EXECUTIVE SUMMARY FOR THE STUDY ON THE PAPER FLOWS AND UTILISATION OF USED PAPER OUTSIDE THE PAPER INDUSTRY

Rationale

Paper, whether newly manufactured or as recovered paper, is a widely utilised and traded good. The recycling of used paper is a general practice which is realised in ever increasing quantity over many decades now. Meanwhile, paper production in Europe is unthinkable without the amounts of recovered paper obtained from the collection at households and from public and commercial premises.

Moreover, recycling is also a declared priority in waste management and primary concern of environmental policy. The clear economics of secondary material use and the enforcement of environmental legislation has prompted the interest of the paper industry in more recovered paper collection and utilisation in the past years. Eventually this turned into a clear commitment of the paper sector to enhance recycling which was reflected in the European Declaration on Paper Recovery of the year 2000. Meanwhile, the paper recycling rate in Europe has come close to 56 % and thus arrived the target corridor the declaration had set out for the year 2005.

Recycling cannot be increased endlessly, however. New and realistic recycling targets are more difficult to define as certain technical limits of recycling and a highly efficient collection are being reached in some areas already. Cost developments and new policy directions on the other hand have even raised concerns whether sufficient recovered paper supplies will still be obtainable in the future.

To disclose reserves for the recycling of paper makes it indispensable to have a clear picture about the available paper quantities and ways they are handled throughout the entire life cycle. The importance derives in particular from the fact that the way paper can take after its use has far more facets than a single stream of recovered paper entering the paper mills for recycling.

It is against this background that a study on the flows of used paper not reaching paper production with particular focus on the volumes forwarded to different disposal options has been carried out. As a part of the research also assessed were the alternative utilisation of recovered paper fibres outside the paper industry. This sector, although filling a segment of growing importance and a not unremarkable position as far as the fibre balance and absorption of the overall used paper potential at the end user are concerned, has remained largely unexposed in the past.

Methodical approach

The segregation of paper from other used components at source, its separate collection and the generation of different feedstock qualities are pre-requisites for any kind of paper recycling. Each step creates its own material streams and diverts a certain portion of the original paper quantity to different outlets. Statistics cover these separate flows very insufficiently. To obtain a complete picture of the used paper flow, one has therefore to look onto this subject from two sides: from the split-up of used materials into different fractions (i.e. the generation of various "waste" streams and their paper content *[paper streams]* at the end user), and from the point where all materials finally end up (i.e. the different outlets/disposal options).

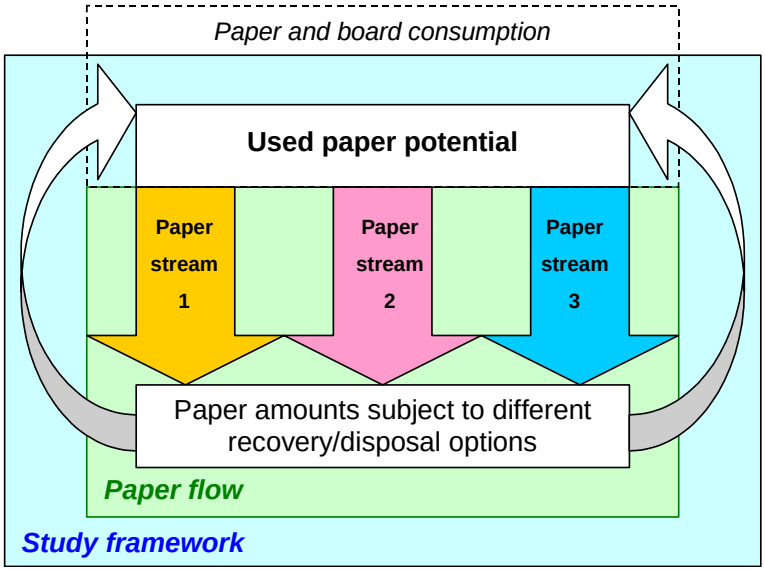

Fig.1: Scheme depicting the methodical approach for paper flow analysis

The corresponding information allow to quantify the different pathways of used paper and likewise to establish the total used paper quantity potentially available for collection after consumption *[used paper potential]*. The difference between used paper potential and total paper and board consumption depicts the non-collectable share from the consumed paper, i.e. paper amounts stored in archives or lost through conversion into non-paper products, through the sewer system or by home combustion, etc..

In terms of its practical application, the quantification model makes a start from the total generated municipal solid waste. As far as the different national and European statistics provide for it, this amount should be made up from all materials that households, public and commercial units set out for collection or otherwise disposed of via the established waste management systems. These materials will then become subject of different treatment, recovery, and/or final disposal options.

Due to the common practice of source segregation and fractionated collection, a quantification must follow further the split of the various material streams as effected in the different countries. Particularly relevant are hereby the separately collected paper and board, the source separated biodegradable waste forwarded to composting, and the residual waste stream which becomes subject of thermal treatment, bio-mechanical or mechano-physical treatment and/or landfilling methods. Each stream and its used paper content must be established by way of different data sources.

Waste characterisation data played a major role in the calculation but also helped backing up the methodical proceedings, for example to include biodegradable waste from households and markets as a material stream containing significant quantities of used paper. A sensitivity analysis was done to assess the uncertainty such data would add to the overall result of the quantification. This issue showed to be of significance only for the residual waste stream in that a deviation of ±2.5 % from the average used paper content established in each country would result in a total difference of about 3.7 million tonnes used paper subject to thermal treatment or landfill disposal.

While delivering a good picture on the different fibre flows beside the quantity collected for recycling, the described methodology does not allow to ascertain further the amount of used paper and board forwarded to other applications than paper manufacturing and the extent to which separately collected paper is used here. This gap had to be filled

from a painstaking research of different information sources and through a survey covering the concerned enterprises, industrial associations and trade organisations.

Results of the quantification of used paper flows and survey on alternative recycling

Based on the outcome of the quantification research and the survey work, a complete data model indicating the amount of used paper products theoretically collectable from the end users, and the subsequent split-up into the different recovery and disposal options could be generated. The collectable paper potential is made up from used paper and board obtained via separate collection schemes plus the amounts of used paper discarded via the two other relevant waste streams; the residual and the separately collected biodegradable waste. The total potential within the area of the CEPI[1] members was calculated to reach the amount of 68.9 million tonnes or about 156 kg/cap.*yr. in the reference period 2002.

About 54 % of this quantity is eventually collected in separate way as recovered paper whereas nearly 10 % of the used paper is exposed to incineration and 36 % account for landfill disposal. Used paper fowarded via the biodegradable waste stream to composting and other forms of biological recovery was found to make up 0.4 million tonnes in 2002 in total.

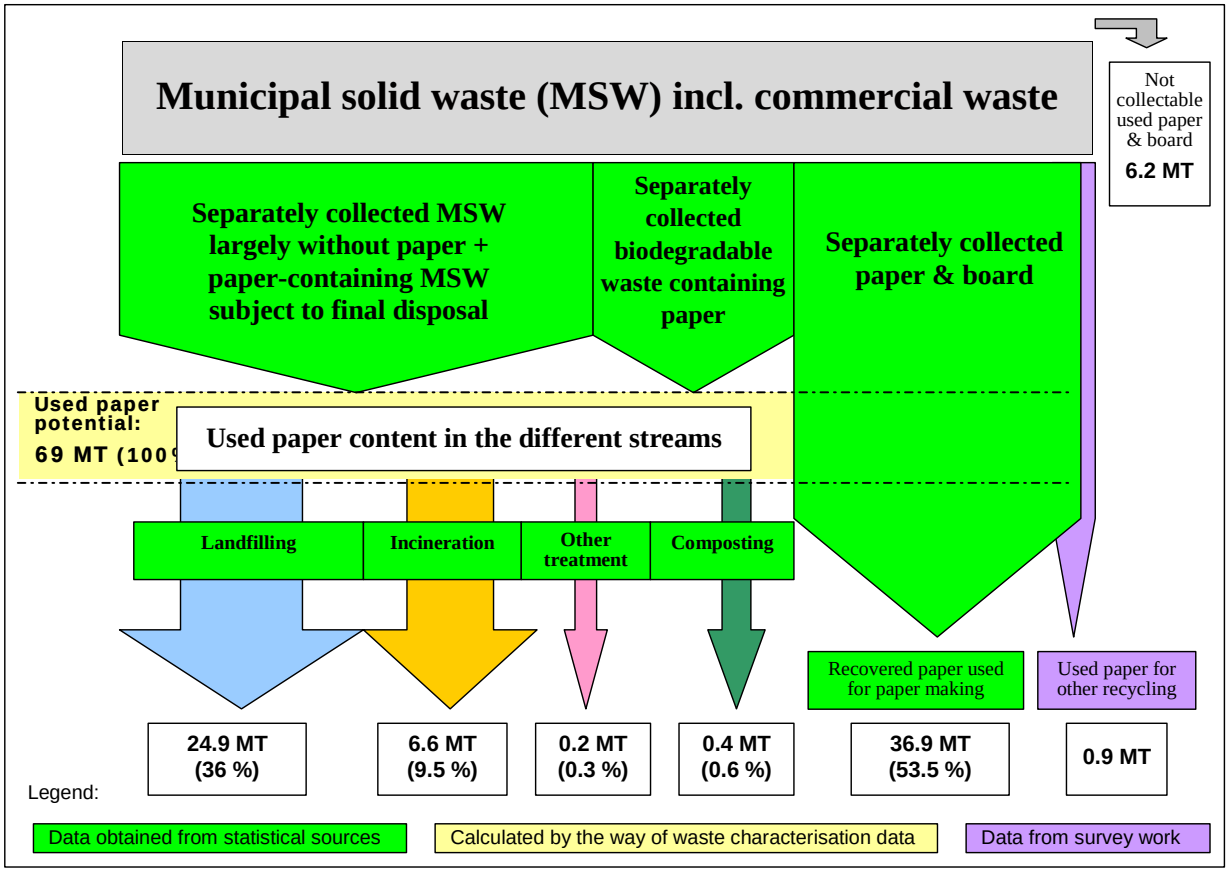

Fig. 2: Methodology applied for the quantification of used paper flows and resulting data model for the area of CEPI member states

[1] CEPI stands for Confederation of European Paper Industries, which is an association joined by 20 European countries (Norway and Switzerland plus all EU member countries except of the Baltic newcomer states, Slowenia and Cyprus)

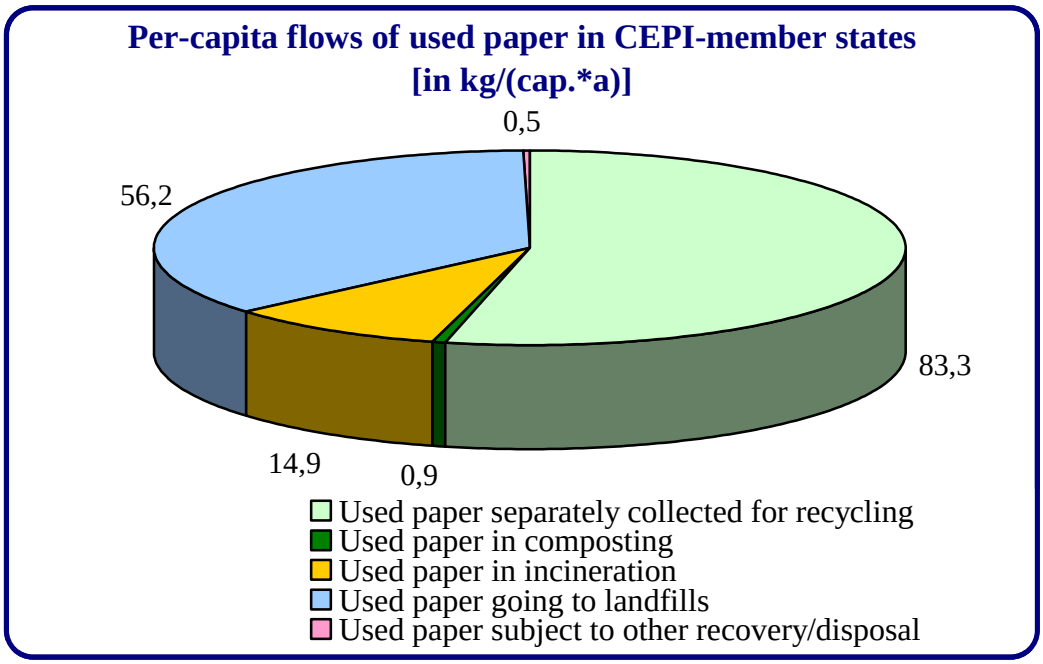

Fig. 3: Per-capita split of the used paper amounts exposed to different treatment options in the area of CEPI member states

All used paper diverted from the paper stream to alternative applications outside the paper industry makes up a total quantity of about 0.9 million tonnes or little more than 1 % of the calculated used paper potential in CEPI countries.

The investigations confirmed that most of the paper fibres used in these kind of applications were coming from recovered paper (old newspaper mainly) which has, for various reasons, been diverted before or in result of sorting operations to serve other purposes than paper making. Some additional quantities originate from different stages in the paper disposal chain, whereby also direct supply systems erected by alternative recyclers are playing a role.

Low paper qualities obtained from the regular collection or sorting operations and surplus stocks, contrary to common belief, could not be confirmed as the point from which alternative applications do principally take a start. The flexibility of the alternative recycling sector for the utilisation of secondary fibres of lower quality is nevertheless higher than that of the paper industry.

Alternative recycling applications and quantities

Searching the internet and literature on alternative applications of used paper, for the most part leads to pilot research and theoretical options rather than cases of practical importance. Likewise observed must be fact that the alternative utilisation of paper fibres is obviously much more widespread in Northern America and Australia than in Europe. To search the spectrum of used paper applications will therefore give a much larger picture than practical applications can actually be found in Europe. Still the spectrum of used fibre applications outside the paper industry can be quite manifold if one considers activities such as home-made articles, small handicrafts and decorative arts. Only a few applications do have a real practical relevance and significant linkage to the recovered paper stream, however.

Applications of used paper fibres for other purposes than paper manufacturing can be found at larger scale in the sector of construction and building supplies in form of insu-

lating materials and fibreboards, in the packaging sector as moulded fibre products and cushion, in farming and agriculture, and as speciality fibre.

Insulating material and construction elements have by far the greatest significance. They are produced in form of insulating mats, acoustic panels and mastic cellulose insulation mainly. Although accounting for a rather small portion of the insulation market yet, a growing interest in cellulose insulation can be noted particularly in the wake of an increasing popularity of ecological products. As of the moment, the share of cellulose based insulation is generally much below the threshold of 1 % of the national markets for insulating material. An exemption is Finland with 7 % and the fact that as much as 3 % of the newsprint collected in the country are going into cellulose insulation.

Contrasting the dominance of small manufacturers in the area of cellulose-based mastic insulation is the fibreboard market which is divided among a few specialised manufacturers who set up an extensive retail network covering nearly all European countries. At the manufacturer's locations the demand on recovered paper can be of significant meaning and absorb a large proportion of the local collection of the respective paper grades.

A second large-scale application of used paper fibres are numerous custom design and general use moulded structures manufactured mainly for the packing of different goods in specialty and non-specialty use markets. Similarities with conventional paper in the production process and product use cause moulded fibre products to assume a intermediary position with regard to their categorisation as alternative utilisation or application of paper production. A reflection of this is provided in the fact that some of the producers for moulded fibre products have enrolled to organisations of the paper industry while others have not. Loose-fill cushion made out of cellulose fibres and starch and wadding material, both serving packaging purposes too, are applications from recovered paper with almost no significance in comparison to moulded fibre products.

Moulded pulp products and cushion materials are also applications where the respective fibre quantities are likely to be returned via paper collection systems into the paper loop. In most of the other applications the fibres are inevitably lost for a future material recycling. Fixed with binders (e.g. in building elements), in mixture with other substances (e.g. fire retarding chemicals in cellulose insulations) or exposed to defilement (e.g. animal bedding), the paper fibre's fate is irreversibly connected to that of the remaining material and unaccessible for any subsequent attempt of paper recycling.

Other applications with still a certain mass relevance are speciality fibres generated for industrial and other specific uses, and animal bedding as a product particularly known in the UK. Speciality fibres from recovered paper are produced in numerous qualities for applications as diverse as roadmaking products, pellets, industrial fibre products, seeding mulch or even for artificial snow.

All other established uses of secondary fibres are of minor relevance and must be refered to local or small-scale applications mainly. Some frequently mentioned examples are planting containers, substrates and pellets made for weed control, soil enhancement and as carrier substance for fertilizer or herbicides.

Economic advantages and the combination of product demand and green image constitute principal drivers for the utilisation of used paper outside the paper industry. The price advantage for used paper fibres as opposed to alternative materials paired with a higher resource efficiency in feedstock generation guarantee for competitive prices on the market. Still, alternative recycling accounts for a rather small share of the paper industry's potential supply with secondary fibres.

Tab.1: The established ways for the alternative recycling of used paper and their application

Application sector	Relevant products	Used paper content	Source of feedstock	Used paper quantity consumed	
				at national level	in CEPI area
Construction and building supplies	Insulating material	80-90 %	newspaper, seldom mixed grades	usually less than 10,000 t/yr., in a few cases up to 30,000 t/yr.	200,000 t/yr.
	Fibreboard and panels	18-20 %	newspaper, mixed grades	few large producers only, 150,000 t/yr. as maximum	up to 300,000 t/yr.
Packaging products	Moulded fibre packaging	variable but often 99 %	newspaper, mixed grades, OCC	few large, some medium - small sized manufacturers, large firms below 30,000 t/yr.	around 250,000 t/yr.
	Cushion material	95-100 %	newspaper, OCC	insignificant	up to 10,000 t/yr.
Other industries	Speciality fibre	100 %	newsprint mixed grades	few specialised producers with about 30,000 t/yr. in maximum	up to 100,000 t/yr.
Farming/ Agriculture	Animal bedding	100 %	newspaper, seldom OCC	specially in UK but generally insignificant	up to 10,000 t/yr.
Miscellaneous	Plant container, Pellets, Art articles	variable but usually high (80-100 %)	mainly newspaper	widely dispersed but insignificant	few thousand tonnes in maximum

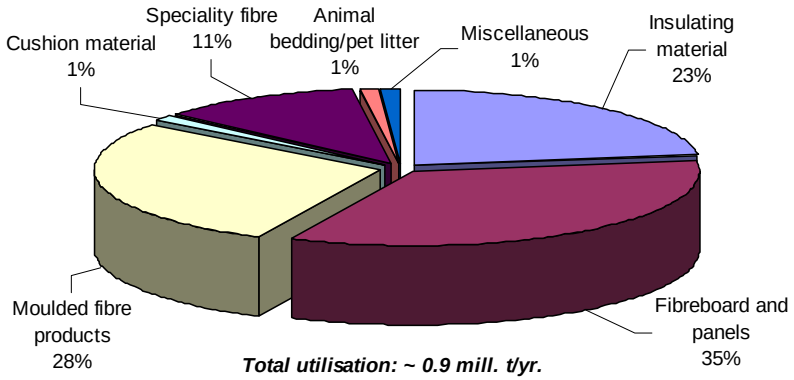

Fig. 4: Segments of secondary fibre use outside paper production

Final note

Alternative users of secondary fibre draw, like paper manufacturers, first of all from the economic advantage of using a secondary raw material part of which is to seek its acquisition for the lowest possible price. With feedstock requirements which are not necessarily below the raw material demands for paper manufacturing, they are after all potential competitors of the paper producers in the supply market. The vast spectrum of applications and generally higher flexibility in terms of fibre quality let alternative recyclers however the chance to secure large portions of their supply from material stocks which are not in the direct interest of the paper industry. Alternative paper recycling is thus unlikely to pose a threat for the traditional paper industry's supply with recovered paper in the near future although meaning and potential for the market might be higher than the rather low quantities currently utilised this way in Europe let assume. These applications can work as sinks for recovered paper at times when recovered paper stocks are high, and demand and prices for secondary fibre are consequently low. A well balanced demand across the whole spectrum of recovered paper grades should also have a stabilising effect on prices which in the long term could help the intensification of separate paper collection in some countries. Paper manufacturers themselves have already started to recognise these benefits and partly began to explore the niche markets for alternative applications to improve the profitability of their own operations.