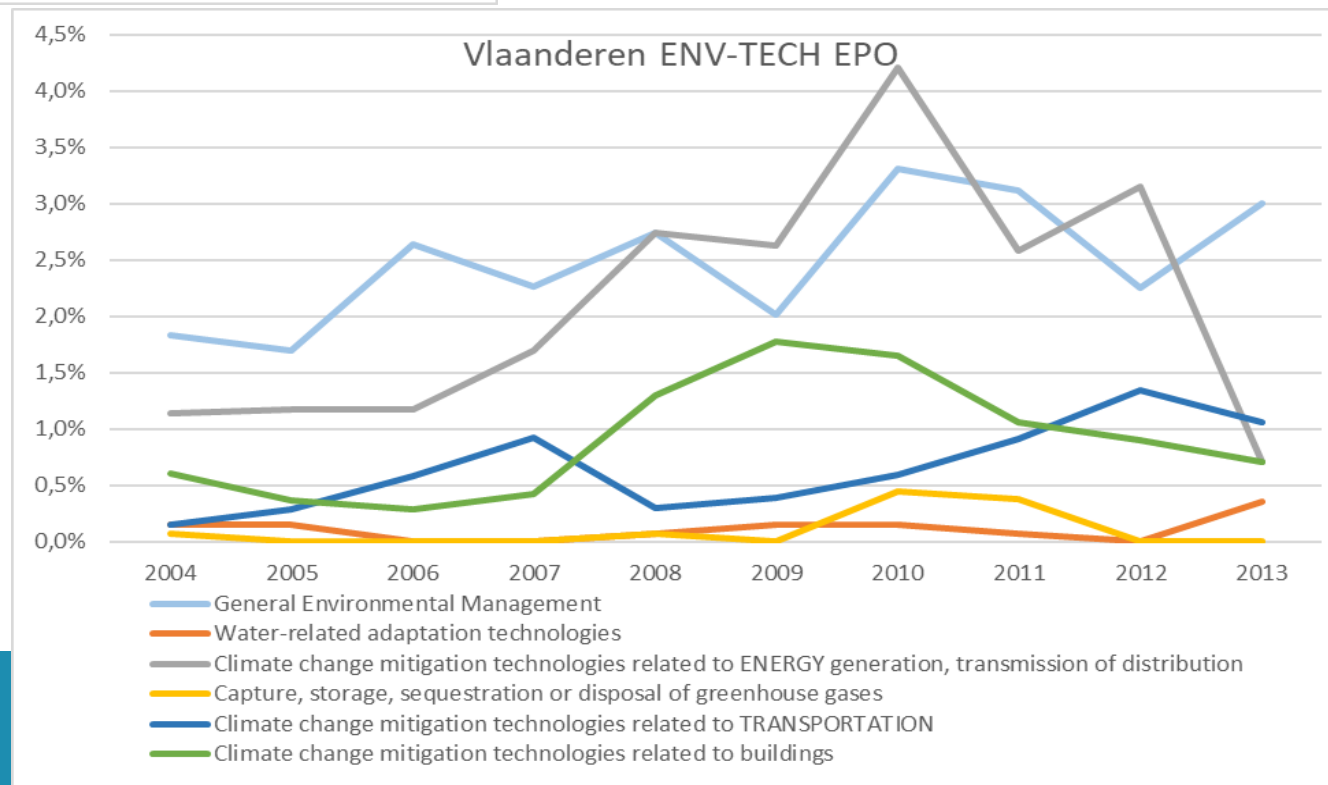
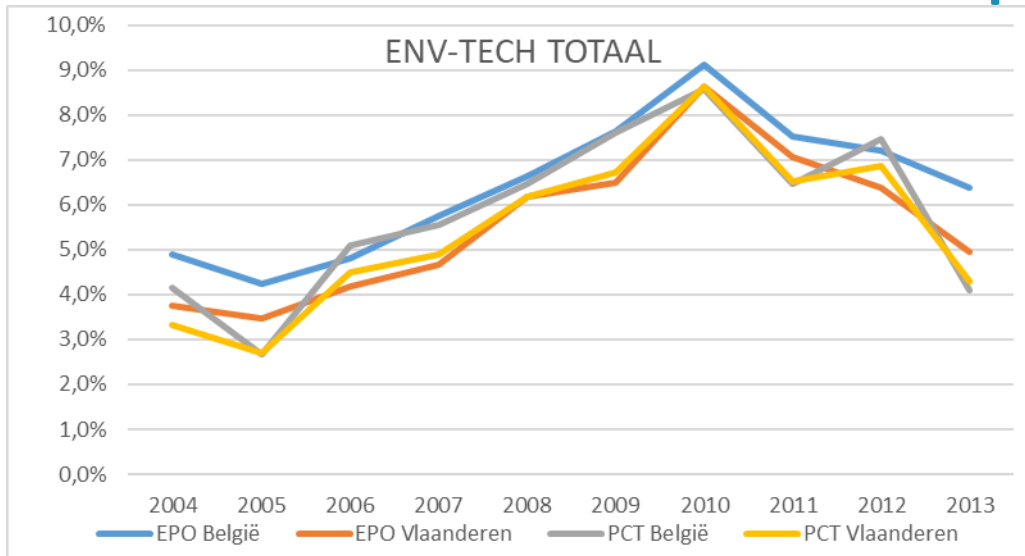
building material	product	biobased origin	organisation	country	type of organisation
bricks		coral making micro-organisms	Biomason	USA	start-up
composietsteen		biobindmiddel + natuurlijke anorganische afvulstoffen	Holonite	NL	
binnentegels	Egg tile	egg shells + cork	NihonMtecs	Japan	
facade bekleding	canal house & Europe building	bioplastic	DUS / Henkel	NL	
bouwplaat	Biostructural insulated panels	waste from paper/noxious weeds, industrial hennep en waste wood	University of Colorado	USA	project (start-up?)
bouwplaat	spaanplaat vlasvezel	geperste vlasscheven	Linex	NL	
honeycombes core sandwich panels	ThermHex production technology	PLA	EconCore	BE	
WPC	wood polymer granules		Beologic	BE	
WPC	composieten kunststof houtvezels		Dumaplast	BE	
lijm voor acoustische panelen	Acous-Tec Adhesive	soya	W.F. Taylor	USA	
asfalt	bio-asfalt	lignin	Wageningen & Dutch Asphalt Knowledge Center	NL	project
asfalt mix	CECABASE	50%biobased additives for warm asphalt mix	CECA (ex SEPPIC Belgium)	BE	
bitumen/waterdichtingsmembraan	Orineo/ DERBIPURE	BIOTumen: Biobased dakmembraan op bases van geraffineerde pyrolyse olie	Derbigum/ IMPERBEL NV		
pipng (regenwater)	DYKA Bioplastic	PLA (Corbion)	DYKA (dochter Tessenderlo)	NL/ BE	
Isolatieschuim	Ucore+ (isolate plastic window frames)	soya	WFI Global		
Isolatieschuim	Heatlox XT	soya	Demilec, Inc		
Isolatiekorrels	BiofoamPearls	PLA	SYNBRA Technology BV	NL	
styrofoam vervanger	cellufoam	wood cellulose as replacement for styrofoam	Cellutech	Sweden	start-up
insulation panels	Biocomposite insulation panels	bioresin matrix + Flax, jute & cork			OSIRYS project
gronddoek/ geotextiles	Ökolys	PLA	Beaulieu Technical Textiles	BE	
gronddoek/ geotextiles	Duracover geweven grondbedekker	PLA	Bonar Technical Fabrics	BE	
gronddoek/ geotextiles		PLA	DS Textiles	BE	
flexible foams	BLOOM	algae derived	Meridian	USA	
flexible foams		Biofoams from Cargill's soy-based BiOH™ polyols.	Recticel	BE	



# Technometric approach

- Main challenge in domain studies: **domain delineation**
  - By technological classification schemes
  - By keyword searches in patent documents
  - By patent portfolios of relevant organisations
- Combining approaches: allows for cross-validation
- In either approach: importance of expert validation!

# Example results – patent studies:



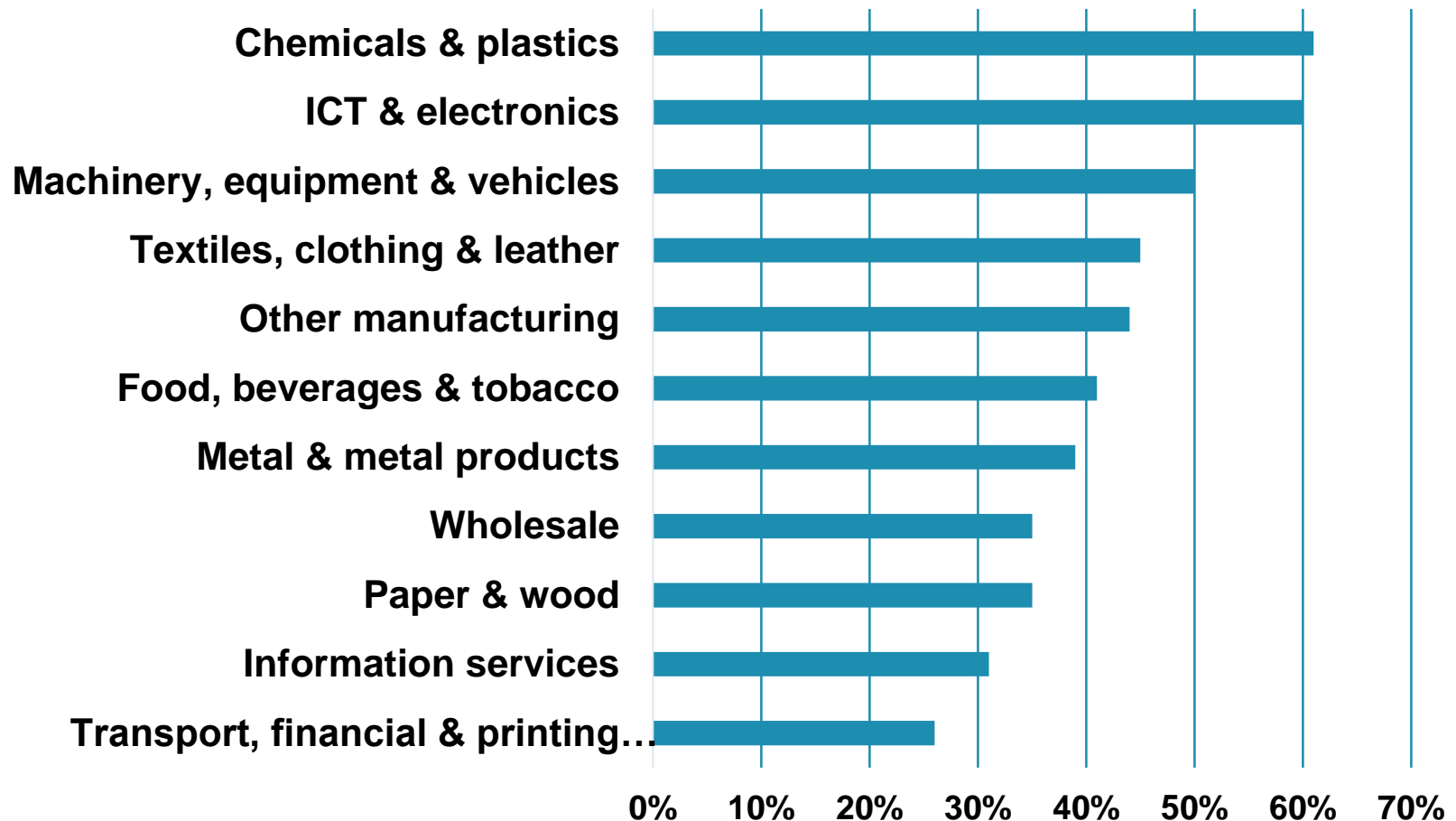
# Measuring R&D and Innovation in the Business Enterprise Sector (Innovation team)

- R&D surveys (even years)
  - R&D expenditure, R&D personnel, funding, types of costs
- Innovation surveys (uneven years)
  - Product innovation, business process innovation, innovation expenditure, cooperation, funding, ...
- Mandated by European Commission
- In line with international guidelines

# Module on Eco Innovation in 2009 Innovation Survey

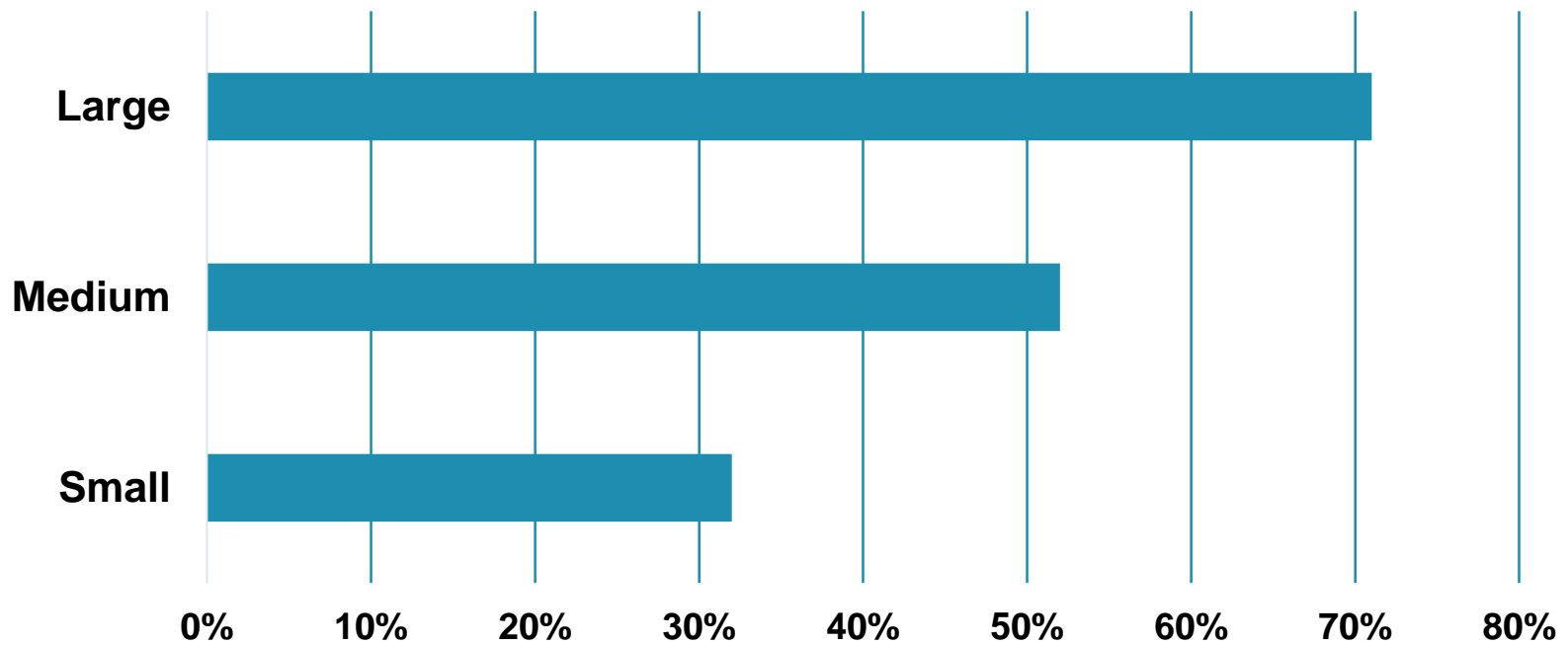
- Part of harmonized survey form within EU
- Innovations with environmental benefits
  - During production
  - During after sales use
- Reasons for innovations with environmental benefits

# % Enterprises with eco innovation (2006-2008)

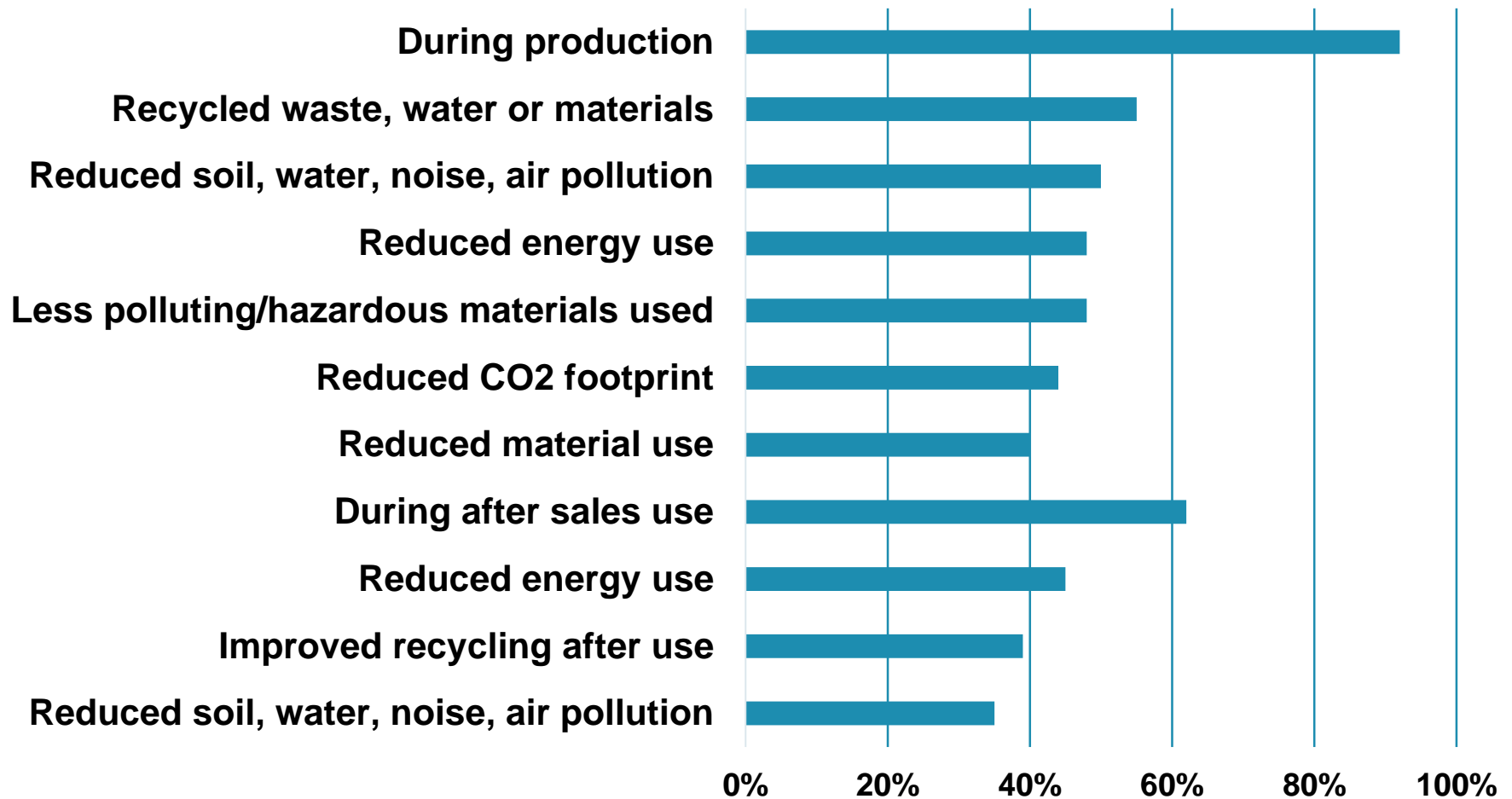




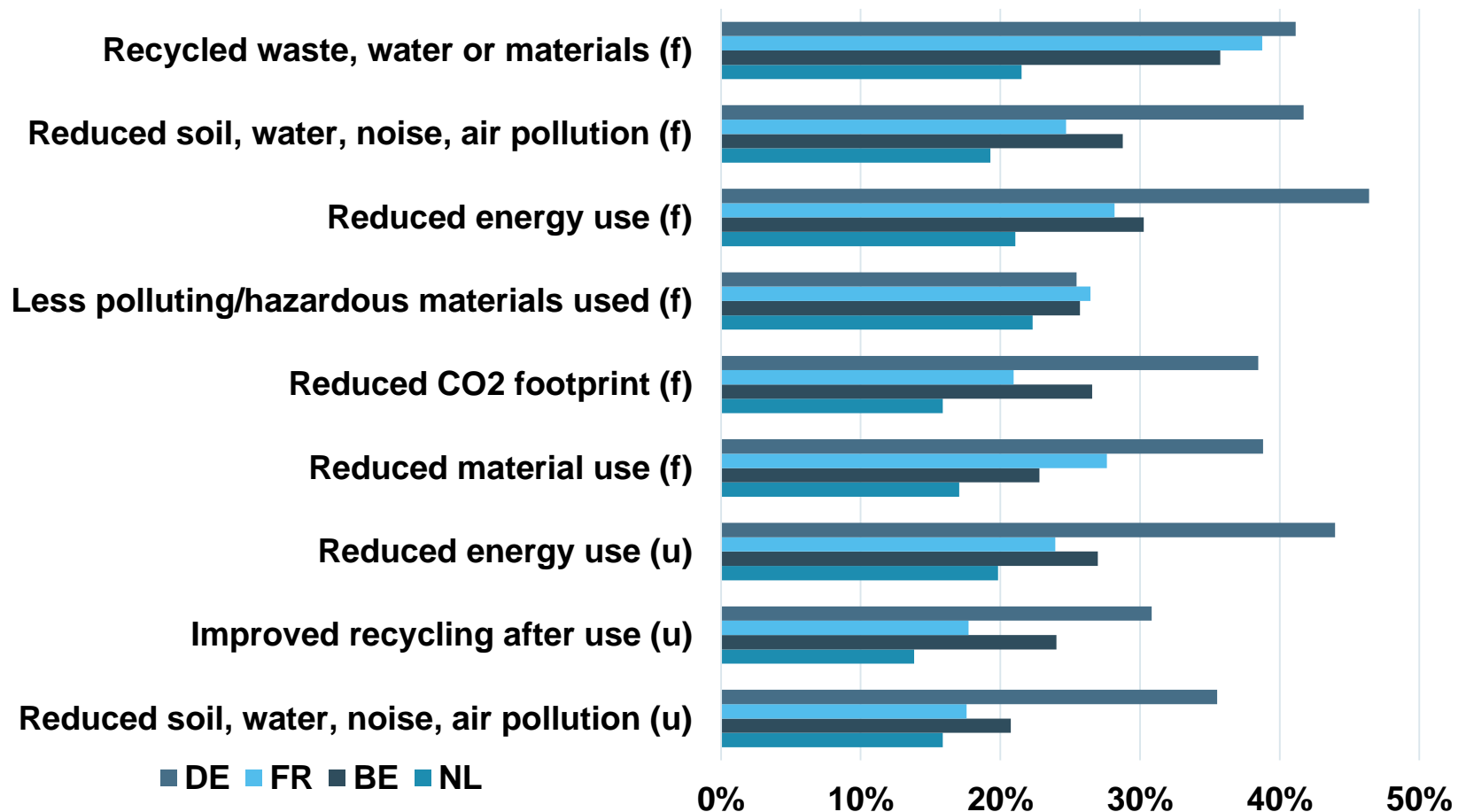
# % Enterprises with eco innovation (2006-2008)



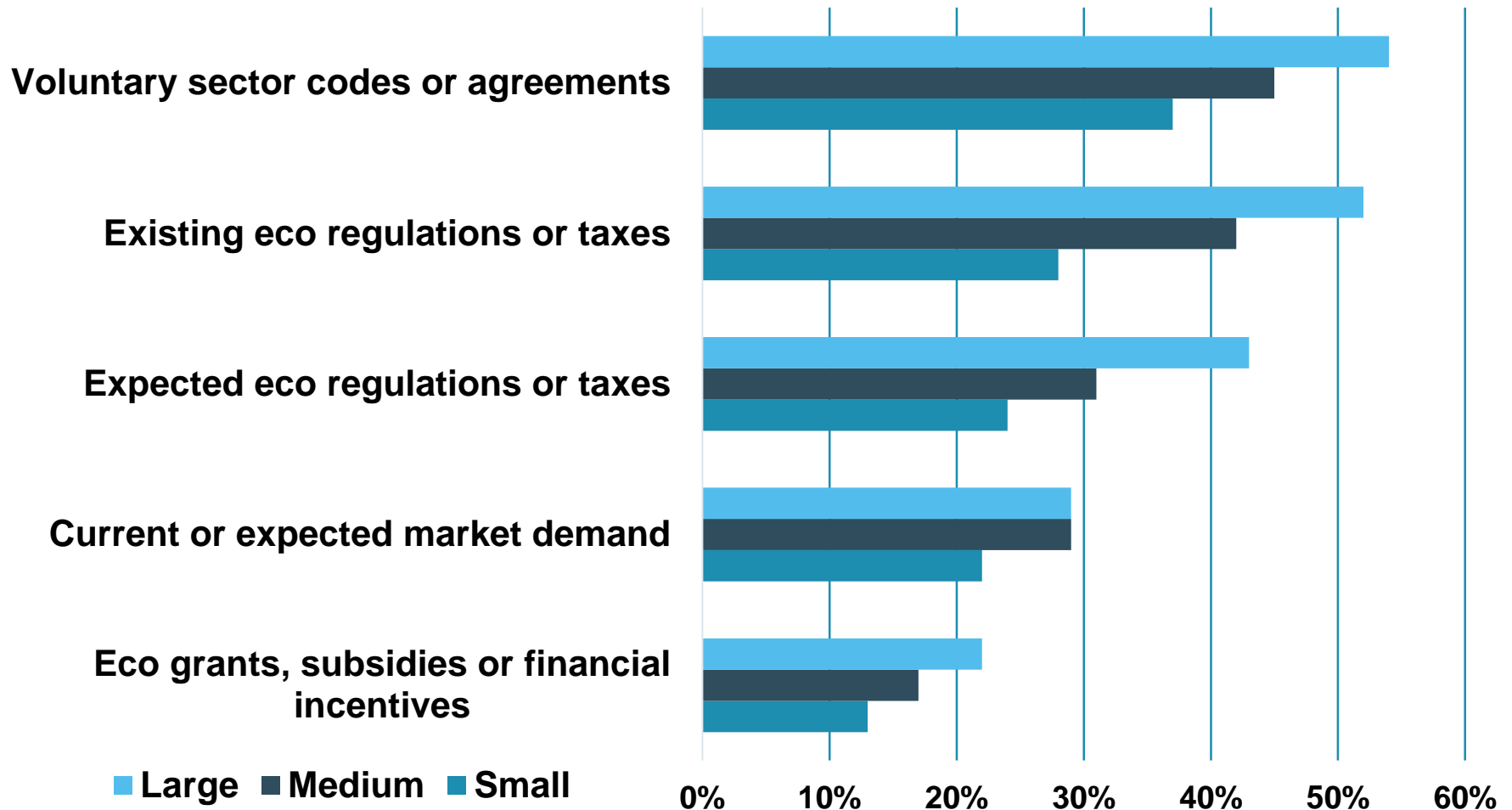
# Innovations w/ environmental benefits (2006-2008)



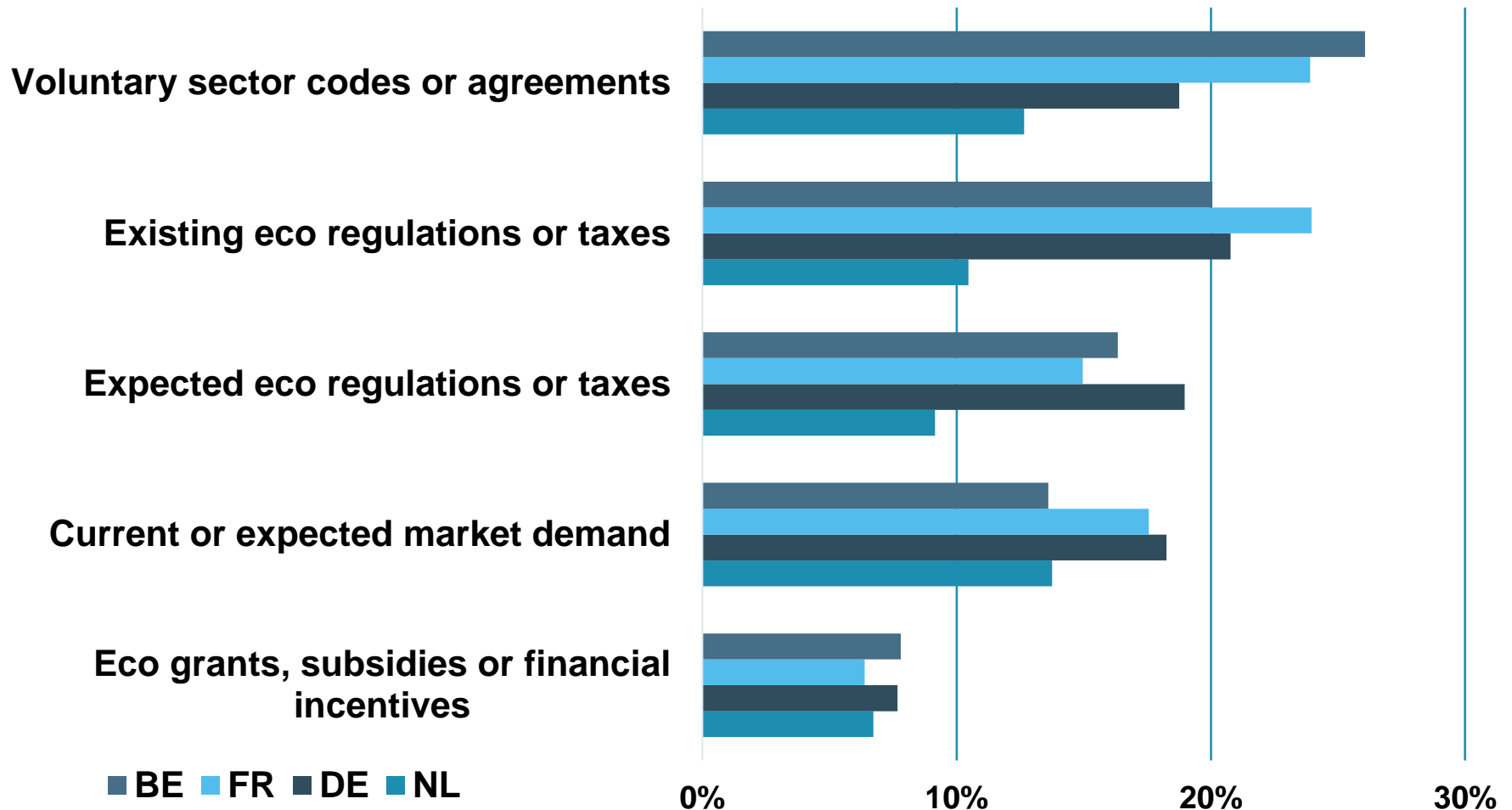
# Innovations w/ environmental benefits (2006-2008)



# Reasons for eco innovation (2006-2008)



# Reasons for eco innovation (2006-2008)



# Eco Innovation Module Conclusions

- 37% of Flemish firms introduced an eco innovation in 2006-2008
- 92% of those indicated environmental benefits during production, vs. 62% environmental benefits during after sales use
- Voluntary sector codes, existing and expected regulations were more important than grants or financial incentives for introducing eco innovations

## More information

- [www.vlaamsindicatorenboek.be/vorige-edities](http://www.vlaamsindicatorenboek.be/vorige-edities)
- Select the 2011 edition, chapter 9

## Contact:

(innovation) [machteld.hoskens@kuleuven.be](mailto:machteld.hoskens@kuleuven.be)  
(technometrics) [julie.callaert@kuleuven.be](mailto:julie.callaert@kuleuven.be)

