

Fibre flows in Europe and in six different European regions. How the future of European fibre will look like?

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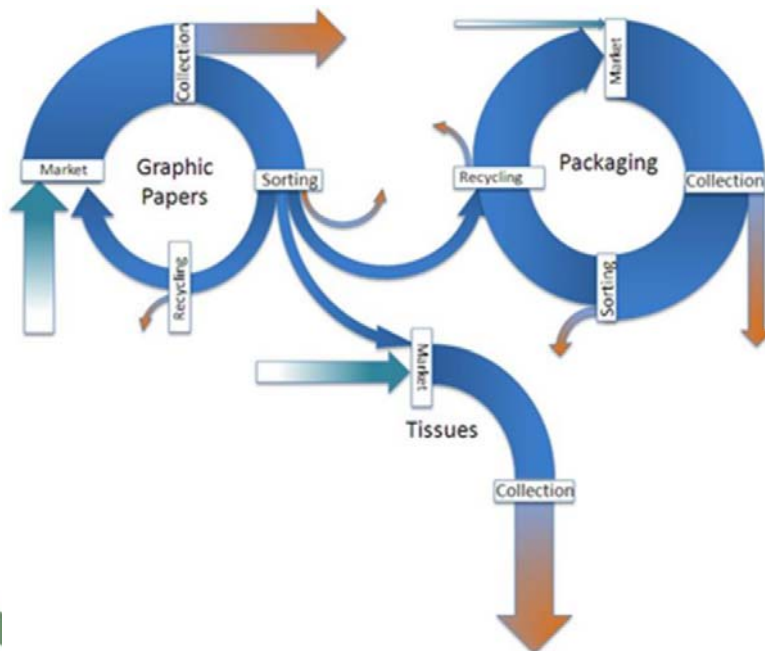
Workshop on 6th of October 2015,
Valencia, Spain

Outline

1. Why dealing with fibre flows? What is your benefit?
2. Specialities of European regions
3. How a (regional) fibre flow looks like?
4. Current situation in the Iberian region
5. Future development of fibre flow
6. Summary

1. Why dealing with fibre flows? What is your benefit?

Fibre Flow Model



- A mass balance of all paper product, *Paper for Recycling* and virgin pulp mass flows
- Can be established over various time and areal scales (from mill scale up to global scale)
- Major challenge for building up a fibre flow: to take recycling loops into account

Source: Robert J-F. "French graphic paper EPR: an incentive to eco-design"

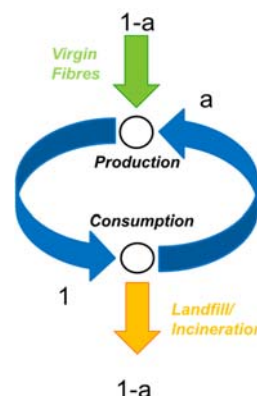
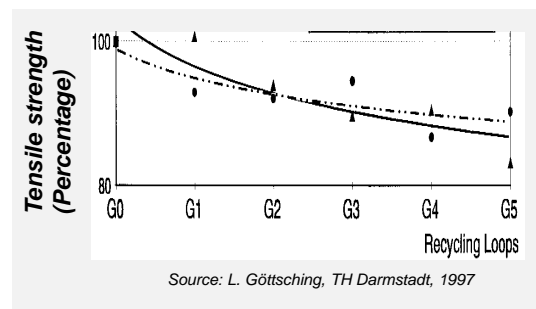
Why dealing with fibre flows?

- To understand the interactions between the various papers / *Paper for Recycling* flows within a region and their influence on quality of *Paper for Recycling* within a certain region
- To quantify the quality of *Paper for Recycling* (PfR) in terms of
 - Composition in regard to (used) paper products
 - Amount of ash
 - Mean fibre age
- To predict the effect of future changes (global/local) in paper production and consumption
 - changes in (global/local) fibre flows
 - changes in quality of PfR

Fibre age

- The number of recycling loops a fibre is used;
agreement within the presentation: fibre age starts with one
- Influence on paper properties was examined in various experiments
- In a One-Input/One-Output recycling system with PfR utilization rate a yields

$$\text{Mean Fibre Age} = \frac{1}{1 - a}$$
- In more complex systems calculation can be very expensive



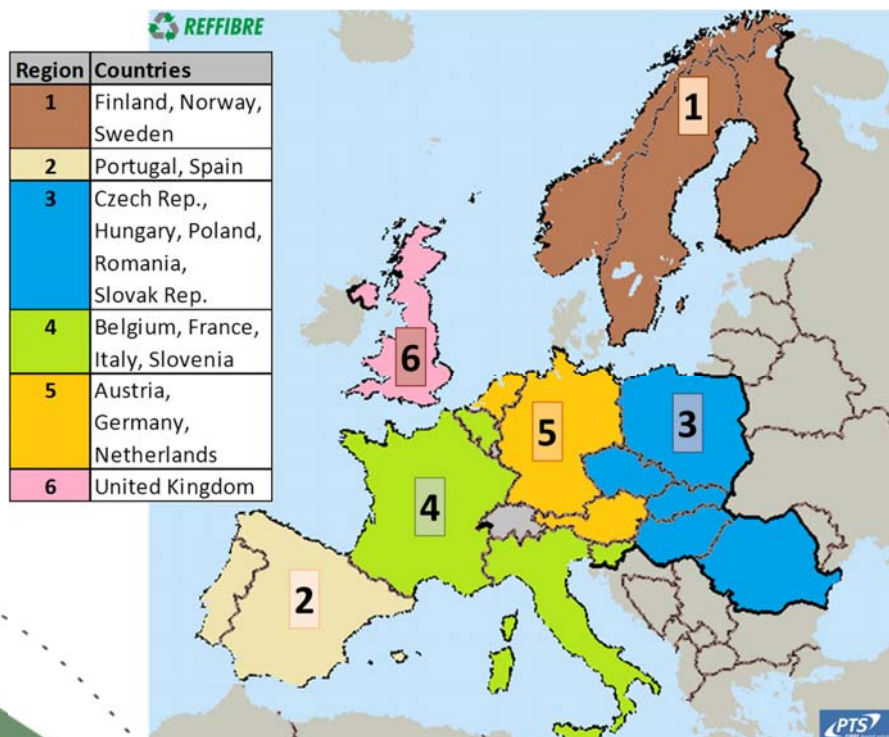
What is your benefit?

- From a paper mill or sorting plant point of view:
 - Preparation of strategic decision making
 - Investments in new raw materials vs. investments in new technologies
 - Partnerships
- From a society point of view
 - Preparation of legislative actions concerning
 - Waste paper collection
 - Paper sorting

→ Improvement of resource efficiency

2. Specialities of European regions

Geographical regions (1)



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Geographical regions (2)

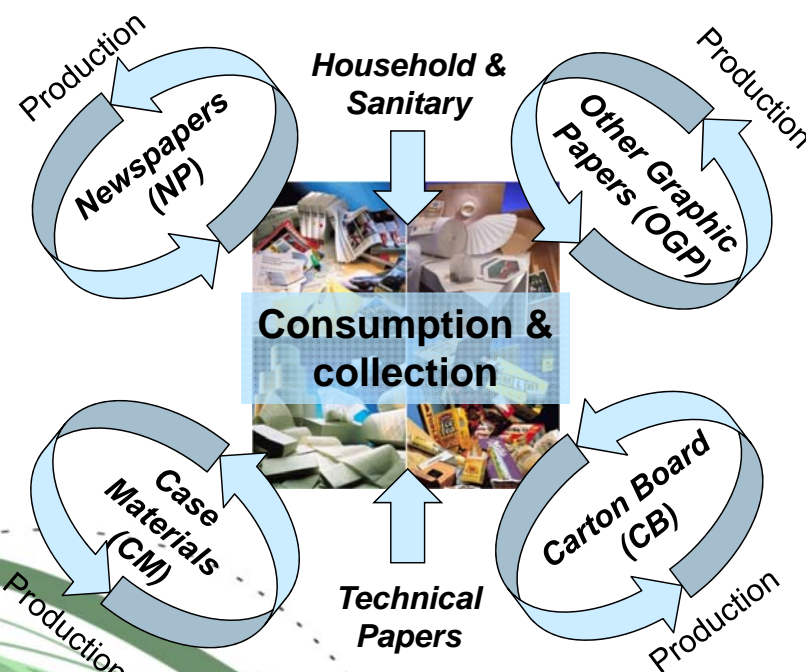
Region	Countries	Characteristics
1	Finland, Sweden, Norway	High PfR collection rate > 70%; low PfR utilization rate; low population density
2	Spain, Portugal	Separate household collection is widespread, high PfR collection rate
3	Czech Rep., Slovak Rep., Poland, Hungary, Romania	Developing waste collection systems; low PfR collection rate
4	Italy, France, Belgium, Slovenia	Co-mingled household collection is widespread, PfR net export
5	The Netherlands, Germany, Austria	Dominating separated household collection; high PfR utilization and collection rates
6	UK	Dominating co-mingled household collection; high PfR net export

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3. How a (regional) fibre flow looks like?

Outline of a 4-Loop Fibre Flow Model



- 6 paper sectors*
 - Newspapers
 - Other Graphic Papers
 - Case Materials
 - Carton Board
 - Household & Sanitary
 - Technical Papers
- Only 4 of them have an Recycling Loop (nearly all of H&S and Technical Papers go to waste)
- Due to consumption & collection fibres migrate from one to another loop

*) The paper sectors were selected according to the needs of the REFFIBRE project. If necessary more or less paper sectors can be introduced.

What is in our paper for recycling?

- To quantify migration of fibres between the loops we need information of the PfR composition per region

PfR Grade	EN 643	Newsprint	Other Graphic Papers	Case Materials	Carton Board
Mixed grades	1.01,1.02				
OCC + Kraft	1.04/4.x				
ONP + OMG	1.11				
High Grades	2.x/3.x				

- Composition of selected PfR grades in Germany (2010)

PfR Grade	Newsprint	Other Graphic Papers	Case Materials	Carton Board
1.02	12%	46%	28%	14%
1.04	3%	16%	59%	22%
1.11	35%	61%	1%	3%

Source: TU Darmstadt (PMV),2010

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Some simple over-the-thump rules to estimate the mean PfR composition from paper consumption data

- Composition of "Mixed Grades" equals the mass ratios of consumption within the four loops, but adding 10% to the amount of Other Graphic Papers and subtracting 10% from the amount of Case Materials
- The weighted sum (according to consumption of Graphic and Packaging Papers) of the composition of "Corrugated/Kraft" and "Newspapers/Magazine" equals "Mixed Grades"
- The amount of Newsprint in "Corrugated/Kraft" and of Case Materials in "Newspapers/Magazines" is zero
- "High Grades" contain mainly Graphic Papers

Calculation for Region 2 (Spain & Portugal) based on CEPI 2014 data

		Newsprint	Other Graphic Papers	Case Materials	Carton Board
Consumption	kt dry	426	1222	2890	1159
Share	%		29%		71%

Composition of grades		Newsprint	Other Graphic Papers	Case Materials	Carton Board
Mixed grades	1.01/1.02	7%	31%	41%	20%
Corrugated / Kraft	1.04/4.x	0%	15%	57%	27%
Newspapers / Magazines	1.11	26%	71%	0%	3%
High grades	2.x/3.x	20%	76%	0%	4%

4. Current situation in the Iberian region

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CEPI statistics for Spain and Portugal (2014)

Region No.	CEPI countries	Paper Sector	Sub group	Used Grades of Paper for Recycling				(Total Pulp Consumption)	Non-Fibrous Materials	Total Paper & Board	
				Mixed Grades	Corrugated & Kraft	Newspapers & Magazines	High Grades			Total	Total Production
				'000 tonnes	'000 tonnes	'000 tonnes	'000 tonnes	'000 tonnes	'000 tonnes	'000 tonnes	Mio. t
2	Spain, Portugal	Graphic Papers	Newsprint	0	0	736	0	n.a.	n.a.	578	463
			Other Graphic Papers	7	1	6	7			2.387	1.328
		Packaging Papers	Case Materials	442	2.719	24	265			3.220	3.142
			Carton Board & Other Pack.	141	328	117	98			821	1.259
		Household & Sanitary	19	1	40	134	194			779	762
		Other papers	103	162	63	5	333			411	420
		Total	711	3.210	986	509	5.417	3.459	1.791	8.196	7.374

Specifics of the region 2 (Spain/Portugal):

- low PfR utilization rate for Other Graphic Papers
- high net export of Other Graphic Papers
- high net import of Carton Board

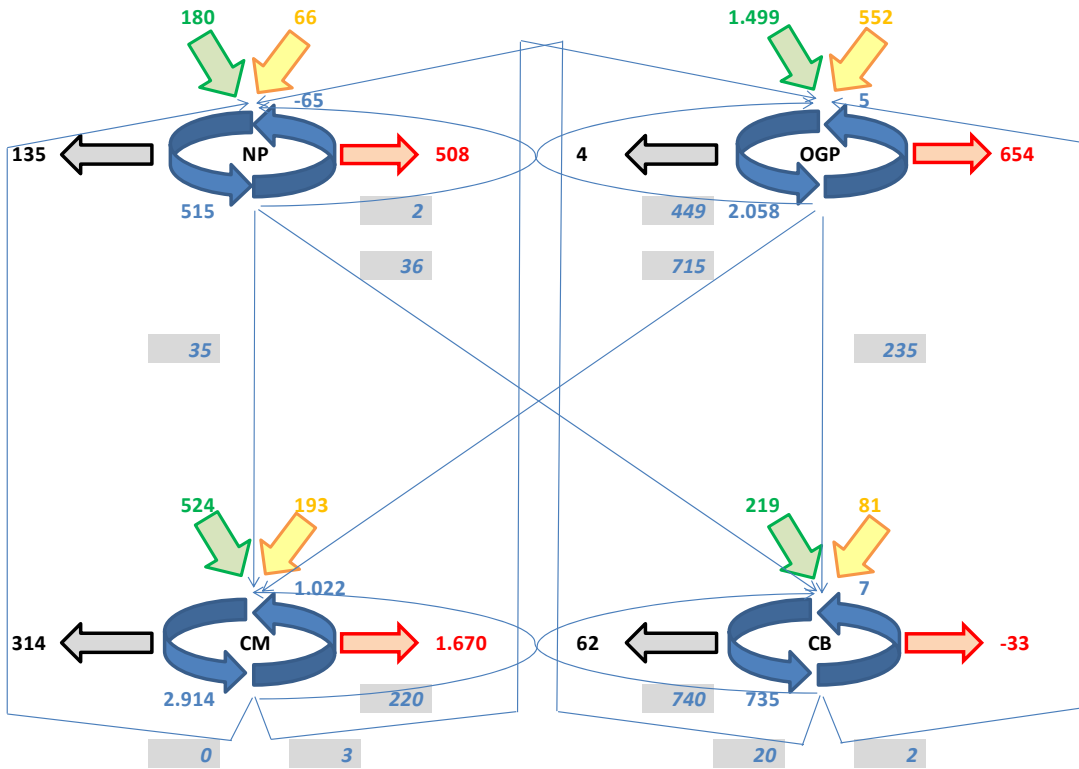
Remarks:

- an automatic procedure was developed to derive the mass flow balance from these statistics
- for missing data general assumptions were made

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Fibre flow in region 2 (Spain, Portugal) in 2014

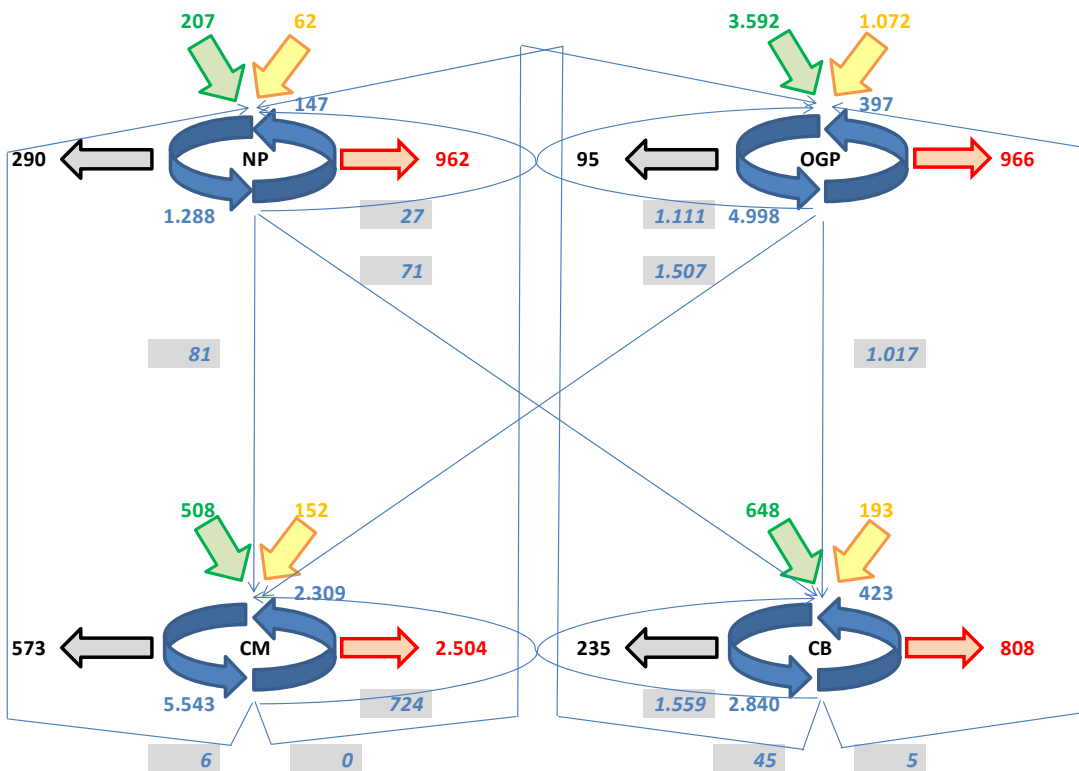


	Ash	Fibre Age
Paper products	NP	19% 0,55
	OGP	27% 0,01
	CM	19% 1,54
	CB	21% 1,10
PFR grades	Mixed	23% 0,59
	OCC	22% 1,01
	ONM	24% 0,25

- xxxxx Virgin fibres
- xxxxx Fillers/Pigments
- xxxxx Product loop
- xxxxx PFR migration
- xxxxx Rejects
- xxxxx Losses *

*) comprises real losses (landfill, incineration) and net import/export

Fibre flow in region 4 (France, Belgium, Italy, Slovenia) in 2014



	Ash	Fibre Age
Paper products	NP	12% 1,04
	OGP	22% 0,09
	CM	12% 2,16
	CB	16% 1,53
PFR grades	Mixed	17% 1,00
	OCC	15% 1,55
	ONM	20% 0,29

- xxxxx Virgin fibres
- xxxxx Fillers/Pigments
- xxxxx Product loop
- xxxxx PFR migration
- xxxxx Rejects
- xxxxx Losses *

*) comprises real losses (landfill, incineration) and net import/export

Comparison between regions (2014)

Region 2: ES, PO

2		Ash	Fibre Age
Paper products	NP	17%	1,65
	OGP	27%	1,01
	CM	19%	2,55
	OP	21%	2,11
PFR grades	Mixed	22%	1,91
	OCC	21%	2,19
	ONM	24%	1,21

Region 4: FR, BE, IT, SI

4		Ash	Fibre Age
Paper products	NP	12%	2,04
	OGP	22%	1,09
	CM	12%	3,16
	OP	16%	2,53
PFR grades	Mixed	17%	2,00
	OCC	15%	2,55
	ONM	20%	1,29

CEPI

CEPI		Ash	Fibre Age
Paper products	NP	11%	1,95
	OGP	20%	1,15
	CM	13%	2,57
	OP	17%	1,73
PFR grades	Mixed	16%	1,73
	OCC	16%	2,01
	ONM	17%	1,35

Conclusions for Spain/Portugal:

- Mean Ash content in paper products and PFR grades is in the same range as in whole CEPI but higher than in the neighbouring region 4
- Mean fibre age in paper products and PFR grades is lower than in the neighbouring region 4 and remarkable lower than in whole CEPI

The influence of the regional composition of PFR on Ash Content and Mean Fibre Age in region 2 (Spain, Portugal)

Over-the-thumb rule

Composition of grades		Newsprint	Other Graphic Papers	Case Materials	Carton Board
Mixed grades	1.01/1.02	7%	31%	41%	20%
Corrugated / Kraft	1.04/4.x	0%	15%	57%	27%
Newspapers / Magazines	1.11	26%	71%	0%	3%
High grades	2.x/3.x	20%	76%	0%	4%

Region 4 like composition

Composition of grades		Newsprint	Other Graphic Papers	Case Materials	Carton Board
Mixed grades	1.01/1.02	7%	47%	28%	19%
Corrugated / Kraft	1.04/4.x	0%	20%	49%	31%
Newspapers / Magazines	1.11	16%	81%	0%	3%
High grades	2.x/3.x	20%	76%	0%	4%

↓

		Ash	Fibre Age
Paper products	NP	17%	1,65
	OGP	27%	1,01
	CM	19%	2,55
	OP	21%	2,11
PFR grades	Mixed	22%	1,91
	OCC	21%	2,19
	ONM	24%	1,21

↓

		Ash	Fibre Age
Paper products	NP	20%	1,50
	OGP	27%	1,01
	CM	20%	2,37
	CB	22%	1,98
	Mixed	24%	2,60
PFR grades	OCC	22%	2,98
	ONM	26%	2,12

The other regions

Region 1: NO, SE, FI

1		Ash	Fibre Age
Paper products	NP	12%	1,26
	OGP	16%	1,00
	CM	14%	1,20
	OP	15%	1,06
PFR grades	Mixed	15%	1,10
	OCC	15%	1,09
	ONM	14%	1,12

Region 3: CZ, SK, PL, HU, RO

3		Ash	Fibre Age
Paper products	NP	2%	2,47
	OGP	12%	1,09
	CM	4%	2,57
	OP	12%	1,11
PFR grades	Mixed	9%	1,68
	OCC	8%	1,87
	ONM	10%	1,35

Region 5: DE, NL, AU

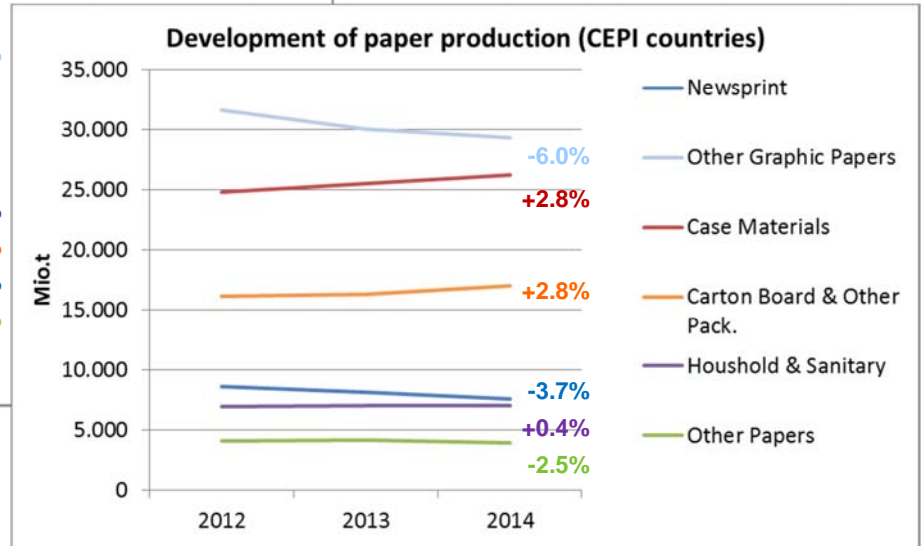
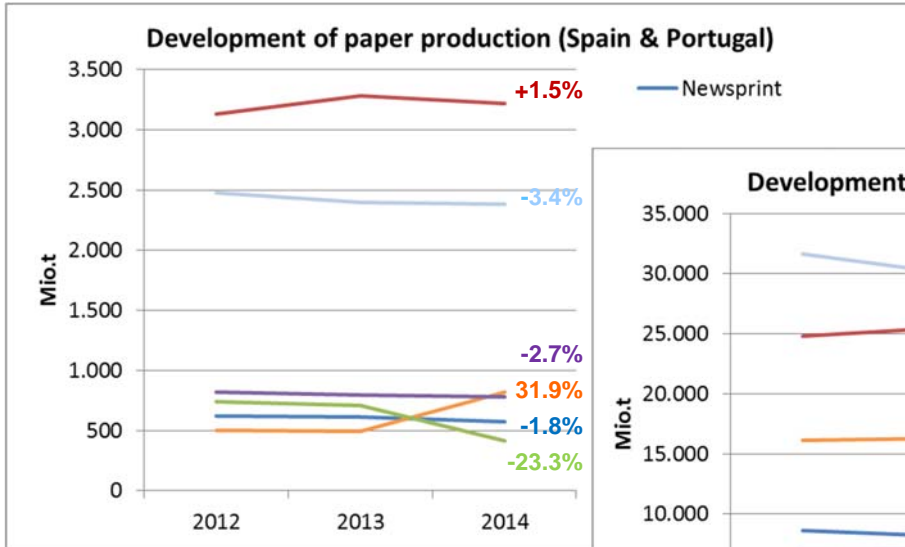
5		Ash	Fibre Age
Paper products	NP	16%	2,65
	OGP	26%	1,51
	CM	18%	3,41
	OP	22%	2,58
PFR grades	Mixed	22%	2,32
	OCC	21%	2,74
	ONM	23%	1,84

Region 6: UK

6		Ash	Fibre Age
Paper products	NP	2%	2,85
	OGP	11%	1,00
	CM	1%	4,81
	OP	7%	2,62
PFR grades	Mixed	4%	2,90
	OCC	1%	4,73
	ONM	6%	2,14

5. Future development of fibre flow

Regional vs. European paper production development 2012-2014



Source: CEPI

Scenario "REG"

Scenario "EU"

Source: CEPI

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Ash Content and Mean Fibre Age in Spain & Portugal 2020 (Prediction) Scenario "REG"

2014

		Ash	Fibre Age
Paper products	NP	17%	1,65
	OGP	27%	1,01
	CM	19%	2,55
	OP	21%	2,11
PFR grades	Mixed	22%	1,91
	OCC	21%	2,19
	ONM	24%	1,21

PfR utilization rate of OGP production in 2020 remains constant (~1%)

PfR utilization rate of OGP production in 2020 increases (~19%)

2020

		Ash	Fibre Age
Paper products	NP	19%	1,54
	OGP	27%	1,01
	CM	19%	2,55
	CB	21%	2,11
PFR grades	Mixed	22%	2,95
	OCC	21%	3,19
	ONM	25%	2,17

2020

		Ash	Fibre Age
Paper products	NP	22%	1,69
	OGP	31%	1,28
	CM	21%	2,65
	CB	23%	2,20
PFR grades	Mixed	24%	3,10
	OCC	23%	3,32
	ONM	28%	2,41

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Ash Content and Mean Fibre Age in Spain & Portugal 2020 (Prediction) Scenario “EU”

2014

		Ash	Fibre Age
Paper products	NP	17%	1,65
	OGP	27%	1,01
	CM	19%	2,55
	OP	21%	2,11
PFR grades	Mixed	22%	1,91
	OCC	21%	2,19
	ONM	24%	1,21

PfR utilization rate of OGP production in 2020 remains constant (~1%)

PfR utilization rate of OGP production in 2020 increases (~19%)

2020

		Ash	Fibre Age
Paper products	NP	19%	1,52
	OGP	27%	1,01
	CM	19%	2,56
	CB	21%	2,11
PFR grades	Mixed	22%	2,96
	OCC	21%	3,21
	ONM	25%	2,15

2020

		Ash	Fibre Age
Paper products	NP	23%	1,69
	OGP	31%	1,32
	CM	22%	2,67
	CB	24%	2,22
PFR grades	Mixed	25%	3,13
	OCC	24%	3,35
	ONM	29%	2,42

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Consequences for quality development of *Paper for Recycling* in Spain & Portugal until 2020, based on calculations

- Results:
 - Differences in the results between both cases (“REG” and “EU”) are minor
 - If the PfR utilization rate for OGP remains constant until 2020 (~1%), the changes between 2014 and 2020 are minor (only due to changing paper migration flows); increase of ash content <0.5% and of fibre age <0.06
 - If the PfR utilization rate for OGP increases until 2020 (~19%), the ash content will increase by ~3% and the mean fibre age up to 0.2
- Remarks:
 - The calculated cases ignore effects of foreign trade of paper and PfR with other CEPI regions or with countries outside Europe

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6. Summary

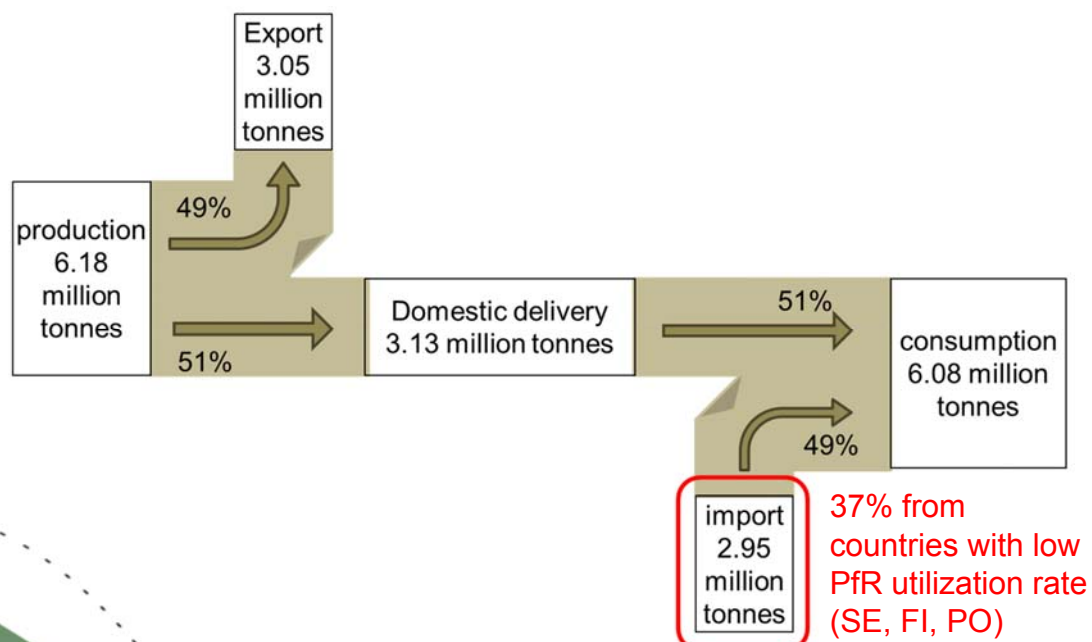
Summary

- A tool is available to quantify fibre flows and to derive forecasts for future PfR quality in predefined European regions
- Based on the assumptions the future changes until 2020 depends on the development of PfR utilization rate (especially for OGP)
- Some details are not considered in the calculations, which can influence the results
 - Import of PfR with different quality
 - Dynamic nature of changes
- Mean composition of PfR grades in every region was assumed by an over-the-thumb rule which needs to be validated. Proved data from the regions or individual countries are very scarce. The influence of PfR composition on fibre flow is obvious.

Future perspectives for fibre flow modelling

- Modelling the interaction (import/export) of fibre flow models between different regions
- Connecting the fibre flow models with
 - LCA tools
 - Process simulation tools for individual paper mill or sorting plant

Foreign trade of paper (Spain 2014)



Many thanks for your attention!

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