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Final Report

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List of acronyms

Acronym	
ACE	Alliance for Beverage Cartons and the Environment
AEBIOM	European Biomass Association
AV	Added value
AVCP	Assessment and verification of constancy of performance
BAT	Best available technique
BREF	Best available technique reference document
CAPEX	Capital expenditure
CCA	Cumulative cost assessment
CEI-bois	European Confederation of Woodworking Industries
CEPI	Confederation of European Paper Industries
CHP	Combined heat and power
CITPA	Confederation of Paper and Board Converters
CLP	Classification, Labelling and Packaging Directive
CLT	Cross laminated timber
CPR	Construction Products Regulation
DDS	Due Diligence System
DG	Directorate General
EAP	Environment Action Programme
EBIT	Earnings before interest and taxes
EBITDA	Earnings before interest, taxes, depreciation and amortisation
EC	European Commission
ECHA	European Chemicals Agency
EDANA	European Disposables and Nonwovens Association
EED	Energy Efficiency Directive
EEX	European energy exchange
EFIC	European Furniture Industries Confederation
EFICEEC	European Forest Institute Central-East European Regional Office
EOS	European Organisation of the Sawmill Industry

EPF	European Panel Federation
EPR	Extended producer responsibility
ETD	Energy Taxation Directive
ETS	Emission Trading System
EU	European Union
EUA	European emission allowance
EUR	Euro
EUTR	European Timber Regulation
FAO	Food and Agriculture Organization of the United Nations
FAP	Forest Action Plan
FBI	Forest-based industries
FEFPEB	European Federation of Wooden Pallet and Packaging Manufacturers
FLEGT	Forest Law Enforcement, Governance and Trade
GBP	Pounds
GOS	Gross operating surplus
HWP	Harvested wood products
IED	Industrial Emissions Directive
IEP	Integrated Environment Permits
ILUC	Indirect land use change
INTERGRAF	European Federation for Print and Digital Communication
IPPC	Integrated Pollution Prevention and Control
ISPM	International Standards For Phytosanitary Measures
IT	Information technologies
Kwh	Kilowatt hour
LCPD	Large Combustion Plant Directive
LULUCF	Land use, land use change and forestry
MDF	Medium density fibreboard
Mw	Megawatt
Mwh	Megawatt hour
NACE	Statistical Nomenclature of Economic Activities
NREAPS	National Renewable Energy Action Plans
OECD	Organisation for Economic Cooperation and Development

OPEX	Operating expenditure
OSB	Oriented strand board
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals Directive
RED	Renewable Energy Directive
SBS	Structural Business Statistics
SIEF	Substance Information Exchange Forum
SME	Small and medium enterprises
SVHC	Substances of very high concern
TOR	Terms of references
UEA	European Federation of Furniture Manufacturers
VA	Value added
VAT	Value-added tax
VOC	Volatile organic compound
VPA	Voluntary Partnership Agreement

Executive Summary

Objectives and scope of the study

The aim of this study is to identify the cumulative costs, both direct and indirect, of the most financially burdensome EU legislation and policies that forest-based industry (F-BI) companies active in the EU28 have to comply with. Specifically, the study **objectives** are:

- Quantification of the cumulative direct and (where possible) indirect costs of relevant legislation and policies for the selected F-BI sub-sectors in the EU;
- Demonstration of the evolution of costs of the relevant legislation and policies over time (2005-14) and likely qualitative developments in the coming years;
- Comparison of costs and provision of conclusions on the cost impact of EU legislation and policies on respective F-BI sub-sectors.

Later on, a qualitative comparison is made between the cost structures of the EU F-BI sub-sectors woodworking and pulp, paper & paperboard, given the legislative regime within which they operate in the EU, with those of their main international competitors, operating within their own specific legislative frameworks. (NB in some cases, the latter may include relevant EU legislation). Where relevant and possible, comments are given about implications for the competitiveness of the respective global regions.

The study was initially designed to cover four sub-sectors of the EU forest-based industries, based on the statistical classification of economic activities in the European Community (NACE): woodworking (NACE 16), furniture manufacturing (NACE 31), pulp and pulp-based manufacturing (NACE 17) and printing (NACE 18). However, after the initial data-gathering phase, a decision had to be taken to confine the scope of the study to only **two F-BI sub-sectors – woodworking (NACE 16) and pulp and pulp-based manufacturing (NACE 17)** – due to the very low rate and quality of response to pilot interviews from companies of the other two sub-sectors, and also a lack of sufficiently detailed secondary data.

Hence, the study covers the woodworking sub-sector and the pulp, paper and paperboard sub-sector, for which the available data are sufficient to produce reasonably representative estimates. These include the following sub-sectors: 16.1 sawnwood; 16.21 wood-based panels; 16.23 other builders' carpentry and joinery; 16.24 wooden pallets and other wooden pallets and other wooden packaging; 17.11 pulp production and 17.12 paper and paperboard.

All pieces of legislation seen as incurring high costs to the EU forest-based industries are included in the study. The relevant regulations and policies are grouped under **eight legislative packages,** comprising the policy areas of: competition, climate and energy, environment, forest-related policies, employment and workers' safety, product policy, transport and trade. However, the competition package has not been addressed quantitatively in the study; businesses reported that competition legislation mainly aims at shaping the competitive environment in which they operate and that it creates no, or very little, cost.

This cumulative cost assessment (CCA) covers the impact to date of the existing legal framework (as at the end of 2014), with cost-related indicators that cover a **10-year period from 2005 till 2014** (quantitative assessment). Following the assessment of the present effects of current EU legislation on the forest-based industries, this section elaborates on future regulatory costs likely to impact the forest-based industries, either based on current legislation with future cost impacts or future legislation (i.e. drafted or already in the adoption process phase as by the end of 2014) under qualitative assessment).

The **territorial scope** of this CCA is the **EU28** and the selected global competitor countries, namely **China, the United States,** and **Brazil.**

Methodology

As opposed to other methods assessing the costs of policies, this study adopts a **cumulative approach**, by providing a quantitative assessment of all direct costs (monetary obligations, capital expenditure, operating expenses and administrative burden) and (where possible) indirect costs incurred by F-BI companies in the EU in relation to the most relevant EU legislation. This study **does not assess the benefits of EU legislation** and does not aim to provide insights related to the proportionality of costs and benefits of legislation, nor its efficiency or effectiveness.

The methodology of this study draws on previous cumulative cost assessment exercises performed for some EU Member States and the European Commission, such as the latter's CCAs for the aluminium and steel industries respectively (CEPS, 2013a and CEPS, 2013b) and for the Chemical Industry (Technopolis, 2016). It also draws on the established methodologies that have been used for several years by Member States and the European Commission, including the Standard Cost Model, or the Cost-driven Approach to Regulatory burdens (CAR) developed for the Dutch Government. Despite its significant advantages regarding feasibility, the CCA method is less accurate than statistical methods, as it can only provide an estimate of the magnitude of cost borne by companies due to EU legislation.

A total of 57 pieces of legislation were finally selected from initial prioritisation by industry associations as having a significant impact on their respective sub-sectors. Legislative acts were grouped under policy packages, based on the similarity of objectives. National legislation that is not transposed from EU legislation was excluded from the study. Companies - selected from the F-BI with the aid of a Mirror Group - participated in the study. They were asked to report only the costs associated with the requirements set out in the prioritised EU legislation. The selected pieces of legislation were further analysed and the actions that companies have to take to comply with them were identified. The actions were then associated with cost categories identified in the European Commission's Better Regulation Toolbox (European Commission, 2015a): monetary obligations, capital expenditures, operating expenditures and administrative burden and each was quantified accordingly.

The legislative costs borne by F-BI companies were estimated by following a six-stage approach:

- The first step included the **development of a questionnaire** and its **distribution** to a panel of typical plants. The selection of the interviews was performed with the support of industry associations, on the basis of the following criteria: representativeness of activities and structure, comparability of companies and clear business operations.
- Next, data were collected through in-depth interviews with the selected companies. Overall, **in-depth interviews** and **on-site visits** were performed for 49 typical plants, and 103 responses were provided to the survey, covering 21 EU Member States.
- On the basis of these data, **an estimation of the costs** for the panel companies was performed.
- This estimation was further validated through two **validation** and **discussion workshops**. In addition to this validation, testing and adjustments of the cost estimates were done using the results from the **online survey**.
- Lastly, the results and input from all steps were aggregated producing a **cumulative overview of regulatory costs for each sub-sector**.
- Finally, a **quantitative estimation of ETS indirect costs** - based on secondary data - was performed for the pulp, paper and paperboard sub-sector, while a **qualitative assessment of indirect costs related to the price of raw materials** was performed for the woodworking sub-sector.

The analysis of data in the current study did not rely on statistical methods. Although the cumulative cost assessment methodology clearly presents advantages in terms of feasibility, it is less accurate than statistical methods, and mainly provides an estimate of the magnitude of cost borne by companies due to EU legislation. Detailed data was collected among 49 typical plants selected according to a set of criteria, and further adjusted based on the results from a larger sample of 103 responses through an online survey. Validation workshops with both the European Commission and the industry, along with results from the online survey, were in line with cost figures provided by the panel companies. Data was collected assuming the full compliance to legislation, which is not always the case: this could therefore lead, in certain cases, to an overestimation of costs.

A methodological challenge in the assessment of administrative burden relates to the difficulty of identifying the origin of the burden — whether burdens can be solely attributed to the minimum requirements of EU legislation or to going beyond minimum requirements ("gold-plating") at national level. This was taken into account by asking companies surveyed to report the portion of administrative burden attributable solely to implementation of the European legislation. However, there is no obvious way to ensure that there is no overlap in administrative burden estimates.

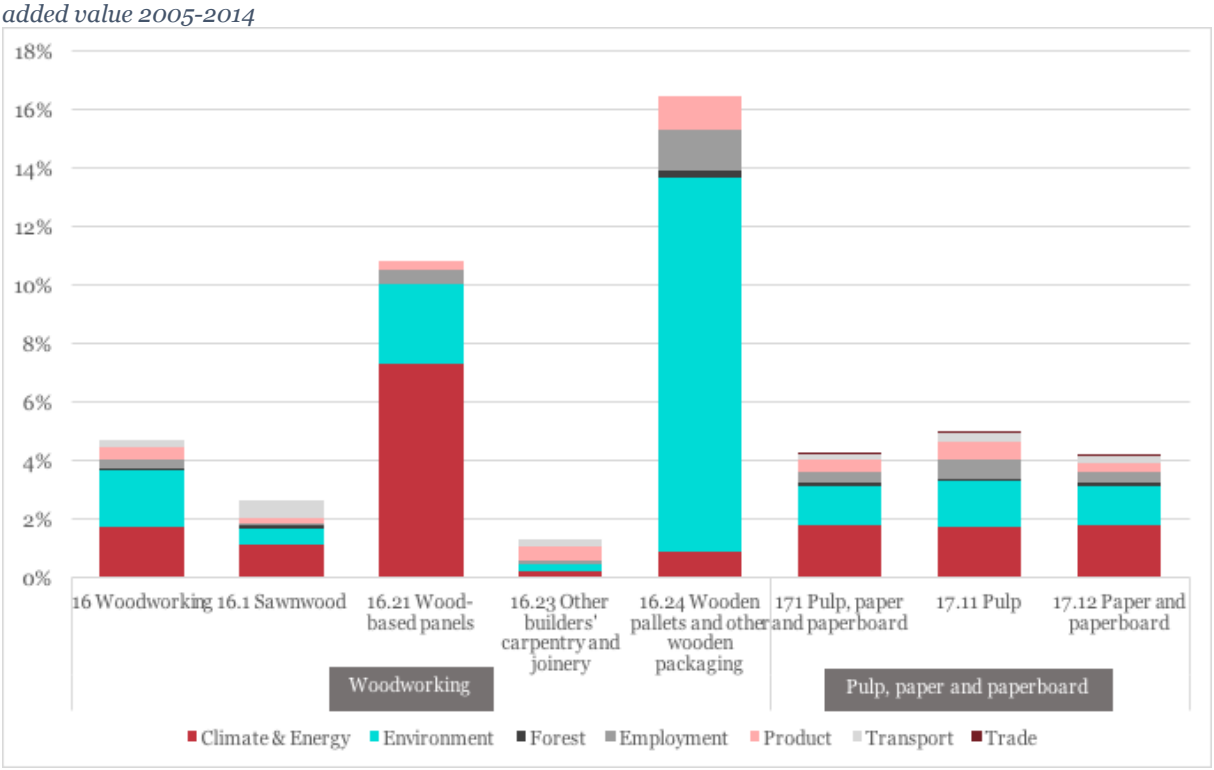
Main findings of the CCA

The EU woodworking industries were derived from NACE code 16 and include: the production of sawnwood, wood-based panels, builder's carpentry and joinery products, wooden flooring, wooden packaging and other wooden articles. Input materials within the woodworking value chain are, apart from saw logs (fresh wood), industrial by-products (like bark, chips and dust) and used materials (recovered wood). On the other hand, the pulp, paper and paperboard manufacturing sub-sector value chain is derived from NACE code 17 and includes all kinds of pulp and products made of pulp.

The variability of costs across the different sub-sectors, as illustrated in the following figure, is significant and reflects differences in product groups and their value chains. Thus, the highest cost as a percentage of added value is observed in wooden containers and packaging, amounting to 16.4%, and the lowest in builders' carpentry and joinery, at 1.3%. The cost for wood-based panels represents 10.8% of the sub-sector's added value, for pulp 5%, for paper and paperboard 4.2% and for sawnwood 2.6%.

Within sub-sectors, variability reflects the size of companies and their organisational structures, efficiency, level of integration and product portfolio. For instance, SMEs in general incur higher costs compared to large firms because the costs to comply with legislation are not linear and cannot be amortised by SMEs on a large volume of products.

Figure 1 Cumulative direct regulatory costs and its composition by legislative package -average annual share of added value 2005-2014



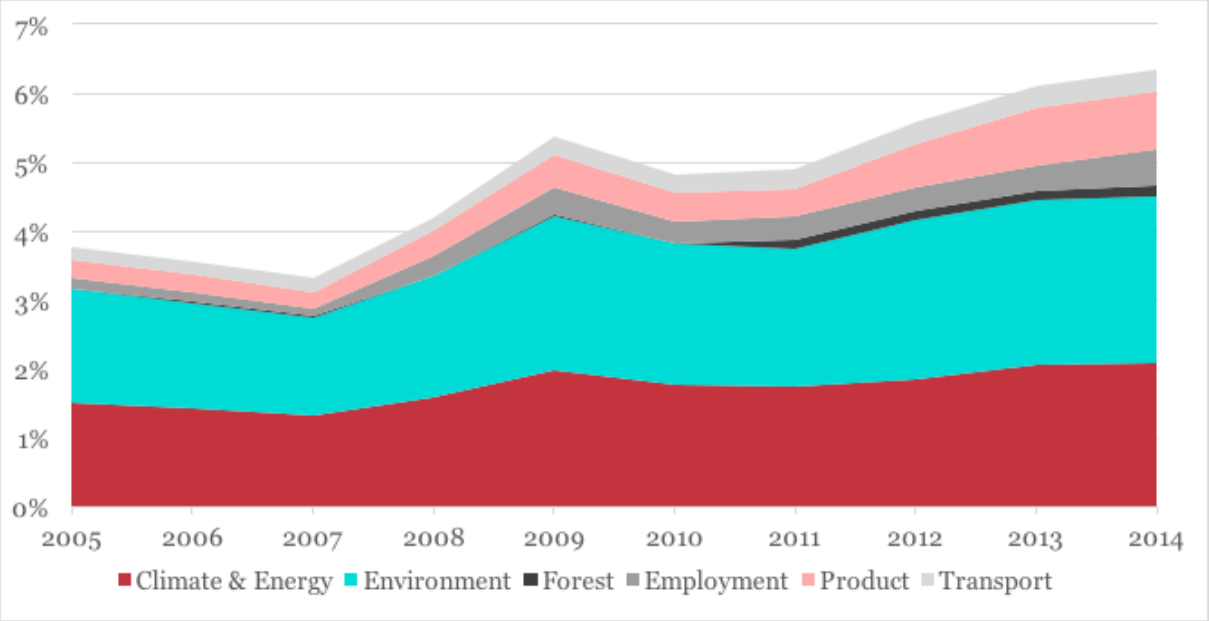
Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics

The woodworking sub-sector

When all legislation relevant to **woodworking** companies is cumulated, the estimated average annual total direct cost borne by them during the period 2005-2014 approaches 4.7% of added value, representing around 1.3% of their turnover and 13.7% of the gross operating surplus. Two legislative packages clearly stand out as the main cause of legislative burden, namely the environmental and the climate and energy packages, generating respectively 41.5% and 36.3% of direct regulatory costs for woodworking sectors. Among the cost categories, monetary obligations and operational expenditures dominate. The very high results for the environmental package mostly relate to the relevant parts of the phytosanitary regulations for the wooden pallets and other wooden packaging (e.g. rules on wooden packaging which incorporate the ISPM 15 standard for treatment and marking, which, although it is a standard developed by the International Plant Protection Convention from the U.N.'s Food and Agriculture Organization, has been incorporated into the EU phytosanitary legislation) to prevent the introduction of harmful, plant-borne alien organisms. Significant investments have been necessary for companies to collect and process returned products and wastes in accordance with the principle of extended producer responsibility (e.g. costs of waste management are to be carried partly or wholly by the producer). Personnel costs and other operating and maintenance costs are also associated with these obligations.

Major milestones of the evolution of costs are the establishment of EU climate and energy targets, known as "20-20-20" targets for a low-carbon economy, the revision of the Renewable Energy Directive in 2009, the adoption of the Integrated Pollution Prevention and Control (IPPC) in 2008 and the transposition of the Industrial Emissions Directive in 2013. Other legislative acts such as the Waste Framework Directive or the Construction Product Regulation contribute to costs. It is important to note that, while the following graph certainly illustrates the evolution of regulatory costs over ten years, the trend is also impacted by the evolution of the ratio's denominator, i.e. the value added of the sector.

Figure 2 Evolution of direct regulatory costs for the woodworking sectors over the period 2004-2015 as a percentage of added value



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics

Companies in the wood-based panels sector consistently reported to be affected by indirect costs they attributed to climate and energy policies, and more specifically to the Renewable Energy Directive (Directive 2009/28/EC). Companies reported that the Directive has contributed to increase the raw material costs (mainly wood), and led to the substitution of wood-based panels by less expensive materials in some cases. However, a quantitative estimate of the effect of the competition with bioenergy for is not possible due to a lack of adequate data.

When all legislation relevant to **pulp, paper and paperboard** companies is cumulated, the estimated average annual total direct cost borne by the sub-sectors covered during the period 2005-2014 approaches 4.3% of added value, representing around 0.9% of their turnover, 10.8% of the gross operating surplus, 7.6% of EBITDA and 21.9% of EBIT.

The same two legislative packages clearly stand out as the main cause of legislative burden, namely the climate and energy package and the environmental package, generating respectively 41.5% and 32% of direct regulatory costs for pulp, paper and paperboard sectors. Among the cost categories, monetary obligations, capital and operational expenditures dominate.

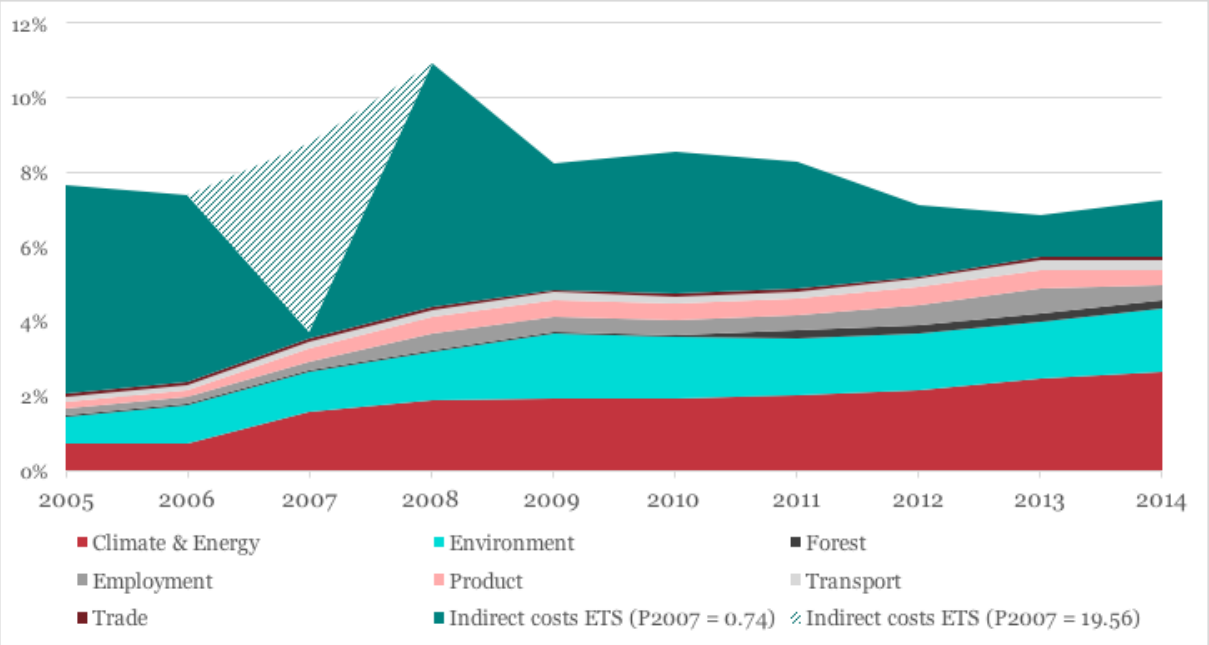
Major milestones of the evolution of costs are the establishment of EU ETS, covering pulp, paper and paperboard since its start in 2005. The second increase in 2012/2013 may also be linked to the ETS, e.g. from 2013 the ETS requires a reduction of 21% of carbon emissions compared to 2005. The Energy Efficiency Directive also came into force during this period and it would also have been preceded by investments to meet new legal requirements.

Results presented above apply to firms of the pulp, paper and paperboard industries where pulp mills sell their market pulp to third parties. An average integrated company of pulp, paper and paperboard will bear direct regulatory costs of approximately 1% of turnover, representing 7.68 EUR/tonne of paper.

Moreover, pulp, paper and paperboard companies undergoing the interview process as well as stakeholders taking the online survey have systematically reported the significant impact of ETS indirect costs of regulation, that occur when utility companies pass-on some of their ETS-related costs to the industry. Such indirect costs from electricity providers become particularly substantial as pulp, paper and paperboard are energy-intensive sectors. Indirect costs from ETS are close to four times as

much as direct costs from the climate and energy package, which contains, inter alia, direct costs from the ETS.

Figure 3 Evolution of direct regulatory costs and ETS indirect costs for the overall pulp, paper and paperboard sector - annual average 2005-2014 as a percentage of added value, with pass-on rate 1



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics * For further details on this figure and underlying hypothesis of Co2 price, see section 3.6.1.3.

While companies from the pulp, paper and paperboard sectors did not systematically report indirect costs incurred by the Renewable Energy Directive (Directive 2009/28/EC), it is likely to also be an issue for the pulp, paper and paperboard sectors, since they use the same types of fresh wood as part of their raw material intake.

Existing legislation and prospective legislative acts (i.e. those new acts already identified but only likely to have their cost impacts during the coming years) will be likely to generate additional compliance costs for the forest-based industries to meet new objectives and standards.

For the **climate and energy package**, such acts will probably include the Clean Air Policy Package and/or the **roadmap for moving to a competitive low-carbon economy in 2050, the 2030 climate & energy framework and the energy roadmap 2050**- although they do not present quantifiable direct costs, they all aim to reduce carbon emission and energy consumption by improving efficiency. Effects from the Third Energy package are not clear-cut as the forest-based industries, while potentially benefiting from the liberalisation of energy markets, may also suffer indirectly from higher power prices because of EU deregulation measures. Similarly, the physical expansion of an integrated energy market may be accompanied by decreasing energy prices since barriers between EU Member States will decrease. The woodworking sector is particularly concerned with the enshrinement of the cascading principle in a detailed legislation and with the revision of the Renewable Energy Directive that may lead to an increase is wood price (i.e. raw material). On the other hand, a new proposal for the LULUCF legislation has been published in July 2016, which should potentially limit the administrative burden on businesses. There is also a high degree of uncertainty for the pulp, paper and paperboard sub-sector, relating to the revision of the ETS. Concern from businesses relate to data collection and verification likely to bring further administrative burden and to the lack of harmonisation in EU compensation scheme that leads to rising electricity costs among Member States.

Currently, the pulp, paper and paperboard sub-sectors are included in the Carbon Leakage List and receive a higher share of free allowances. Future cost impacts from ETS will substantially depend on its ongoing revision and the implications for the updated carbon leakage list (2014-19).

Environmental legislation likely to affect the woodworking sector in the future relate to the harmonized EU VOC-Classes, depending on the products that will be covered in the new requirements of VOC emissions and potentially rising operating costs of labelling and administrative costs. On the other hand, the main costs from environmental legislation for the pulp, paper and paperboard sub-sector are expected to emerge from the Industrial Emission Directive, as BREFs will require capital expenditures in new machines and equipment, operating expenses of personnel, training and maintenance.

Regarding the **forest-related package**, further and more consistent coordination of the enforcement of the EU Timber Regulation is encouraged by businesses to bring down the current costs of administrative burden emanating from the different transposition of the regulation.

Regarding the **employment package**, both woodworking and pulp, paper and paperboard sub-sectors may be impacted by the amendments on better workers' protection against cancer causing chemicals, now under proposal, as adding 13 new substances to the original list could increase administrative burden for hazard identification and risk assessments, capital expenditure for equipment and operating costs of training.

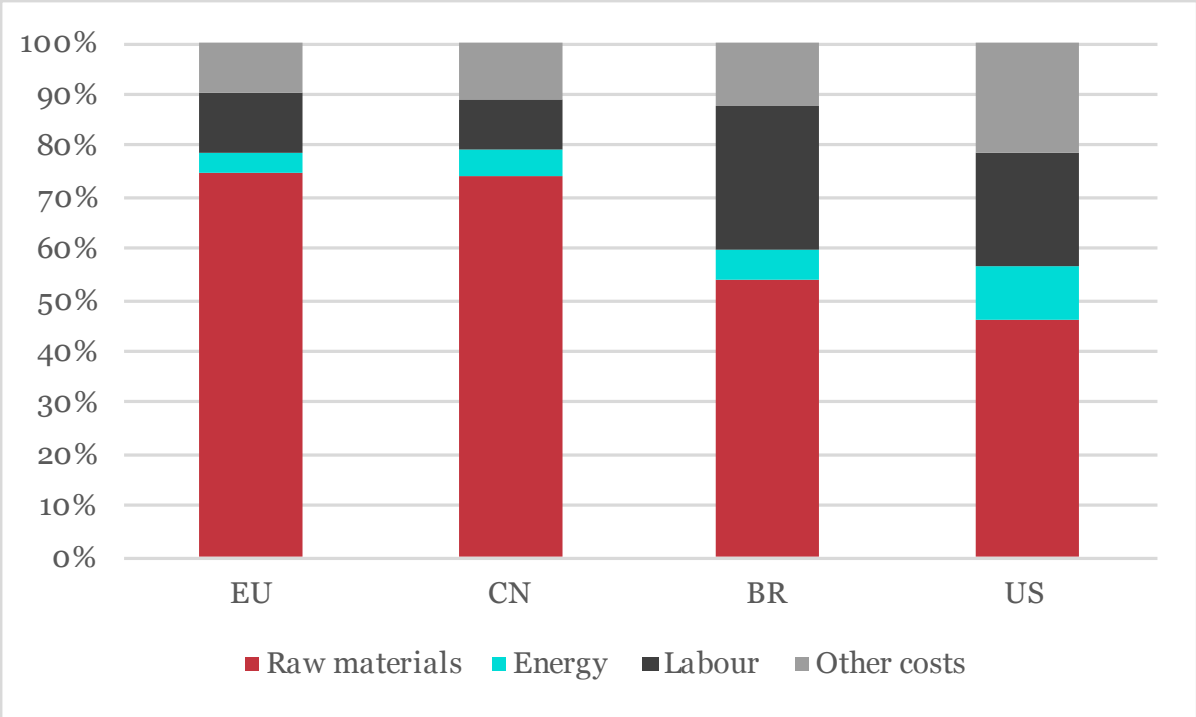
Insights on international competitiveness

A qualitative comparison is made between the cost structures and costs impacts of regulation of the EU F-BI sub-sectors woodworking and pulp, paper & paperboard, given the legislative regime within which they operate in the EU, with those of their main international competitors (Brazil, China and the United States), operating within their own specific legislative frameworks. The international comparison of cost structures and the cost impacts of regulation has been done using secondary data, and further complemented with the results from two questionnaires: 1) a questionnaire for relevant associations, federations and industry experts, followed up with telephone interviews; and 2) a shorter on-line questionnaire for companies in the target countries.

Overall, the **comparison of cost structures for the woodworking sub-sectors** in the EU, Brazil, China and USA shows significant differences in the relative importance of particularly raw materials costs, energy costs, labour costs and service costs.

For the woodworking sector, raw material costs' relative share of costs is much higher in China than in the USA, and in Brazil but similar to EU. Prices of wood raw material as a global commodity are expected to rise due to increasing demand for wood and wood-based products of verified legal origin. Employment costs are relatively highest in Brazil (27%), followed by the USA (22%). In China the employment costs form only 10% of total costs. In monetary terms, average employment costs are much lower in China than in Brazil and the USA. Increasing living standards particularly in China, but also in Brazil, and corresponding employment cost increases are set to reduce the competitive advantage of these countries on this cost category.

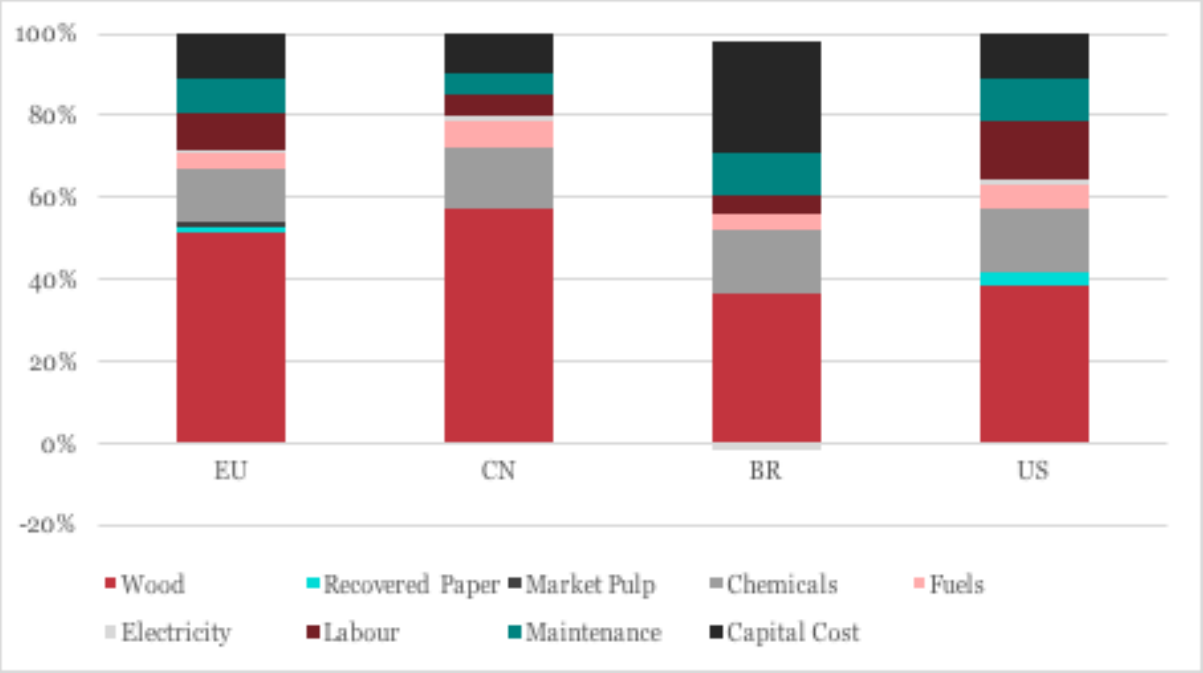
Figure 4 Cost structure by main cost categories for the woodworking sub-sector in EU, Brazil, China and USA (% of country total production costs)



Source: Euromonitor for US, China and Brazil (2012, 2013, 2014) and ToSIA for EU (2005)

For the overall **pulp, paper and paperboard sector**, the main differences between costs in EUR/tonne produced lies mainly in wood costs, labour, capital costs and maintenance costs. Electricity costs do not display large differences, except for the case of Brazil, where the negative share is to be attributed to the increasing self-generation capacity through the use of bioenergy (black liquor) to the detriment of oil and gas. The Chinese wood raw-material costs stand out for being the highest of the four global regions. This may at least partially be an effect of lower other costs, e.g. labour. In addition, the explanation for this can be traced back to the large amount of wood and pulp that China has to import from abroad due to the high internal demand and, as a consequence, the exposure to market exchange rate fluctuations (i.e. the appreciation of the RMB in the last years contributed substantially to this effect). Labour costs are the highest in the US and in Europe, but these are statistics that need to be interpreted in a context of high labour productivity accompanied by diminishing labour inputs in the two areas.

Figure 5 Cost structures by main cost categories for the pulp, paper and paperboard sub-sector in EU, Brazil, China and USA (% of production costs as included in RISI database)



Source: RISI database

A country-specific analysis of legislation in the three analysed countries feeds a **comparative synthesis** of the competitors' likely cost impacts of the national and EU legislation.

Regarding **climate and energy**, it will be critical for the forest-based industry in how far political priorities for forest biomass production are set towards (renewable) energy or (first) material use of forest biomass. The respective regulations are under continuous political debates in all regions. Second, it will be critical how the mitigation potential of the forest based industries is accounted and politically incentivized or not. Climate-smart forestry holds great potential as a contribution to an overall (global) climate change mitigation policy, but the political and academic debate relating to the mitigation potential of forests, forestry and the forest based industry could result in quite distinct future policies that will, in turn, possibly greatly impact the competitiveness of the forest based industries a) in comparison to other (competing) sectors and b) in a regional perspective.

Regarding the **environmental legislation**, forest related environmental policy has, in all four regions, been a major impacting factor for forest management in the last decades. Yet, environmental regulation for forest management, and related major strategic decisions to either integrate species protection and forest production, or separate them, has potentially significant impacts on the both the raw material costs of the forest based industry and its social license to operate – with both aspects having potentially major/decisive impacts on the cost of the forest-based industry.

Regarding the **forest-related legislation**, in all four regions, forest legislation sets the basic regulatory requirements for forest management which is, in turn, crucially important (however to different degrees, depending on the import orientation) for the possibility of the forest based industries to achieve a continuous and cost-efficient supply of forest products. In the US, as well as in the EU, forest legislation shows great regional diversity with rules for sustainable forest management being very diverse depending on the country/state. Moreover, in several cases, ordinances, programmes or plans have great effects on forest management practices despite being not codified law and provisions made by national legislation may be subject to notable discretion by the implementing authorities.

Of all EU legislation, the EU Timber Regulation, considered in this context as **trade legislation**, comes forward as having an important impact on businesses and their production costs for particularly products destined to the EU market, in the three studied countries. Taking into account the bilateral trade relations between the four regions, legality requirements for trade with the EU are mostly an issue for China due to its massive trade with EU while its national due diligence requirements are set systems not yet fully developed, then followed by USA and Brazil.

Finally, regarding **employment policy**, a main feature on the international scene relies in the salary increases that have put labour costs up in Brazil, China and US as well as the EU, but most significantly in China where labour costs in the woodworking sector increased nearly three-fold between 2007-2012. This will possibly affect its competitiveness with lower wage countries in the near to medium future, and some companies might relocate to countries with still lower salaries.

1 Introduction

1.1 Objectives of the study

The aim of the Cumulative Cost Assessment of Forest-based Industries (CCA F-BI) is to identify the cumulative costs, both direct and indirect, of the most financially burdensome EU legislation and policies that forest-based industry companies active in the EU28 have to comply with. These costs are further qualitatively compared to the costs borne by companies under corresponding legislation in three of the main the EU competitor countries. Specifically, the study objectives are:

- Quantification of the cumulative direct and (where possible) indirect costs of relevant legislation and policies for the selected F-BI sub-sectors in the EU and a few key non-EU competitor countries;
- Demonstration of the evolution of costs of the relevant legislation and policies over time (2005-14);
- Comparison of costs and provision of conclusions on the cost impact of EU legislation and policies on respective F-BI sub-sectors and consequently insights into the EU F-BI's competitiveness vis-à-vis the non-EU competitors.

The CCA F-BI capitalises on the lessons learned from the previous CCAs on steel and aluminium industries (CEPS, 2013a; CEPS 2013b) and adopts a very similar methodology to the previous CCA on chemical industry (Technopolis Group 2016) in order to ensure that the results are as comparable as possible. In this perspective, all CCAs are consistent in terms of cost categories analysed, namely monetary obligations, capital expenditures, operating costs and administrative burden. The grouping of legislation under legislative packages is slightly different, in order to adapt to the specificities of an industry (e.g. ETS included in a package called "Emissions and processes" in CCA Chemicals and in "Climate and Energy" in CCA FB-I). The indicators used to provide results may differ among CCA and within a CCA between the different sub-sectors, depending on the availability of data for the covered sectors: for instance, the CCA Aluminium uses the indicators of euro/tonne, price-cost margin, EBITDA, price of raw materials, production costs and market price. However, for both CCAs Chemicals and FB-I, indicators used are turnover, added value and gross operating surplus (with additional indicators of EUR/tonne, EBITDA and EBIT for pulp, paper and paperboard. It must be noted, that the first CCAs concerned very much more homogenous sectors with value chains having costs that are strongly influenced by raw material and energy prices. Forest-based industries represent extremely complex value chains, having secondary data sources that were only partially comparable to those available in the first studies. Hence, the approach in CCA F-BI is calibrated to overcome these methodological challenges[1].

1.2 Scope of the study

In analogy with a previous study[2], CCA F-BI initially was designed to cover four sub-sectors of the EU forest-based industries based on NACE Rev.2 categories (Eurostat, 2015): Woodworking (NACE 16), Furniture Manufacturing (NACE 31), Pulp and Pulp-based Manufacturing (NACE 17) and Printing (NACE 18). However, after the initial data gathering phase, the decision was taken to confine the scope of the study to only **two F-BI sub-sectors – Woodworking (NACE 16) and Pulp and Pulp-based Manufacturing (NACE 17)** – due to the very low response rate to pilot interview requests from companies of the other two sub-sectors and the lack of sufficiently detailed secondary data. Hence, the coverage of this CCA encompasses the abovementioned two sub-sectors as determined by value chains and their value chain variants, which link their consecutive manufacturing steps[3].

[1] For more details on methodology see Chapter 3

[2] Indufor (2013) *Study on the Wood Raw Material Supply and Demand for the EU Wood-processing: Final Report*. Helsinki

[3] For more details on value chains see Chapter 2

All pieces of legislation seen as incurring high costs to forest-based industries are included in the study. The relevant regulations and policies are grouped under **eight legislative packages,** comprising the policy areas of: competition (however, not quantitatively assessed), climate, environment, forest-related policies, employment and workers' safety, products, transport and trade.[4]

The study makes both an *ex-ante* and an *ex-post* assessment of the costs. Firstly, the CCA considers the effects of the existing EU legislation applying cost assessment methods partially from the 'standard cost model' (Better Regulation Toolbox, European Commission, 2015) used by the EU and its Member States. In the second stage, the probable/possible future legislative cost impacts are assessed qualitatively. Hence, the CCA covers **two specific time periods**:

- Impact to date of the existing legal framework (as at the end of 2014), where cost-related indicators should cover a **10-year period from 2005 till 2014** (quantitative assessment);
- Likely future impacts of the existing legal framework (end of 2014), over the **period 2014-2030 for energy and climate policies, and 2014-2020 for other policies** (qualitative assessment).

The **territorial scope** of this CCA is the **EU28.** The **geographical focus** of this international comparison was modified through the project, following discussions with the Mirror Group after the study was narrowed down in an initial phase, and now includes three countries relevant to the reviewed sub-sectors: The United States of America, China and Brazil.

It should be highlighted that, in accordance with the CCA's specifications, the potential benefits that arise from the EU legislation are not considered. The focus is exclusively on cost implications for the F-BI.

1.3 Structure of the report

The report is structured in six chapters. **Chapter two** sets the scene for the analysis of the regulatory costs by defining the boundaries of the value chains and product groups that are considered in the scope of this study. The overview also outlines information on the key drivers and structure of regulatory costs for forest-based industries, in particular the value chains and cost structures of woodworking and the manufacturing of pulp, paper and paperboard.

Chapter three presents the methodological approach of the study. It defines the key differentiating factors of a CCA compared to other exercises, such as impact assessments and the cost benefit analyses. The chapter further explains the cost categories used in the study and details the key implementation phases of the assessment (pilot interviews, to test the questionnaire and thence adapt it, in-depth interviews to collect necessary source data for all sub-sectors and an online survey to validate the computed cost estimates). It also includes a reflection on the methodological assumption, challenges and limitations of the study approach.

In **Chapter four,** an overview of the selected pieces of legislation and their grouping into eight legislative packages is provided. The chapter presents a short summary of each legislative package and highlights the types of cost that respective legislation incurs to the industry.

The main results of the cost assessment are presented in **Chapter five**. This chapter provides an overall picture of the cumulative costs borne by the F-BI in total and for each legislative package and sub-sector separately. The evolution of the costs over the period 2005-2014 is mapped and presented for the two analysed sub-sectors as a whole (woodworking and pulp, paper & paperboard). The cost is presented for each legislative package as a share of added value, gross operating surplus (which is used as a proxy for profit), and turnover. Additional indicators (EBIT, EBITDA, €/tonne) are only provided for the pulp, paper and paperboard sectors as these economic indicators were not available for the woodworking sector. Also for each legislative package the different types of cost are presented. Indirect costs from the ETS are computed in a quantitative way for pulp, paper and paperboard industries,

[4] For more details on the relevant legislation see Chapter 4

while only a qualitative comment is provided for woodworking on the increased costs of raw materials due to the Energy Renewable Energy Directive.

Lastly, **Chapter six** summarises information about three of the key EU competitor countries - China, the United States, and Brazil. The chapter makes international comparisons between the cost structures of manufacturing of woodworking, pulp, paper and paperboard in the EU and respective competitor countries, together with qualitative analyses of the likely cost impacts of key pieces of domestic and EU legislation there.

1.4 Organisation of work

A **Steering Group** was set up by DG GROW in order to provide guidance to the consultancy team for the study; it was chaired by DG GROW/C2 and included other representatives from DG GROW along with other Commission services from: Secretariat General (SG), DG Climate Action (CLIMA), DG Energy (ENER), DG Environment (ENV), DG Research & Innovation (RTD), DG Transport (MOVE), DG Employment, Social Affairs and Inclusion (EMPL), etc.

Moreover, a **Mirror Group**, composed of industry representatives from all four sub-sectors, was constituted and chaired by DG GROW. It was responsible for validating findings and providing feedback on reports. More specifically, the Mirror Group supported on the following tasks:

- Develop the value chains;
- Prioritise legislation;
- Test the questionnaires;
- Identification of companies for interviews and surveys;
- Circulate the questionnaire and mobilise companies;

2 Framing the EU forest-based industries

This section sets the scene for the analysis of the regulatory cost by defining the boundaries of the value chains and product groups that are considered in the scope of the study. The overview also outlines information on the key drivers and structure of regulatory costs for the forest-based industries, in particular for the woodworking sub-sector and the pulp, paper and paperboard sub-sector.

2.1 Use of value chains and product groups for defining the EU Forest-based Industries

In the context of this CCA, the term 'value chain' implies a series of consecutive manufacturing steps, which link raw materials to final products through the various F-BI sub-sectors and product groups. In the simplest sense, each F-BI sub-sector could be described as a value chain. However, processing steps in different product groups downstream from raw materials often have common origins upstream, hence key parts of several F-BI sub-sectors may be linked into the same value chain.

Also, the concept of a 'value-chain variant' is used, which means that there are two or more variations of a given main value chain. These variants differ in parallel parts of the corresponding steps (e.g. they differ in primary processing) but also have one or more other steps in common. For example, wood chips and other particles can be produced directly by chipping wood or as a co-product of sawmilling. Regardless of the primary processing technique, they can be used both as wood fuels, in the production of particleboard panels or in making pulp.

At the beginning of the study and as set in the Terms of Reference (ToR), the scope was set to cover the following four EU forest-based industries sub-sectors: **woodworking, furniture, pulp, paper and paperboard and printing**. Consequently, four value chains – one for each of the sub-sectors - were developed (Figure 6, Figure 7, Figure 8 and Figure 9). **The use of value chains and their variants thus provided a mapping of the F-BI sub-sectors and helped to set the scope of the study.** The sub-sectors and product groups were used as a conceptual framework for the collection of primary data from companies and to select the most relevant pieces of legislation for each of them. The value chains are fundamentally based on the NACE Rev. 2 codes. However, the classification provided by the NACE does not include all products which might be understood as forest-based products and production processes, therefore additional product classifications were taken into account (e.g. the PRODCOM and the FAO classification were also considered).

The aim of the value chain graphs presented (Figure 6, Figure 7, Figure 8 and Figure 9) is to show which kind of products are assigned to which defined product group. Also they show the degree of processing (primary, secondary and tertiary) in the value chain. Presented in grey are the product groups on which the cost assessment was done. The products covered by each of the product groups (in grey) are presented in the white boxes[5]. On the whole, the material flow is from left to right. However, some products consist of more than one preceding product, (e.g. wood-based panels consist of sawnwood, recovered wood, by-products and fresh wood).

Some clarifications and definitions to be mentioned on value chain coverage are the following:

- **Textile fibres and non-paper speciality cellulose products** (e.g. food additives) **are not covered in the study.** Although these products are based on pulping processes, the number of companies operating in the market is low whilst their business focus is very individual – nearly every company working in this area has an individual business focus. The number of companies producing these products is too small to fulfil the aim of the study with regard to the number of companies needed for interviews and survey. Furthermore, there is a difference in the types of

[5] The listing of products within the higher-level product groups is non-exhaustive but shows the complexity and variety of products within one product group and within the four sub-sectors.

legislation having an impact on these business areas compared to more conventional forest-based products. The assessment of these different policy documents would result in disproportionate additional work.

- **Forestry is not included in this assessment, except in so far as it has an impact on the cost of the forest-based industries' main raw material, wood**. The basic forest-related value chains start with raw timber being transported. The costs arising from the EU legislation and policies related to wood procurement are considered (see Legislation package 4: Forest-related policies), whereas forestry itself is not covered. Small-scale forest owners in particular have to bear high transaction costs, an aspect that is not found to be comparable with the F-BI. Furthermore, although forestry and forest-based industries are linked through their value chains, they are defined to be two separated sectors.
- The following **definition for recovered wood** will be used: "*Post-consumer wood includes all kinds of wooden material that is available at the end of its use as wooden products. Mainly comprises packaging materials (including pallets), demolition wood, timber from building sites and fractions of used wood from residential (municipal waste), industrial and commercial activities*" (Mantau et al., 2010, 93).
- **Industrial by-products are defined according to the following definition** of wood-processing residues: *Wood-processing residues can be differentiated in sawmill by-products and other industrial wood residues. Sawmill by-products are "a natural resource without additives and have their origin in one specific industrial source, whereas other industrial wood residues often contain additives/contaminants and have a wide variety of scattered sources. Other industrial wood residues are residues which arise during the further processing (resawing, planning) and the production of manufactured wood products (furniture, construction)"* (Mantau et al., 2010, 100).

2.1.1 The woodworking value chain

The EU woodworking industries were derived from NACE Ch. 16 and so include: the production of sawnwood, wood-based panels, builder's carpentry and joinery products, wooden flooring, wooden packaging and other wooden articles. Input materials within the woodworking value chain are, apart from saw logs (fresh wood), industrial by-products (like bark, chips and dust) and used materials (recovered wood).

Regarding each of the product groups and products, the following should be considered:

- Fresh wood is not defined as a separate product-group. It is rather the starting material for the whole woodworking value chain. Other raw materials, such as resins, coatings and impregnation chemicals are also use in woodworking manufacturing. However, these are not included as a product group in this study;
- The sawmilling industry is defined as producing sawn and planed wood, and veneer sheets as defined by NACE Ch. 16;
- The wood-based panel manufacturing includes the production of particle boards, OSB, MDF, hardboards, plywood and other varieties out of small industrial roundwood (also sometimes referred to as pulpwood), by-products from sawmilling (woodchips) and recovered wood as well as products from the sawmill industry and fresh wood;
- Solid wood products include glulam, CLT and solid wood panels (KVH, Duo/Trio beams) and other products mainly used for construction;
- Other builders' carpentry and joinery includes all kinds of wood used for construction purposes (trusses, beams [e.g. construction beams], formwork, scaffolding, frames, etc.) prefabricated wooden buildings, windows and doors. Sawn wood and wood based panels are input materials;

- Wooden pallets and other wooden packaging include materials for the purpose of packaging and transportation (e.g. industrial pallets);
- The product group bioenergy products in the woodworking value chain comprises only wood pellets and wooden briquettes (part of 16.29 'Manufacture of other products of wood'), used for the production of bioenergy and produced from industrial by-products and recovered wood to be used outside the industry; whereas the use within the industry to produce energy (e.g. drying sawnwood) is part of the industrial operation and thus part of the woodworking value chain;
- Cross-laminated timber (CLT) is a product having high market growth, along with other engineered wood products, even though its production only uses 0.5% of sawnwood and is not yet reported in any official statistics. Given its potential future growth, including for exports, CLT production will be covered as one of the activities carried out by sawmilling companies.

Figure 6 shows the graphical representation of the woodworking value chain.

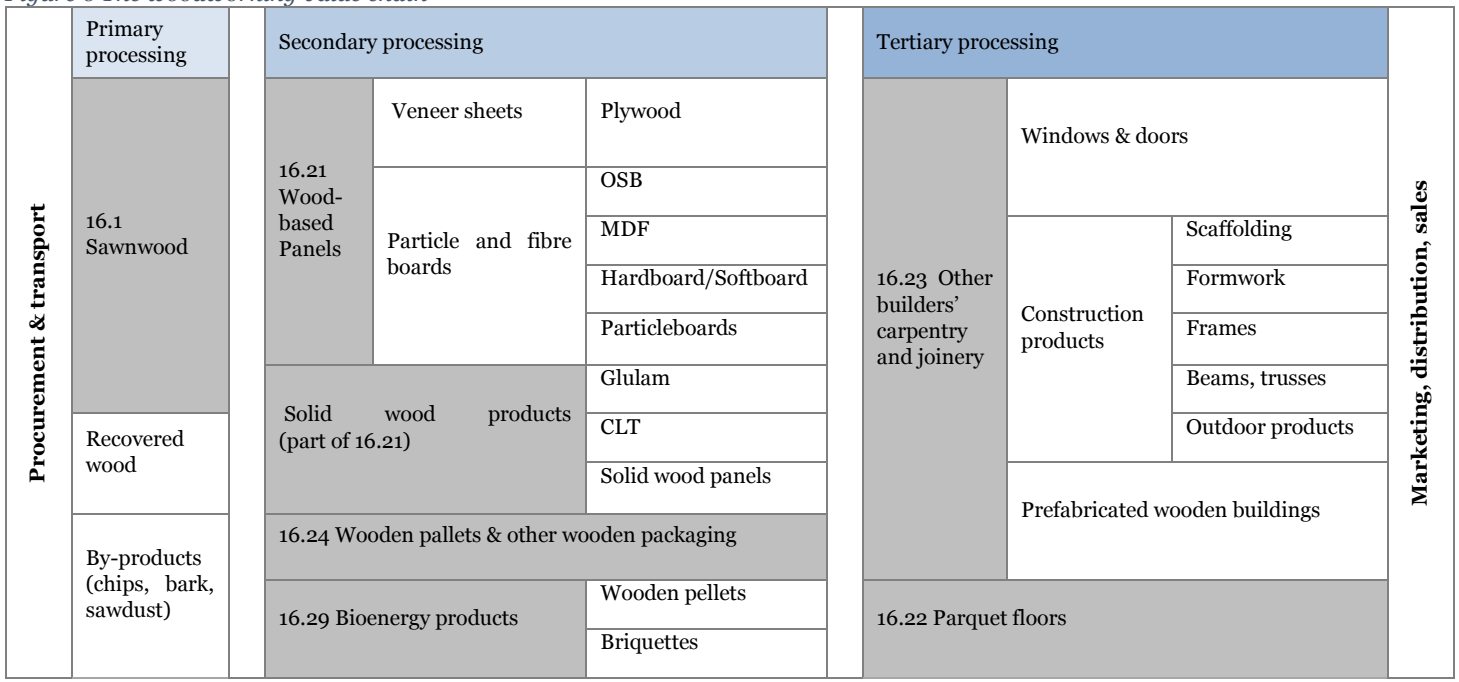
2.1.2 The pulp, paper and paperboard manufacturing value chain

The pulp, paper and paperboard manufacturing sub-sector value chain includes all kinds of pulp and products made of pulp. Regarding each of the product groups and products, the following are to be considered:

- Pulp production includes pulp from several kinds of pulping processes (chemical: dissolving and non-dissolving; mechanical, semi-chemical and others). To produce pulp, paper and paperboard, non-fibrous raw materials (e.g. chemicals) are also needed, but they do not represent a separate product category;
- Graphic papers are papers used for printing and writing purposes, including paper for newspapers, magazines and copy papers (e.g. different kinds of paper grades for various graphic purposes);
- Packaging includes paper and paperboard used for corrugated boxes, transport packaging, storage and product display, for consumer products such as frozen food, cosmetics and for liquid containers, and bags for fruits and vegetables;
- The sanitary product group includes household and sanitary paper products (e.g. including toilet paper, handkerchiefs, tissues, etc.). Non-wovens are also included in this product group.
- Bio-refinery products, textile fibres and speciality cellulose products are not fully covered in pulp and pulp-based manufacturing. Although these products are based on pulping processes, the number of companies operating in the market is low whilst their business focus is very individual - nearly every company working in this area does have an individual business focus. Due to the expected future growth of the biorefinery sector, chemicals derived from tall oil are covered in the value chain as representatives of the sector.
- Textile fibres, non-paper speciality cellulose (e.g. food additives) products are not included as the number of companies operating in the market is low whilst their business focus differs from company to company.

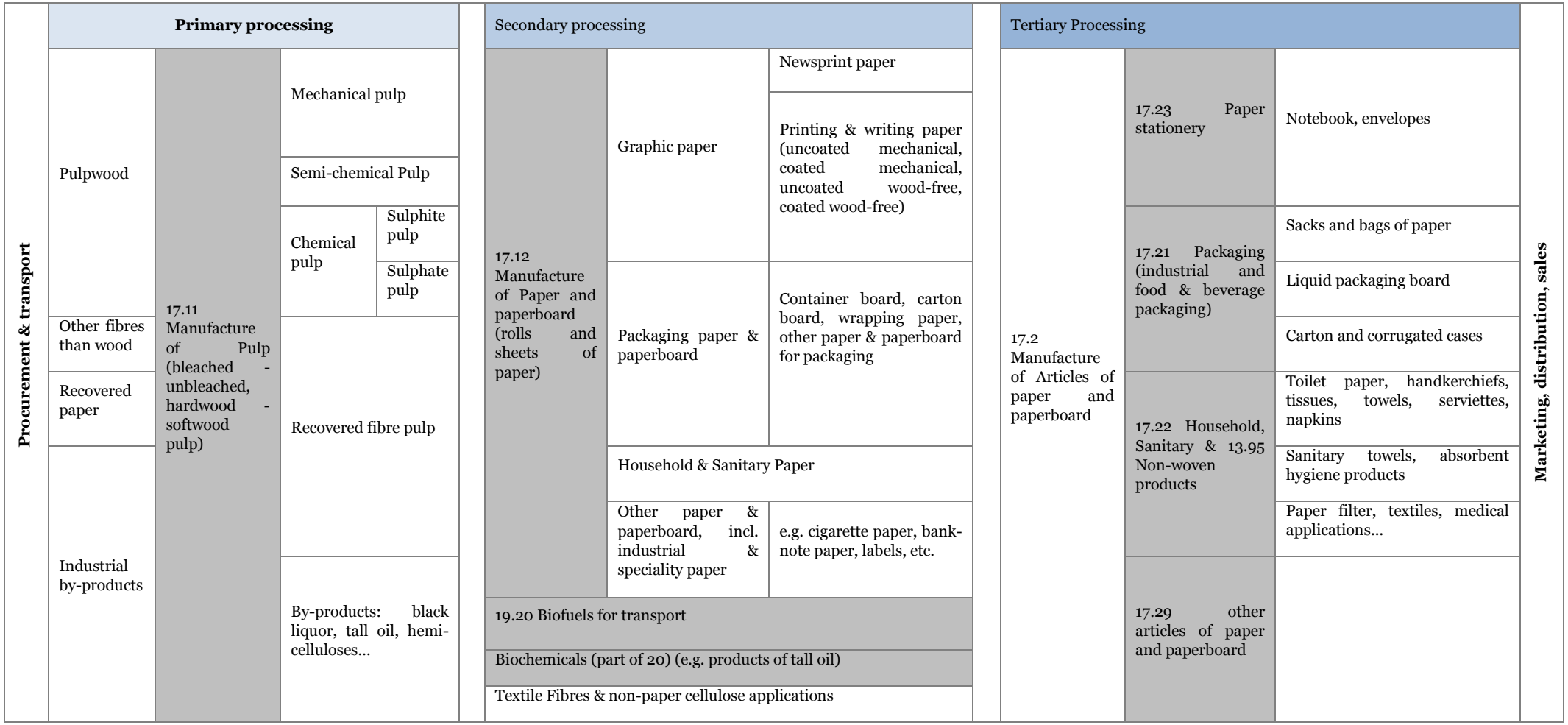
Figure 7 shows the graphical representation of the value chain.

Figure 6 The woodworking value chain



Source: Author's elaboration

Figure 7 The pulp, paper and paperboard manufacturing value chain



Source: Author's elaboration

2.1.3 The furniture manufacturing value chain

As defined in the NACE Rev. 2, the Value Chain for Furniture Manufacturing "includes the manufacture of furniture and related products of any material except stone, concrete and ceramic." Two main groups of furniture products are defined:

- **Office and contract furniture:** this product group refers to the kind of furniture, which is purchased by public facilities or companies. It includes furniture for public facilities (schools, hospitals, theatres, churches), restaurants, hotels, companies, offices and shops, etc.
- **Domestic furniture:** all kind of household furniture (kitchen, living room, dining room, bedding, etc.) produced for private households. This product group covers the two NACE codes 31.02 "Manufacture of kitchen furniture" and 31.09 "Manufacture of other furniture", which includes the manufacturing of sofas, sofa beds, sofa sets, garden chairs and seats, furniture for bedrooms, living rooms as well as the upholstery of chairs and seats and finishing such as spraying, painting and French polishing.

However, as the furniture industry is very heterogeneous and uses various input materials, a distinction solely based on NACE codes was not found to be completely sufficient in terms of legislation: **office and domestic furniture e.g. can be affected by the same legislation whereas these legislations may have a different impact on wood-based and metal-based furniture and vice versa**. Therefore, the primary processing in the furniture value chain comprises not only the manufacturing of sawn & planed wood and wood-based panels (product groups which are both covered in the woodworking value chain) but also the manufacturing of leather, fabrics, plastics and metal as input materials for the furniture industry. These materials do not represent separate product groups in relation to the cost assessment but aim at providing a more complete picture of potential input products for furniture.

The assignment of NACE codes to the primary processing materials is merely an approximation. The furniture industry uses diverse products of these materials and there are various NACE codes covering these different products. The assignment is as follows:

- Leather - NACE 15.11 "Tanning and dressing of leather; dressing and dyeing of fur"
- Fabrics - NACE 13.9 "Manufacture of other textiles"
- Plastics - NACE 22.21 "Manufacture of plastic plates, sheets, tubes and profiles", within this group also foam is considered as there is no separate code explicitly for foam.
- Metal - part of NACE section 25 "Manufacture of fabricated metal products, except machinery and equipment"

Figure 8 presents the graphical representation of the furniture manufacturing value chain.

Figure 8 The furniture manufacturing value chain

Procurement & transport	Primary processing	Secondary processing		Marketing, distribution, sales
	16.1 Sawn & Planed Wood	31.01 Contract Furniture	Office & shop furniture	
	16.21 Wood-based panels		Furniture for public facilities, companies, hotels	
	15.11 Leather & 13.9 fabrics	31.02 & 31.09 Domestic Furniture	Kitchen furniture	
	22.21 Plastics & foam		Dining room furniture	
	25 Metal		Bedroom furniture	
			Living room furniture	

Source: Author's elaboration

2.1.4 The printing value chain

The sub-sector "Printing" includes paper- and paperboard-based printing and service activities related to printing. The following is considered:

- Paper- and paperboard-based printing includes among others newspaper, magazine, book, commercial, catalogue and packaging printing.
- Four out of the six main printing processes are considered, namely sheet-fed offset, heat-set offset, rotogravure and flexography.

Figure 9 presents the graphical representation of the printing value chain.

Figure 9 The printing value chain

Procurement and transport	Primary processing			Secondary processing			Marketing, distribution, sales
	17.11 Pulp (already covered in the pulp & pulp based manufacturing & converting)	17.12 Paper & Paperboard (already covered in the pulp & pulp based manufacturing & converting)	Writing & printing paper (e.g. uncoated mechanical, coated mechanical, coated and uncoated wood-free)	18.1 Paper- and paperboard-based printing and service activities related to printing	Sheet-fed offset	Books, brochures	
					Heat-set offset	Books, advertising, magazines, catalogues	
			Converted Paper & Paperboard Products (sacks, boxes,...)		Rotogravure (publication & packaging)	Packaging, magazines, catalogues, decorative papers, wallpaper	
					Flexography	Packaging, labels	

Source: Author's elaboration

2.2 Final scope and coverage for the Cumulative Cost Assessment

The study team encountered considerable difficulties in engaging SMEs, notably in the furniture-manufacturing sub-sector and in the printing sub-sector, during the data collection phase. As a consequence, three possible options were proposed for conducting the in-depth data collection phase of the CCA. These options were:

Option 1: "SME-friendly"

In order to simplify and reduce the burden for SMEs to participate in the study, the possibility of having a "SME friendly" questionnaire was proposed. This questionnaire would be shorter and only include a subset of the questions posed to large companies, notably focusing on **monetary obligations**, **CAPEX** and **OPEX**.

Option 2: Retain comparability

To avoid losing comparability between enterprises of different sizes and previous cumulative cost assessments, it was proposed to reduce the number of sub-sectors participating in the study. More specifically, those sub-sectors that are dominated by SMEs, in this case **furniture manufacturing** and **printing**, could be excluded from the study in order to achieve broader participation in the remaining sub-sectors. This would ensure comparability with other CCAs.

Option 3: Qualitative assessment of SME-dominated sub-sectors

Finally, an alternative to exclusion or dropping out sub-sectors (Option 2) was to produce a qualitative cost assessment based on data collected exclusively through an on-line survey for furniture manufacturing and the printing sub-sectors. The results of this assessment would be solely qualitative for both sub-sectors concerned.

Option 1 and Option 3 presented above would not allow for comparability across F-BI sub-sectors or with other CCAs in terms of the cost categories that are to be analysed. Moreover, Option 3 would only present a qualitative assessment, which was far from the original and main objective of Cumulative Cost Assessments. The study team thus adopted "**Option 2, Retain Comparability"** for the reminder of the study.

The scope of the CCA was thus reduced to only include the pulp, paper and paperboard manufacturing and woodworking sub-sectors. This implied dropping the printing and furniture manufacturing sub-sectors fully from the CCA, including from the on-line survey and other qualitative assessment.

2.2.1 Coverage of sub-sectors and product groups

This CCA covers two sub-sectors of the forest-based industries - woodworking and pulp, paper and paperboard manufacturing. Given the quality and quantity of responses received during the data collection phase a few product groups within these two sub-sectors were also dropped from the final quantitative calculations. A total of six product groups within the two sub-sectors were retained. These are presented in Table 1.

Table 1 Sub-sectors and product groups covered in the study

Sub-Sectors	#	Product groups
Woodworking NACE Code 16	1	16.1 Sawnwood
	2	16.21 Wood-based panels
	3	16.24 Wooden pallets and other wooden packaging
	4	16.23 Other builders' carpentry and joinery
Pulp, Paper and Paperboard Manufacturing NACE Code 17	5	17.11 Manufacture of pulp
	6	17.12 Manufacture of paper & paperboard

Source: Eurostat, 2016

2.3 Drivers of costs in EU forest-based industries

The cost structures of various F-BI sub-sectors differ greatly and thus also the implications of different policies vary. The cost structures are dependent on the complexity of manufacturing processes that sub-sectors represent. In addition to that, the cost impact of the legislation represents the relative importance of the legislative costs as compared to the total costs of production, or as compared to the added value of the product (cost ratios). To understand the relative importance of cost ratios and differences between them, it is also important to understand the main drivers of manufacturing costs for the main production chains.

The key factors affecting the cost of production in the forest-based industries are:

- **Raw materials**: wood, recovered paper, market pulp, chemicals;
- **Energy**: electricity and fuels;
- **Other costs**: including labour, maintenance and capital costs.

Important limitations in the availability of data prevent the elaboration of cost structures that would be comparable between sub-sectors. In order to focus their efforts on the already extensive cost assessment exercise, companies were not required to provide additional data on their cost structure within the in-depth interviews or surveys. On top of this, such data is often considered as confidential by companies as they reflect part of their competitiveness status. In this regard, the considerations presented in this section are based on secondary data bases. The European cost structure for the pulp, paper and paperboard sub-sector emanates from the RISI database, and the European cost structure for the woodworking sub-sector has been sourced from the ToSIA database. Both databases and their main cost components are presented in the two following sections, 2.3.1 and 2.3.2.

2.3.1 Pulp, paper and paperboard sub-sector

RISI data were used to understand the cost structures of the pulp, paper and paperboard sub-sector.[6] RISI is a proprietary information provider for the global forest products industry. Its database includes information of the pulp, paper and paperboard sub-sector for Europe and world-wide. Europe in RISI data is defined as EU25 (which is the whole European Union, without Bulgaria, Croatia and Romania and represents over 98% of the pulp, paper and paperboard production value of EU) plus Norway and Switzerland[7]. In data collection RISI uses publicly available information (pulp, paper and paperboard

[6] See: http://www.risiinfo.com/service/mill-data-costs/asset-database/

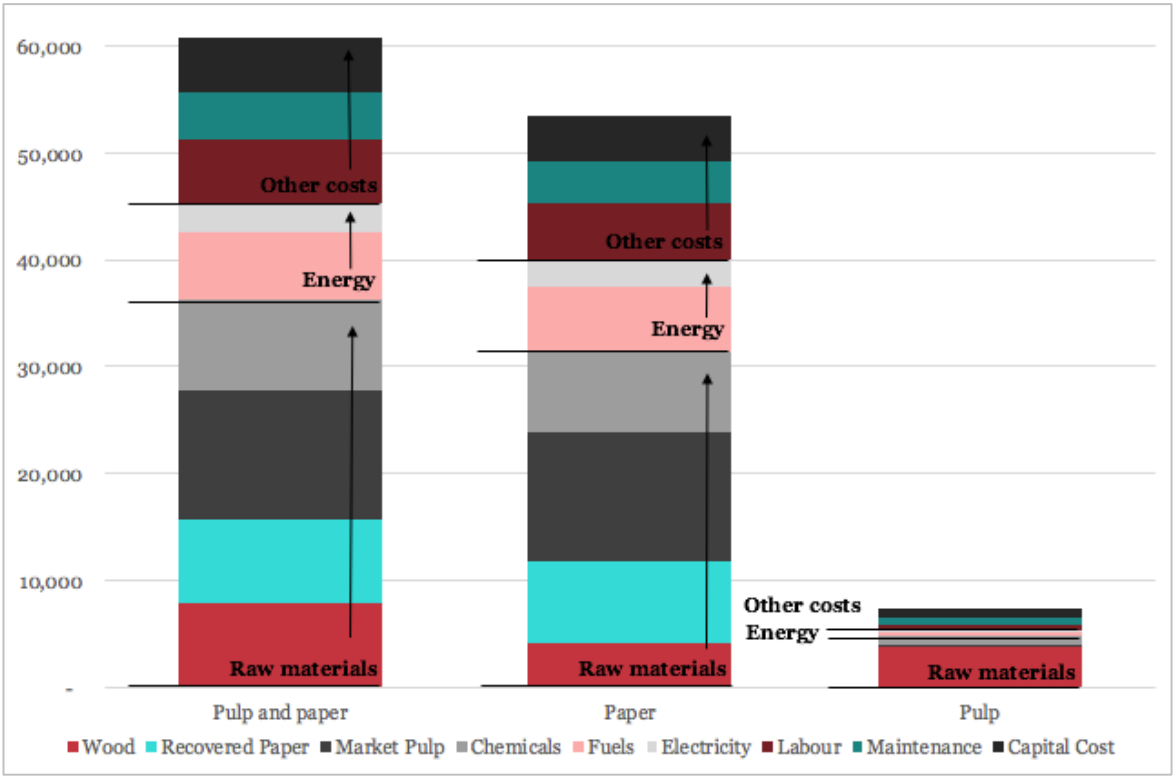
[7] Figures have not been adjusted to EU28 as this would require many uncertain manipulations of data in order to remove countries as well as to add others. The 25 countries cover over 98% of the pulp, paper and paperboard industries in terms of

directories, industry publications and conferences) and supplements it with market research, including surveys and interviews. Explanations of each of these cost components under RISI are given in Appendix C[8].

Figure 10 and Figure 11 summarise the cost structure in pulp, paper and paperboard sub-sector for EU25 countries plus Norway and Switzerland respectively in absolute and relative figures. As can be seen from the aggregated figures, raw materials represent a very important share of production costs, and have been calculated to amount to more than €36bn per year. Market pulp accounts for a slightly larger part of the total material costs (more than €12bn per year), while the cost of wood, recovered paper and chemicals constitute roughly around €8bn per year each. It must be noted that there are significant differences in the raw material base between the EU countries. For example, while Finland and Sweden use mainly pulpwood and chips in pulping, Central European countries rely heavily on recovered paper.

The total energy costs per year in the countries covered by RISI dataset, amount to almost €9bn per year, where fuels account for €6.3bn and electricity €2.6bn per year for the pulp, paper and paperboard sector. Labour costs amount to around €6bn per year, and maintenance and capital costs are calculated to constitute €4.4bn and €5bn per year respectively for pulp, paper, and paperboard sector. The paper-making sub-sector shows considerably higher energy costs in the production processes than the pulp industry.

Figure 10 Cost structure in the EU pulp, paper and paperboard sub-sector, million EUR/year, 2014

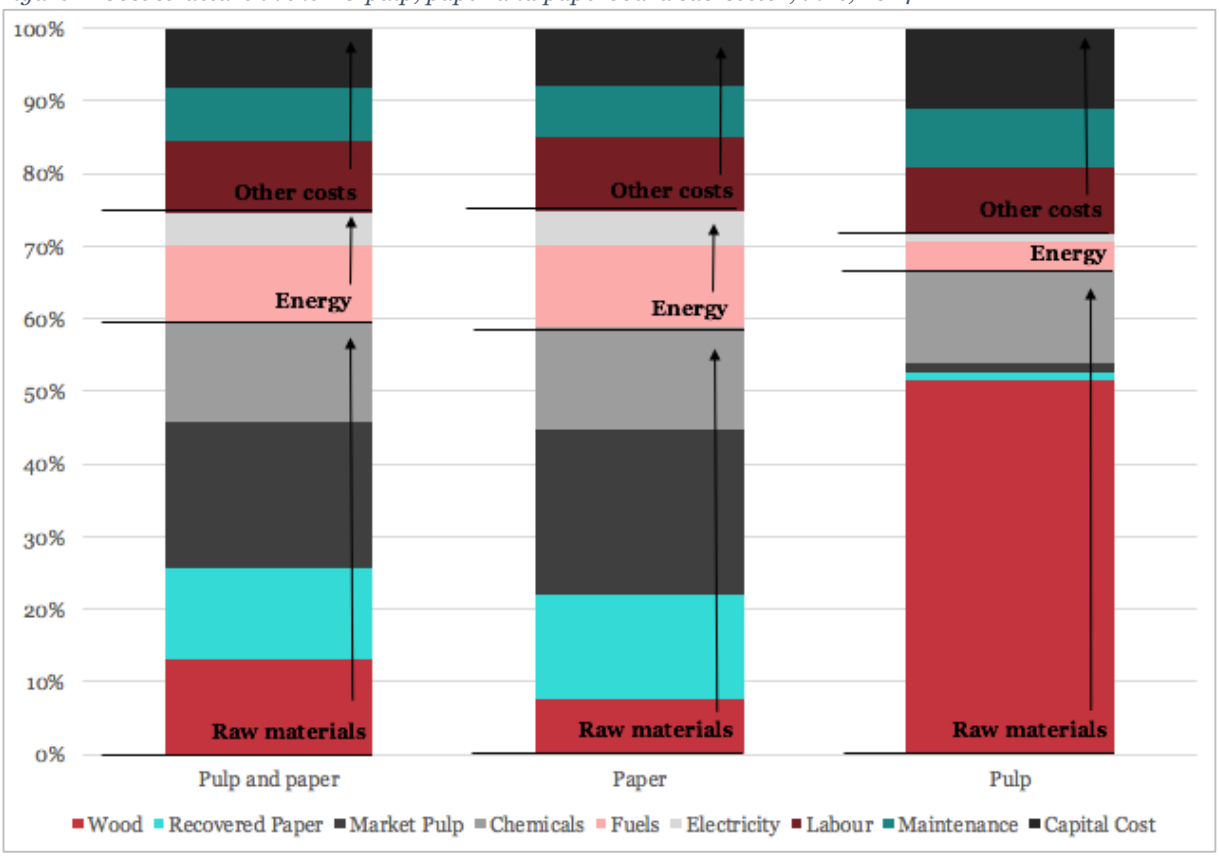


Source: RISI data

production value and should be close in any case from the EU28. On top of this, a reliable picture of relative costs components is also provided (cost category as % of total production costs).

[8] For more details, please refer to RISI (2015) Methodology Business Impact Assessment Tool. Note that transport costs are not included in the RISI cost categorisation.

Figure 11 Cost structure in the EU pulp, paper and paperboard sub-sector, in %, 2014



Source: RISI data

2.3.2 *Woodworking sub-sector*

To appraise the cost structure in the woodworking sub-sector, a dataset of forest-based value-chain process indicators was employed. This dataset was originally developed in the FP7 project EFORWOOD for application in the Tool for Sustainability Impact Assessment (ToSIA). ToSIA is a decision support tool for the forest-based sector. Using this tool, forest-based industry, national and international policy-makers, and researchers can analyse the sustainability effects of changes due to deliberate actions (e.g. in policies or business activities) or due to external forces (e.g. climate change, global markets). ToSIA analyses environmental, economic, and social impacts of changes in forestry-wood production chains, using a consistent and harmonised framework from the forest to the end-of-life of final products. It allows users to analyse different kinds of sustainability effects in a balanced way.[9]

The dataset includes cost data for the sawmilling sector for 25 European countries[10]. In general, the dataset considers mostly larger enterprises and the related cost structures are hence less or not representative for smaller and medium enterprises. The cost information is available for the following categories (ToSIA indicators), which are documented in the dataset for each production process:

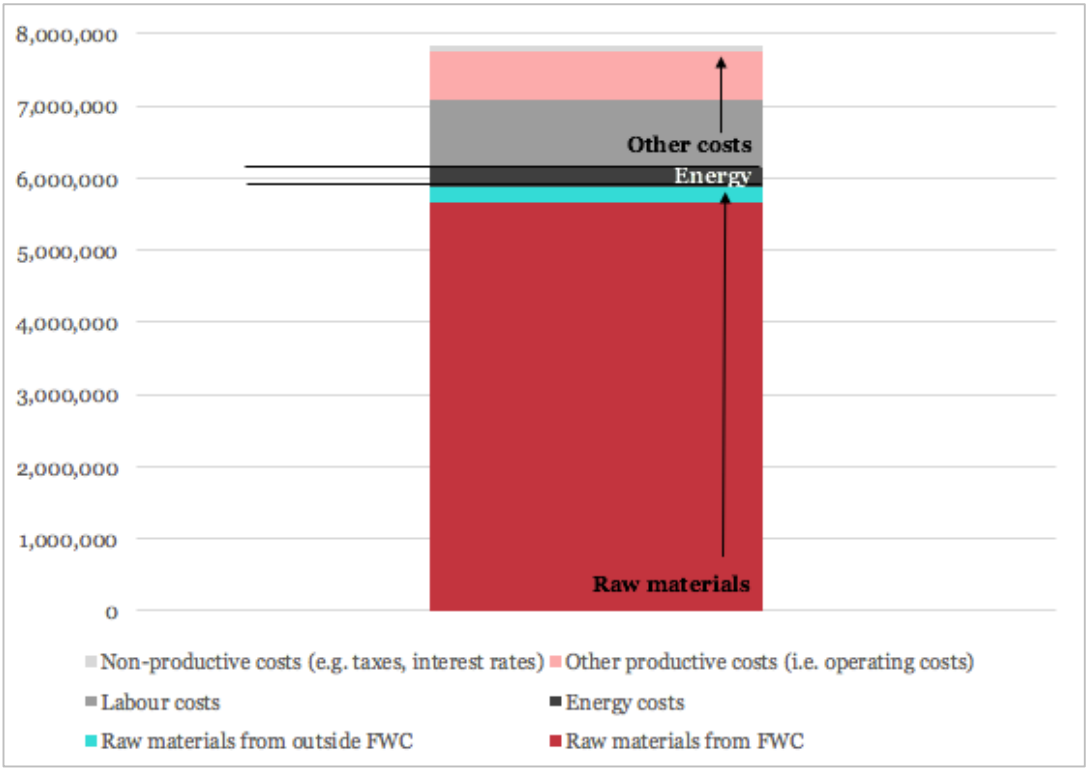
[9] http://tosia.efi.int/.

[10] Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK. Figures have not been adjusted to EU28 as this would require many uncertain manipulations of data in order to remove countries as well as to add others. The 25 countries cover over 96% of the woodworking industries in terms of production value and should be close in any case from the EU28. On top of this, a reliable picture of relative costs components is also provided (cost category as % of total production costs).

- **Raw materials from the forest wood chain (FWC)**: include prices paid for purchase of these materials. There are no raw material costs to be calculated if a process is carried out as a service. VAT and indirect taxes are excluded;
- **Raw materials from outside the FWC**: include prices paid for purchase of materials needed for production but which come from outside the value chain. VAT and indirect taxes are excluded;
- **Labour costs**: costs paid for by the employer in the employment of labour, including: wages, social costs, bonuses, holidays, etc.;
- **Energy costs**: costs paid for energy used in the production process;
- **Other productive costs: including depreciation**: costs associated with the framework conditions of a process, like maintenance costs of machines, general industrial costs, administrative costs, sales expenditures, etc., but it is unclear if all the data consistently include infrastructure depreciation;
- **Non-productive costs**: costs related to general process costs and coming from corporate taxes, capital charges, VAT and any other taxes or charges.

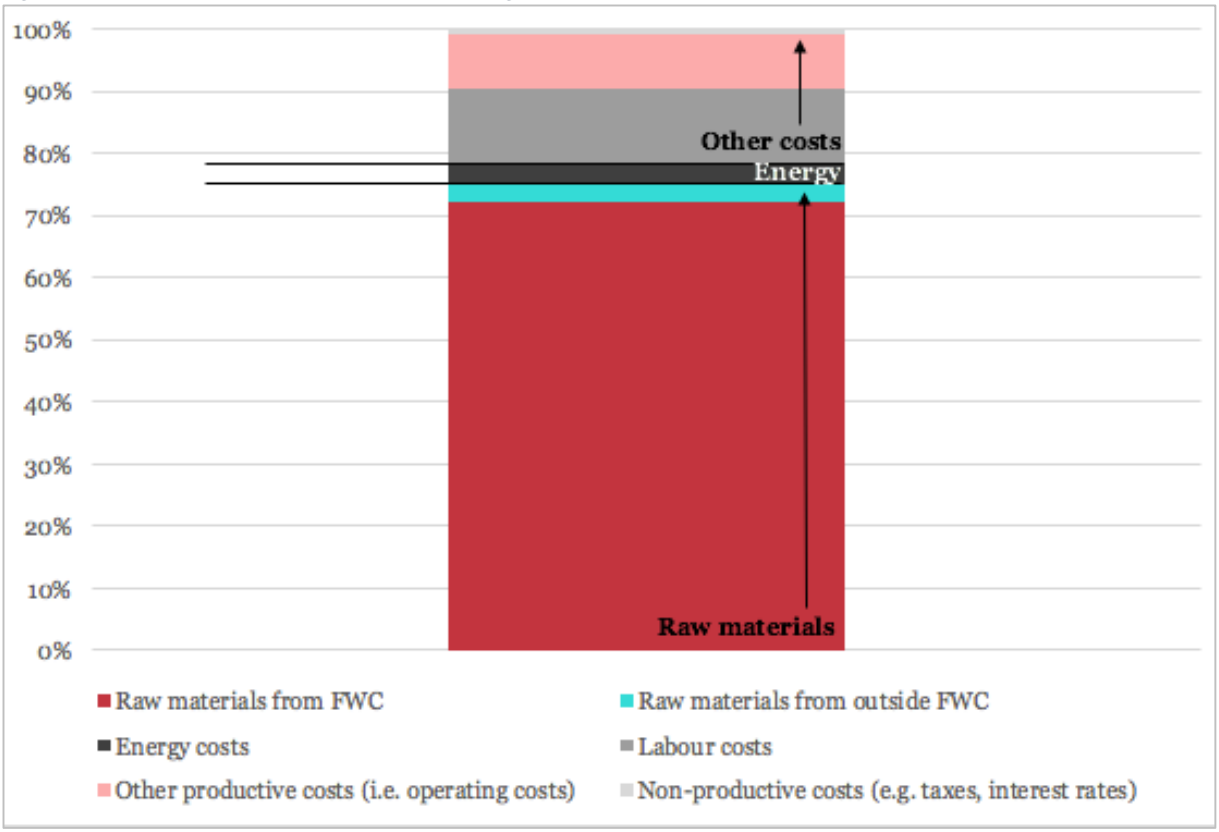
Figure 12 summarises the cost structure in woodworking sub-sector in the 25 EU countries covered by ToSIA dataset. Figures show that raw material costs constitute the most significant share of production costs, where raw materials from forest wood chain comprise €10.8bn and raw materials outside the forest-wood value chain around €4.4bn per year. Energy costs are calculated to amount to €5bn per year and labour costs to roughly €3.7bn. Other production costs and non-productive costs constitute approximately €1.7bn and €1.4bn per year respectively. However, it should be emphasised that these figures represent the woodworking sub-sector as a whole and the relative costs within the further sub-divisions of woodworking can vary considerably.

Figure 12 Cost structure in the EU woodworking sub-sector, million EUR/year, 2005



Source: ToSIA data, 2005

Figure 13 Cost structure in the EU woodworking sub-sector, in %, 2005



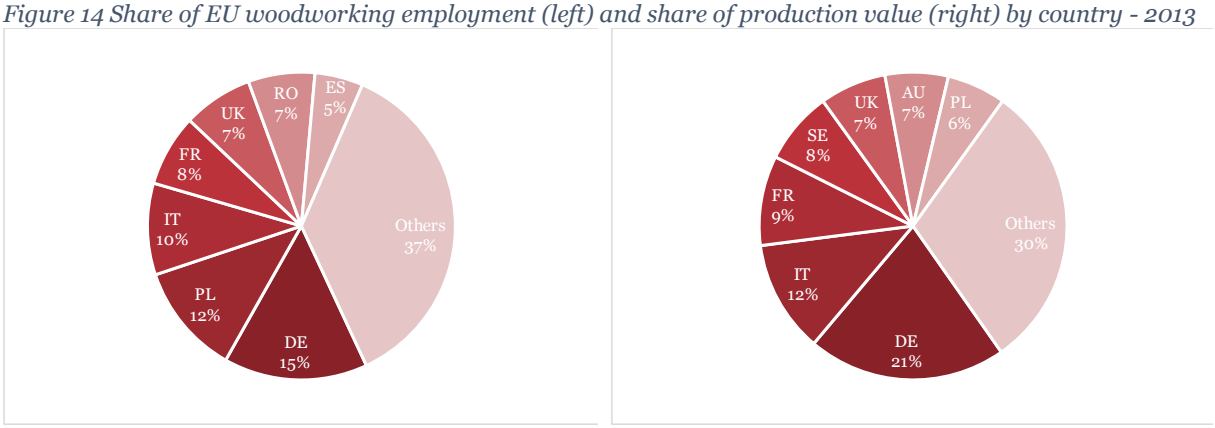
Source: ToSIA data, 2005

2.4 Geographical panorama of the woodworking and pulp, paper and paperboard industries

2.4.1 The woodworking sector

The EU woodworking sector is characterised by geographical concentration, as about 70% of the woodworking production value is located in only seven EU countries, namely Germany, Italy, France, Sweden, United Kingdom, Austria and Poland. Similarly, seven countries account for about 64% of the EU employment in the sector, led by Germany (15%) and closely followed by Poland, Italy and France.

Figure 14 Share of EU woodworking employment (left) and share of production value (right) by country - 2013

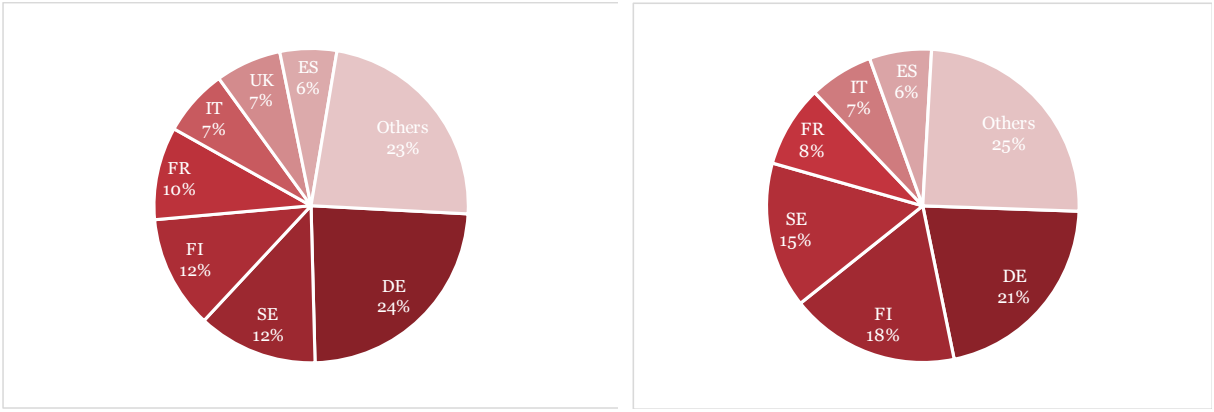


Source: Eurostat, Structural Business Statistics, 2013

2.4.2 The pulp, paper and paperboard sector

The geographical concentration for the pulp, paper and paperboard sector is higher than in the woodworking sector as up to 77% of the employment in the sector is concentrated in seven countries. These are led by Germany (24%), followed by Sweden, Finland, France, Italy, the United Kingdom and Spain, and about 75% of the production value emanates from six countries, also led by Germany.

Figure 15 Share of EU pulp, paper and paperboard employment (left) and share of production value (right) by country - 2013



Source: Eurostat, Structural Business Statistics, 2013

3 Methodology of the cumulative cost assessment

3.1 A cumulative approach to cost assessment

The aim of this study is to identify the cumulative costs of the most financially burdensome EU legislation and policies that companies in the forest-based industries (F-BI) which are active in the EU28 have to comply with. While impact assessments traditionally focus on one specific action undertaken by the European Commission and other relevant EU institutions (new legal act, white paper, etc.), this study adopts a **cumulative approach**, by providing a quantitative assessment of all direct costs (monetary obligations, capital expenditure, operating expenses and administrative burden) and (where possible) indirect costs incurred by F-BI companies in the EU, in relation to the most relevant EU legislation and policies (e.g. specific indirect costs from ETS for the pulp, paper and paperboard industry).

This study **does not assess the benefits of EU legislation** or policies and does not aim to provide insights related to the proportionality of costs and benefits of legislation or policies, nor their efficiency or effectiveness. Furthermore, a **cumulative approach is to be distinguished from a non-cumulative approach** as traditionally used in a cost-benefit analysis (CBA). The cost-benefit approach examines the incremental costs and benefits related to policy proposals against a baseline. This implies that a CBA focuses on the net change in costs and benefits, relevant to a specific policy decision, not the aggregate (or cumulative) level of regulatory costs and benefits (European Commission, 2015). On the other hand, the cumulative cost assessment (CCA) focuses on whole sectors, rather than focusing on a particular policy proposal or legislation, and aggregates the costs generated by a selection of relevant existing EU legislation and other policy instruments. Hence, this cumulative cost assessment does not focus on a policy field and does not aim at assessing whether the regulatory framework is fit for purpose in a policy field, which is an approach used when conducting fitness checks. Thus, a CCA can point out which are the most burdensome regulatory areas (legislative packages) and which have instead a limited impact, which constitutes very important information for policy-making.

The assessment of cumulative cost impacts of specified EU legislation and policies on European forest-based industries (CCA F-BI) falls under the framework of the EU's Regulatory Fitness and Performance Programme (REFIT[11]), which is aligned to the principle of Smart Regulation, which is an expression of the European Commission's commitment to a simple, stable, clear and predictable regulatory framework for business, workers and citizens.

While there is not yet any recognised standard methodology for the assessment of cumulative impacts, the methodology of this study draws on previous similar cumulative cost assessment exercises performed by Member States (e.g. Kostengestuurde Aanpak Regeldruk, by SIRA consulting for the Netherlands) and the European Commission. For the overall CCA approach the previous studies on the aluminium and steel industries (CEPS, 2013a and CEPS, 2013b) have been consulted; and a similar methodological approach to the CCA for the Chemical Industry (Technopolis, 2016) has been adopted. However, with regard to the quantification of the impact of the single regulatory items or areas and their attribution to the various costs categories, CCA studies are based on the established methodologies that have been used for several years by Member States and the European Commission. This includes the Standard Cost Model, and the Cost-driven Approach to Regulatory burdens (CAR) developed for the Dutch Government.

The Standard Cost Model methodology (SCM) is used by several Member States (Network Standard Cost Model, 2005), as well as the European Commission, as part of its REFIT programme[12] and the "Better Regulation Toolbox" (European Commission, 2015). The CAR methodology, which is used by the Dutch government (SIRA, 2015) is similar to the SCM, but its scope is broader regarding the types

[11] Better Regulation, REFIT, http://ec.europa.eu/smart-regulation/refit/index_en.htm

[12] http://ec.europa.eu/smart-regulation/refit/admin_burden/scm_en.htm

of cost covered and gives more emphasis to linking legislation cost with the cost structure of companies.

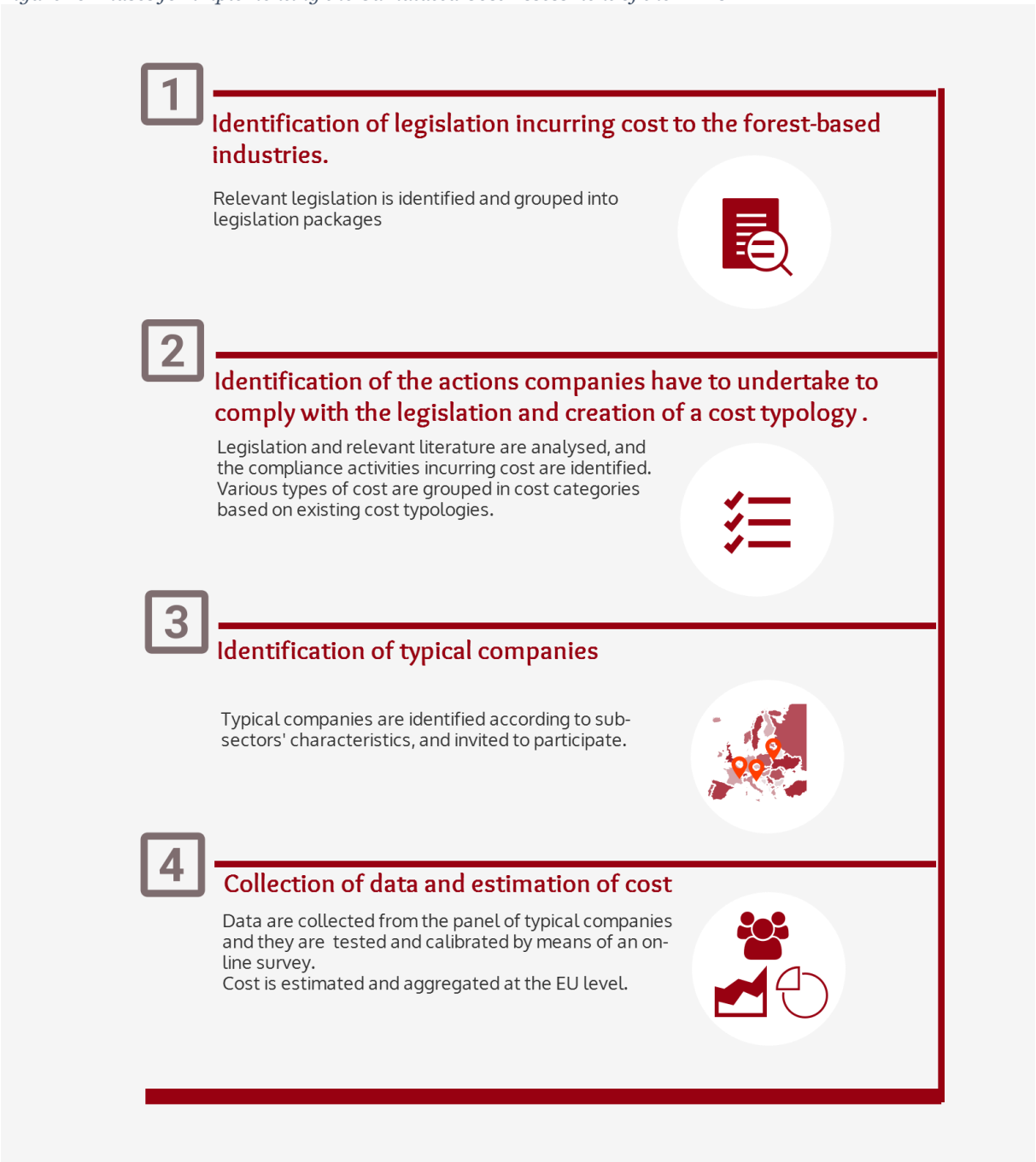
Methodologies to measure legislative burdens follow this principle summarised by the European Commission in its presentation of the SCM: "the purpose of the SCM methodology is to produce estimates that allow **an order of magnitude** of the burdens in different regulatory areas to be identified. Considering the level of detail and the number of parameters, **it is not cost-efficient to seek statistically valid results, rather than more general estimates**" (European Commission, Better Regulation Toolbox, 2015).

Applying statistical methods would require large samples with a significant number of strata, due to the complexity of the system. Such approaches are disproportionally expensive and time-consuming, and they are not feasible within the time frame and budget of a cost assessment exercise. Thus, instead of statistical valid samples, the concept of **typical companies (based on plants that are typical of their product group)** is used, for example, in the Better Regulation Toolbox (European Commission, 2015, p.369) or the methodology used by the Dutch government (SIRA, 2015, p.40). A typical plant **is not an average firm in statistical terms** but an entity that is neither particularly efficient nor inefficient in terms of complying with the legislation. Thus, short of being statistically representative, it can be taken as reasonably representative of the sample population.

Following a variation of the above approach, data collection in the current study **did not rely on statistical methods**. Detailed data were collected from a panel of **typical plants** identified using a set of tangible criteria, which were then validated in two workshops and calibrated using a larger sample of companies by means of an on-line survey. Finally, the data were aggregated to the whole population. The method is explained in more detail in the following sections. Despite the significant advantage regarding feasibility, the method is less accurate compared to statistical methods, and it can only provide an **estimate of the order of magnitude of cost** borne by companies due to EU legislation.

Figure 16 presents four key phases followed to implement this CCA. Firstly, the identification of legislation that incurs costs to the forest-based industries was carried out. Further, the actions that companies have to undertake to comply with the identified pieces of legislation were scoped and the cost typology was created. The third step concerned the analysis of F-BI characteristics and the identification of typical plants. Finally, the last phase comprised all activities related to the collection of data and the estimation of costs.

Figure 16 Phases for implementing the Cumulated Cost Assessment of the F-BIs



Source: Authors' elaboration

3.2 Phase 1: Identification of legislation incurring costs for European forest-based industries

The project team articulated an **initial list of legislation**, regulatory measures and policy documents drawn from study terms of reference and the Forest Policy and Innovation Database of the European Forest Institute Central-East European Regional Office (EFICEEC).[13] The database focuses exclusively on international and EU policy documents having an impact on the forest-based sector as a whole. The first screening indicated that as many as 570 policies (some international but mostly EU documents)

[13] http://policydatabase.boku.ac.at

might have an impact (direct or indirect) on EU forest-based industries (comprising the four sub-sectors that were initially considered). This list was further reviewed resulting in a list of 245 policy entries, divided across nine policy areas or 'legislative packages'. The division into different legislative packages was made in terms of commonly identified policy areas (e.g., competition, and climate).

The **second step** was to bring the draft list of legislative acts and non-legislative policies to 12 Industry Associations representing the four sub-sectors initially included in the study. This was done, in part, through scoping interviews and by distributing a policy matrix where each association (representing respective sub-sectors and product groups as noted in Table 2) could highlight and prioritise the most relevant policy documents, using a 1 to 5 scale reflecting cost impact, as well as indicate which legislation they think incur direct or indirect costs. This process resulted in a reduced list of 106 legislative acts and non-legislative policies across eight packages. One legislative package (Industry and Other Policies) was at this stage deleted, as it was not ranked as important enough nor considered by the industries as generating any direct costs.

Table 2 Industry associations contributing to the prioritisation of legislation

Industry Association	Sub-sector/product group (NACE codes)
International Confederation of Paper and Board Converters in Europe (CITPA) and the Alliance for Beverage Cartons and the Environment (ACE)	(17.21) Packaging (industrial and food & beverage packaging); (17.29) Other articles of paper & paperboard.
Confederation of European Paper Industries (CEPI)	(17.11) Manufacture of pulp; (17.12) Manufacture of paper and paperboard;
European Disposables and Non-wovens Association (EDANA)	(17.22) Household and sanitary paper goods; (13.95) Non-woven cellulose products.
European Federation for Print and Digital Communication (INTERGRAF)	(18.1) Sheet-fed offset printing; Heat-set offset printing; Rotogravure printing; Flexography printing.
European Organisation of the Sawmill Industry (EOS)	(16.1) Sawnwood
European Confederation of Woodworking Industries (CEI-Bois)	(16.22) Solid Wood products (16.22) Flooring (16.23) Other builders' carpentry and joinery
European Panel Federation (EPF)	(16.21) Wood-based panels
European Federation of Wooden Pallet and Packaging Manufacturers (FEFPEB)	(16.24) Wooden pallets and other wooden packaging
European Furniture Industries Confederation (EFIC) and the European Federation of Furniture Manufacturers (UEA).	(31) Contract Furniture Domestic Furniture
European Biomass Association (AEBIOM)	(16.29 & 19.20) Bioenergy products

Source: Author's elaboration

The **third and final step** was to further reduce the list of legislative acts and non-legislative policies to a manageable number. This was, in part, done by grouping legislative acts (e.g. EU Emission Trading System) based on the similarity of their cost generation mechanism and removing some non-legislative policies that would only generate unquantifiable costs (e.g. Europe 2020 strategy) as well as through continued iterations with the industry associations and a final consultation with the European Commission. This process resulted in a list of 57 policy entries. This final list of legislative acts and non-legislative policies was at this stage further distinguished into two categories: one category consisting of 41 policy entries where the calculation of regulatory costs was considered possible (e.g.

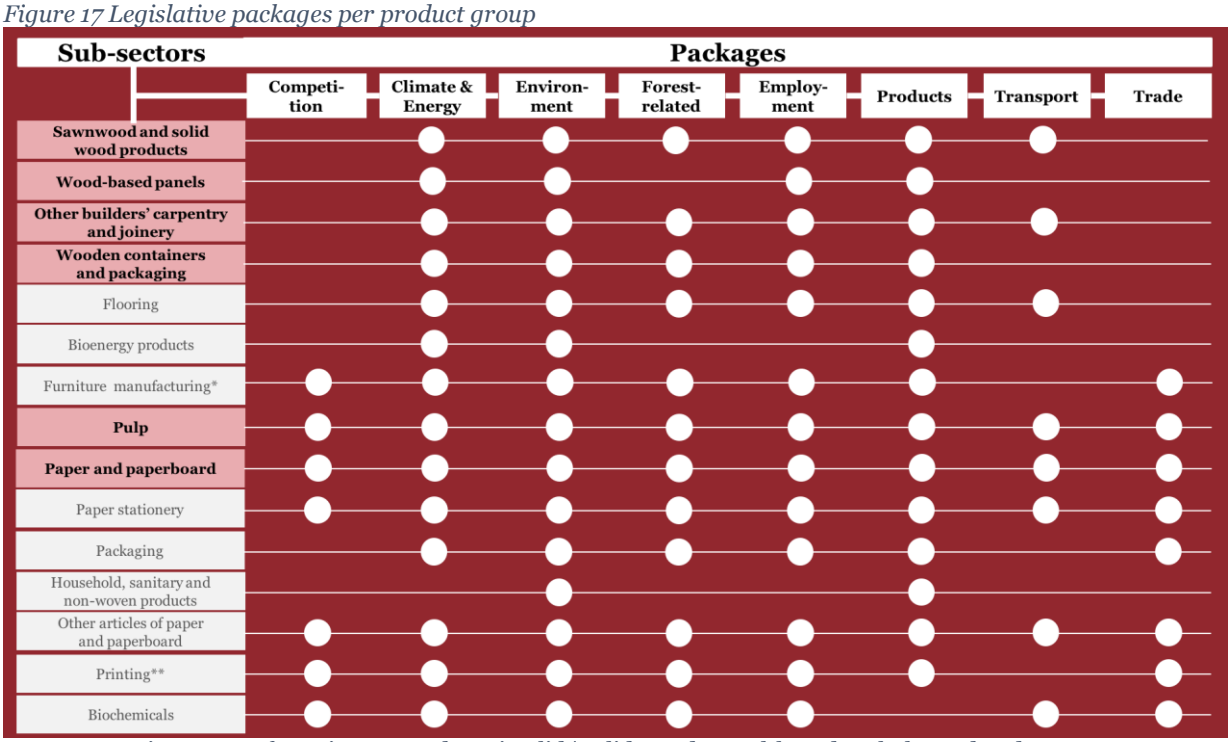
REACH and ECHA regulations) and one category of 16 policy entries where a qualitative approach seemed more appropriate (e.g. key roadmaps, strategies and reports).

The final prioritised EU policy framework, consisted of the following:

- eight packages grouped on the basis of their overarching and specific policy objectives: Competition, Climate and Energy, Environment, Forest-related, Products, Employment, Transport, Trade (see Figure 17)
- 57 policy entries where several entries cover more than one legislative act and non-legislative policies.

The number of policy areas for which cost data was collected was dependent on the legislation that was prioritised for each product group. Figure 17 illustrates each legislative package to be filled by product group.

Figure 17 Legislative packages per product group



Notes: * Furniture manufacturing covered semi-solid/ solid wood, panel-based, upholstered and metal-based furniture. Please note that upholstered and metal-based furniture did not prioritise the competition and forest-related packages. **Printing covered sheet-fed offset, heat-set offset, rotogravure and flexo printing. Source: Authors' elaboration

The complete list of legislative acts and non-legislative policies covered in the study can be found in Chapter 4.

3.3 Phase 2: Identification of the actions required for compliance and creation of a cost typology

The selected pieces of legislation, grouped into eight packages, were analysed and the actions that companies have to take to comply with them were identified. The actions were then associated with cost categories identified in the European Commission's Better Regulation Toolbox (European Commission, 2015a), and previous cumulative cost assessment studies for the steel and aluminium industries (CEPS, 2013a and CEPS, 2013b) and the Chemical industry (Technopolis Group, 2015). Chapter 5 presents the results of the analysis per legislative package.

Those studies had identified two main categories of costs: direct costs and indirect costs.[14]

Direct costs are directly incurred due to compliance with the legislation. Two types of costs can be identified under this category:

- Specifically identified cost types defined in detail in the legislation or other administrative acts, so the exact cost amount can be reliably estimated (e.g. REACH registration fees, taxes or levies, etc.)
- Costs not identified as such in the legislation but directly borne by companies in order to comply with the requirements and standards set by the legislation, although the exact cost is defined by investment decisions of the companies, the specific business environment and price structures, the technologies available or other factors not directly related to or affected by the legislation. An example of such types of cost is investment in technologies to reduce emissions, to comply with the limits set by legislation. Although the legislation defines the limits — and often requires the use of the best available technology — the final selection of the specific technology and equipment, and hence its cost, is the firm's decision. The estimation of such cost is straightforward although the accuracy of the estimate depends on information provided by the companies.

Indirect costs are also generated as a result of legislative requirements. However, either they are incurred by other companies upstream in the value chain, and passed on to F-BI companies through the price of inputs (e.g. wood), or they are related to opportunity costs due to the substitution of products and the loss of markets. Although some of the passed-on (also referred as pass-through) costs could be estimated (e.g. the effect of climate legislation on electricity prices), several of its components (e.g. opportunity cost) are difficult to quantify and their estimation can only be based on strong assumptions.

In the context of this report, scenarios for the quantification of indirect costs due to carbon pass-on in electricity prices for the pulp, paper and paperboard sector are made in chapter 5. Lack of plant level information on electricity consumption for the woodworking companies and other information did not allow the same exercise to be run for the woodworking sector as a whole. Nonetheless, indirect costs for climate and energy are analysed qualitatively for the panel product group. Other than this, due to the ambiguities of the indirect costs and the limited, mainly qualitative, information provided by companies, no robust assumptions could be made for the estimation of other indirect cost and, therefore, they have had to be excluded from the assessment.

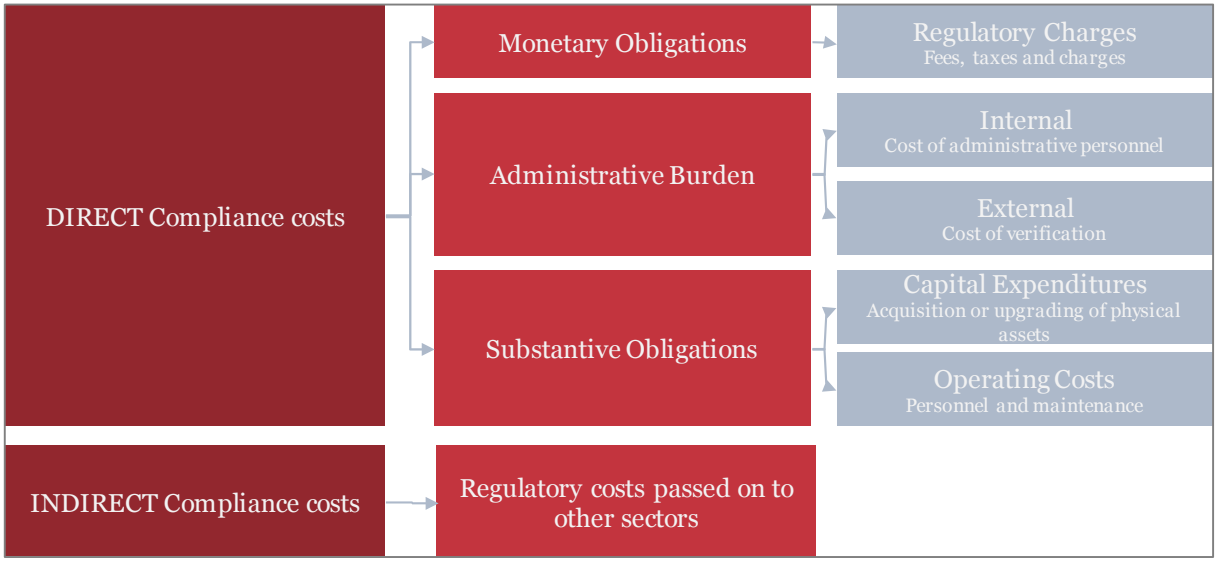
Thus, **the typology of cost used in this study includes the following types of direct costs**, which are illustrated in Figure 18.

- **Monetary obligations** are regulatory charges such as fees, levies, or taxes on certain stakeholders. The identification and computation of such costs are rather straightforward, as regulatory charge amounts are usually known and their extent is clearly communicated to a company. Examples include national environmental taxes and charges, and net costs for CO_2 emission allowances for industries covered by the EU's Emissions Trading Scheme (ETS).

[14] A third category named "enforcement cost" is also included in the cost classification, however it is incurred by the public administration and the authorities responsible for the enforcement of the legislation and thus not included in costs to industry.

- **Administrative burden** is defined as the additional cost of fulfilling the **information obligations** to public authorities or other third parties as required by legislation. It is important to note that administrative burden is thus different from administrative cost, as administrative burdens only represent part of administrative cost and do not integrate business-as-usual costs that would nonetheless occur in the absence of legislation. Administrative burden can be incurred internally (e.g. staff time) or externally by retaining help and advice such as verification, which may or may not be mandatory. The types of administrative burden identified in previous studies on cumulative costs include: cost of personnel, laboratory testing (internal or subcontracted), consultants, and necessary training.
- A methodological challenge in the assessment of administrative burden relates to the difficulty of identifying the origin of the burden — whether burdens can be solely attributed to the minimum requirements of EU legislation or to going beyond minimum requirements ("gold-plating") at national level. This was taken into account by asking companies surveyed to report the portion of administrative burden attributable solely to implementation of the European legislation. However, there is no obvious way to ensure that there is no overlap in administrative burden estimates.
- **Substantive Compliance Costs**: Substantive Compliance Costs are provisions made to comply with regulations, which can be further broken down according to the following categories: capital costs (CAPEX) and operating costs (OPEX).

Figure 18 Cost categorisation



Source: Author's elaboration

Capital costs include any acquisition or upgrading of physical assets, (land, building or equipment), usually "fixed costs", but also investment costs from investments necessary to meet legal obligations. Investment costs can be one-off costs (e.g. new equipment needed) or recurrent costs (periodical training or tests). Operating and Maintenance Costs include additional expenses for personnel (wages), energy inputs, materials, consumables associated with legal acts, and are usually "variable costs". Indirect compliance costs are related to the fact that other stakeholders in the value chain have to comply with other legislation. Such costs are passed on by upstream companies or passed back to producers by downstream users. A number of undue effects of legislation, like transaction costs, reduced competition and adjudication or litigation costs, generate indirect costs that are relevant for the competitiveness of the industry but are very difficult to quantify, given the fact that very often they are one-off costs, and very variable across sub-sectors.

3.4 Phase 3: Identification of typical plants

3.4.1 Criteria for selecting typical plants

Plants selected for the interviews with the companies must comply with legislation with a degree of efficiency that should be "typical" of their product group in order not to bias the outcomes of the analysis. Therefore, an effort was made to collect data on ***plants*** that were typical regarding their product group and not only their company. This **compliance efficiency** of plants was expected to vary according to several factors and the group of plants should therefore reflect a series of ex-ante criteria at the selection stage. In this regard, the aim of the selection process was to have a group of plants that satisfies the criteria of the CAR (Cost-driven Approach to Regulatory burdens) methodology (SIRA, 2015) – as was the case for the steel and aluminium CCAs, which defines three criteria that a "typical" plant should conform to:

- The plant of a company should be considered as representative in terms of activities and structure of the other plants of the same product group. A panel of plants that reflect the production chains, processes and products of the product group should also present a degree of compliance efficiency that can be considered as typical for the product group.
- The plant should be comparable to other plants in the product group in terms of business and business operations. This implies that large and small plants should be selected and that the size effect is to be taken into account in the calculations (large vs SME).
- The plant should present clear business operations and one should be able to associate costs to specific activities. For large plants, one must therefore be able to target the analysis in terms of sites and activities.

Overall efficiency of the plants should also be comparable to the product group efficiency (i.e. efficiency not specifically related to complying to the legislation, but to the general activities of the firm) as legislative cost is part of the wider operating and production costs and this overall efficiency also affects compliance efficiency. Turnover per employee has been used as a proxy for overall efficiency to compare the panel of plants and the product group as a whole. Added value would be a better indicator, but it is not available at plant level. The comparison between the panel and the product group overall should show if the selected plants are close to the product group average or diverge from it. In case larger (lower) productivity indicators be observed in the panel of firms, one can expect costs figures to be under(over)-estimated.

The **online survey** (see Phase 4 below) also contributes to verifying the typicality of the set of companies by adding more (but less detailed) data points to the information compiled during the earlier parts of study. A sensitivity analysis over different sets of weights for the online survey and the in-depth interviews was implemented. Overall, results after the adjustment were stable according to the various scenarios and the direction of the adjustment is not systematic. The lack of a systematic bias supports the assessment that the approach is robust. The results of the sensitivity analysis are also presented in Appendix A.

3.4.2 Selection of companies for pilot and in-depth interviews

Forest-based industries were first analysed according to fundamental parameters (e.g. number of companies, size, turnover, employment, country distribution, etc.). This provided an initial overview of the F-BIs, the sub-sectors and their product groups. Firms were then invited to participate to the study through in-depth interviews (initially through a Pilot phase that enable fine-tuning the questionnaire based on pilot companies' feedback).

The selection of the interviews was performed on the basis of the above criteria (representativeness of activities and structure, comparability of companies and clear business operations) with the support of industry associations. Not all companies were willing to participate to the study during the interview phase because of significant constraints in terms of burden (data collection represents a time-consuming and costly process, especially when cost of legislation is not systematically identified by the

companies) and confidentiality issues (sensitivity of the collected information due to their strategic value).

As a result, not all companies contacted responded positively to the invitation. Table 3 presents an overview of the final panel of companies that took part in the in-depth interviews. While not all pre-selected companies were involved in the interviews, this final panel of companies still reflects the initial selection criteria.

Table 3 The panel of typical plants

NACE code	Label	Large	Small	Countries	% covered of product variety in the sector*
16.1	Manufacture of sawnwood and planing of wood	2	2	SE, DE, EE	91%
16.21	Manufacture of veneer sheets and wood-based panels;	4	2	FI, BE, RO, IT, UK, PT	82%
16.23	Manufacture of other builders' carpentry and joinery	2	2	AT, FI, PT, IT	77%
16.24	Manufacture of wooden pallets and other wooden packaging		5	IT,IT,UK, PT, SP	98%
17.11	Manufacture of pulp	11		DE, AT, SE, FI, IT, PT, UK	100%
17.12	Manufacture of paper and paperboard	19		FI, SE, ES, AT, FI, IT, UK, NL, FR, PT,	100%

Source: Author's elaboration * Note: Based on production value

Concerning the *representativeness of activities and structure of the product groups*, the production value of each product group by detailed products as they are reported in Prodcom for the EU28 (Total production by PRODCOM list NACE Rev.2, table DS-066342, 2014)) was put into perspective with our group of typical plants (see Table 3 and Table 4). Companies that participated in in-depth interviews cover the majority, if not all, of the most important products (in terms of sold production value of EU28 companies) for each product group. The product group for which the coverage of products is the lowest is 16.23 "Other builders and carpentry". For this product group, interviewed companies do not cover windows of wood (22% of value of sold production) nor shuttering for concrete constructional work, shingles and shakes of wood (1% of sold production value). However, the coverage of the group of companies includes the main products of the product group, which represent together 77% of the sold production value (builders' joinery and carpentry of wood, prefabricated buildings of wood, and doors and their frames and thresholds of wood).

Overall, the coverage of products by the companies interviewed effectively illustrates the heterogeneity of the activities, production processes and technologies associated with the different products in each product group. Furthermore, the country coverage of the panel of companies also supports the fact that the selected companies are present in countries that account together for the large majority of the activities of the EU forest-based industries. In terms of turnover, the countries covered by the study represent more than 90% of the woodworking, and more than 83.5% of pulp, paper and paperboard industries in the EU.

Table 4 Value of production sold by product group

Products by product group	Sold production value of the sector (Prodcom)	Coverage by interviewed companies
16.1 Sawnwood		
Spruce wood (Picea abies Karst.), fir wood (Abies alba Mill.)	29%	yes
Coniferous wood; sawn or chipped lengthwise, sliced or peeled, of a thickness > 6 mm, end-jointed, sanded or planed	21%	yes
Pine wood (Pinus sylvestris L.)	14%	yes
Coniferous wood in chips or particles	8%	yes
Wood, sawn or chipped lengthwise, sliced or peeled, of a thickness > 6 mm (excluding coniferous and tropical woods and oak blocks, strips and friezes)	8%	yes
Coniferous wood continuously shaped (including strips and friezes for parquet flooring, not assembled)	6%	yes
Coniferous wood sawn or chipped lengthwise, sliced or peeled, of a thickness of > 6 mm (excl. planed or sanded, and spruce "Picea abies Karst.", silver fir "Abies alba Mill." and pine "Pinus sylvestris L.")	5%	yes
Other	9%	yes (also other products)
16.21 Wood-based panels		
Particleboard, of wood	31%	yes
Fibreboard (excluding medium density fibreboard [MDF]), of wood or other ligneous materials, whether or not bonded with resins or other organic substances, of a density exceeding 0,8 g/cm³	10%	yes
Medium density fibreboard (MDF), of wood or other ligneous materials, whether or not bonded with resins or other organic substances, of a thickness exceeding 9 mm	8%	yes
Oriented strand board (OSB), of wood	6%	yes
Veneered panels and similar laminated wood (excluding with block board, laminboard or batten board)	5%	yes
Medium density fibreboard (MDF), of wood or other ligneous materials, whether or not bonded with resins or other organic substances, of a thickness not exceeding 5 mm	5%	yes
Coniferous and tropical wood veneer sheets and sheets for plywood, sawn lengthwise, sliced or peeled, of a thickness ≤ 6 mm excluding end-jointed, planed or sanded	5%	no
Plywood consisting solely of sheets of wood (excluding of bamboo), each ply not exceeding 6 mm thickness, with at least one outer ply of non-coniferous wood (excluding tropical wood)	5%	no
Medium density fibreboard (MDF), of wood or other ligneous materials, whether or not bonded with resins or other organic substances, of a thickness exceeding 5 mm but not exceeding 9 mm	5%	yes
Veneered panels and similar laminated wood with blackboard, laminboard or batten board	4%	yes
Plywood consisting solely of sheets of wood (excluding of bamboo), each ply not exceeding 6 mm thickness (excluding products with at least one outer ply of tropical wood or non-coniferous wood)	3%	yes
Fibreboard (excluding medium density fibreboard [MDF]), of wood or other ligneous materials, whether or not bonded with resins or other organic substances, of a density	3%	yes

Products by product group	Sold production value of the sector (Prodcom)	Coverage by interviewed companies
exceeding 0,5 g/cm³ but not exceeding 0,8 g/cm³		
Particle board and similar board of ligneous materials (excluding wood)	3%	yes
Other	8%	no
16.23 Other builders and carpentry		
Builders' joinery and carpentry of wood (excluding windows, French windows and doors, their frames and thresholds, parquet panels, shuttering for concrete constructional work, shingles and shakes)	29%	yes
Prefabricated buildings of wood	26%	yes
Doors and their frames and thresholds, of wood	22%	yes
Windows, French windows and their frames, of wood	22%	no
Shuttering for concrete constructional work, shingles and shakes, of wood	1%	no
16.24 Wooden containers and packaging		
Flat pallets and pallet collars of wood	48%	yes
Cases, boxes, crates, drums and similar packing's of wood (excluding cable drums)	29%	yes
Casks, barrels, vats, tubs, and coopers products and parts thereof of wood (including staves)	11%	yes
Box pallets and load boards of wood (excluding flat pallets)	9%	yes
Cable-drums of wood	2%	no
17.11 Pulp		
Chemical wood pulp, soda or sulphate, other than dissolving grades	77%	yes
Chemical wood pulp, dissolving grades	11%	yes
Mechanical wood pulp; semi-chemical wood pulp; pulps of fibrous cellulosic material other than wood	7%	yes
Chemical wood pulp, sulphite, other than dissolving grades	4%	yes
17.12 Paper and paperboard		
Graphic paper	40.5%	yes
Packaging paper and paperboard	47.5%	yes
Sanitary and household paper	7.7%	yes
Other paper and paperboard	4.3%	yes

Source: Eurostat (Prodcom) and Historic Statistics 1991-2014, CEPI

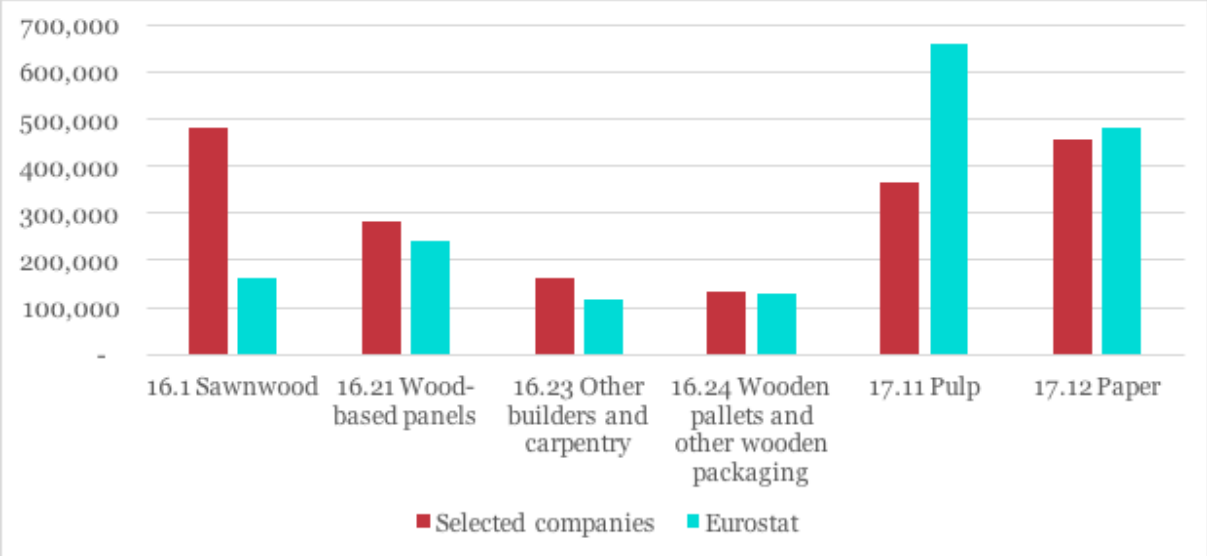
In order to ensure *comparability* of the data collected, companies were asked to report data for a plant or mill that they considered as typical, i.e. average in terms of productivity, cost-efficiency and overall characteristics. This reduces the possibility to observe data related to plants/mills that are outliers within a given company. Furthermore, cost data were rescaled (see Appendix A on main assumptions) during the calculations in order to transform the cost figures in figures that are more comparable and

appropriate for aggregation. Size (SMEs or large) was also a characteristic that was taken into account during the data collection process and the production of cost figures.[15]

A critical aspect of the data collection process consisted in ensuring that data provided by the companies were correctly referring to the targeted activities (i.e. the company has *clear business operations* and it is possible to focus the data collection on a specific activity). This issue especially concerned large companies. In order to address this aspect, the interviewers ensured that companies responded for a specific plant/mill in order to reduce the scope of the data collection to a specific activity, product group and country of operation.

In addition to the above criteria (CAR criteria), *overall efficiency* of the interviewed companies was assessed for each product group by comparing their productivity (in terms of turnover per employee) with the same indicator for the product group in Eurostat. According to Figure 19, indicators of productivity are comparable in terms of scale for all product groups. For the Sawnwood product group, there is a more pronounced divergence between the figures of the panel of companies and Eurostat figures, indicating that the sample is characterised by a larger productivity in comparison with the product group as a whole at EU28 level. This implies that there was a larger risk of underestimating the cost figures for this sector based on the interview data only, which led to an adjustment of cost ratios with survey answers (see section 3.5). Conversely, for the pulp product group, there was a risk of overestimating the cost figures based on the interview data. However, survey answers were in line with the initial cost figures.

Figure 19 Comparison between the panel of interviewed companies and Eurostat sub-sectors – average turnover per employee, 2014



Source: Sub-sector data from Eurostat; panel data from authors

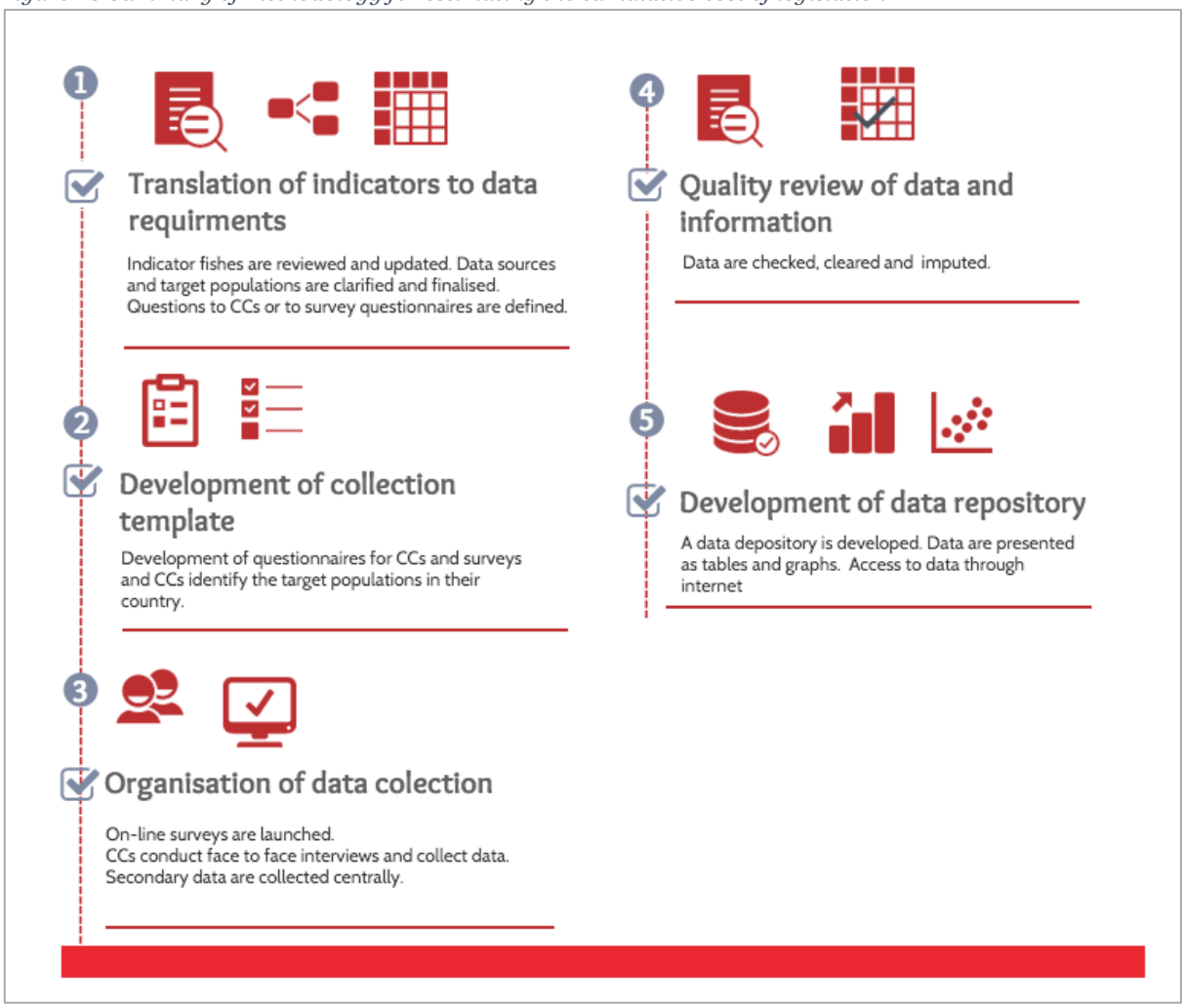
3.5 Phase 4: Collection of data and estimation of cost

The legislative cost borne by F-BI companies was estimated by following a six-stage approach illustrated in Figure 20. The first step included the development of a questionnaire and its distribution to a panel of typical plants. Next, data were collected through in-depth interviews with the selected companies. On the basis of these data, an estimation of the costs for the panel companies was performed. This estimation was further validated through two validation and discussion workshops. In addition to this validation, testing and calibration of the cost estimates were done using the results

[15] SMEs are defined as companies with less than 250 employees. Large companies are companies with 250 or more employees.

from the online survey. Lastly, the results and input from all steps were aggregated producing a cumulative overview of regulatory costs at EU level.

Figure 20 Summary of methodology for estimating the cumulative cost of legislation



Source: Authors' elaboration

Step 1: Development of a questionnaire and its distribution to a panel of typical plants

Four sub-sector-specific questionnaires[16] were designed together with the respective industry associations, company stakeholders and the European Commission in order to collect primary data from companies. The questionnaires were designed in such a way as to maintain comparability across cost categories and legislative packages, and to spot possible inconsistencies during data collection. By filling in the questionnaires, companies were expected to provide information about the typical total cost per legislative act and hence also per legislative package. A company information form, to collect company plant-level data on relevant information for the CCA, was also sent together with the questionnaire. During this step, also detailed guidelines for companies on how to fill out the questionnaire were developed. A help-desk was set-up to support the companies at any point during the process.

[16] In total, one questionnaire for pulp and paper, and three for woodworking (a general questionnaire, one for panels (16.21) and one for packaging (16.24)) were designed. The questions and legislative packages are the same across sectors and product groups. Taking into account the prioritisation of different legislations across sectors and product groups in woodworking, some legislations included under specific legislative packages varied.

Step 2: Data collection and interviews

A set of pilot interviews with companies was performed to test the questionnaire, obtain the first absolute cost figures and thence adapt the questionnaire and its distribution process to the industrial realities of the F-BI sub-sectors. Further in-depth interviews, with a selected pool of companies, were carried out to collect the necessary source data for all targeted sub-sectors and product groups. A number of interviews, in particular for woodworking sector, were performed on-site which allowed the inter-active gathering of additional qualitative insights from companies on the issues of EU regulatory burden.

All legislative acts included in the questionnaires were scanned by the interview team in order to support the process of data collection (i.e. guide the companies) and also to assess whether the answers received were in line with what the prior literature review had suggested. Also national industrial experts were contacted in some cases (e.g. Finland, Germany, Portugal and Italy), to make sure that the answers were referring to European and national legislation.

During this stage secondary quantitative data were collected for multipliers, comparators and validation and filling in missing values in time series. To have a solid basis for comparability, whenever possible secondary data used were taken from Eurostat. Other secondary data (e.g. number of pallets – see step 5) were also used to identify inconsistencies and outliers, as well as to validate data collected via the questionnaires. In cases of inconsistencies or outliers, data were checked again with the companies and adjusted taking into account the additional information received and secondary data (see Appendix A). Data sources and uses can be summarised as follows:

Table 5 Sources and uses of data

Type of data	Source	Use
Regulatory costs	**Primary data** from interview questionnaire **Primary data** from online survey **Secondary data** from additional reports, mostly related to indirect costs	Build numerator of cost ratio
Comparators at company/plant level	**Primary data from panel companies (turnover, # of employees, production quantity, etc.)** **Secondary data** from RISI database (company turnover, # of employees, production quantity)	Ensure a diversified sample
Comparators at sub-sector level	**Secondary data** from Eurostat, Structural Business Statistics, time series: turnover, added value, gross operating surplus **Secondary data** from other sectoral reports, e.g. Historical Statistics 1991-2014, CEPI: production quantity, EBITDA, EBIT	Transpose initial cost/turnover ratio to other comparators (cost/EBIT, cost/EBITDA, etc.).
Indicators to validate group of companies	**Secondary data** from RISI database for detailed plant presentation: type of products, capacity, turnover, # of employees, etc. **Secondary data** from Eurostat, Structural Business Statistics, time series: turnover, added value, gross operating surplus **Secondary data** from Prodcom database, Eurostat, 2014: production value by product and product group.	Compare the panel of plants with sectoral characteristics

Source: Author's elaboration

Step 3: Estimation of legislative costs for the groups of companies

The outcome of Step 1 and Step 2 was an initial set of grids with proxy companies' cost estimates covering all pieces of legislation concerned. At that stage costs were aggregated in order to produce, where possible, a preliminary view of costs per sub-sector, product group and the evolution of costs over time as share of added value. Details on the calculations are presented in Appendix A.

Step 4: Validation of cost estimates

Three validation workshops[17] were organised to present the results of the initial calculations to companies and other pre-identified stakeholders (mainly, experts from industry, industry representatives and European Commission representatives). The first validation workshop presented the results of the pulp and pulp-based manufacturing value chain. The second validation workshop concerned the results for woodworking value chain. The validation workshop for woodworking concluded that the trends and the order of magnitude of the data provided were generally in line with the expected results. For pulp, paper and paperboard, the industry association CEPI asked for further investigation on outliers, comparators and indirect costs. A third validation workshop was performed in Finland, in order to submit interim results to three Finish experts (on climate/energy, environment and transport), which were found consistent with the Finns' own assessment of highlighted legislation and subsequent costs.

Step 5: Testing and adjustment of data with an online survey

In parallel to the validation workshops an online survey was conducted to validate the computed cost estimates. The survey was in two parts: 1) a cost validation for predefined cost types and legislative packages and 2) an assessment of indirect costs in relative terms, with close-ended questions, without asking for absolute figures.

In order to increase the response rate, the online survey was kept simple and short. Companies were asked to select the most appropriate cost range among a list of ranges, expressed as a percentage of turnover, for each legislative package and each category of direct cost. The link to the questionnaire was distributed to companies through national associations and to the companies e-mail addresses found in company databases such as Orbits. In total, 103 responses (91 complete, 12 partial) were provided to the survey. Overall, respondents had to provide answers for at least three legislative packages to be taken into account.

Responses from companies with 250 employees or more cover 52.4% of the sample, which indicates a bias towards larger enterprises, e.g. only 5.8% of the sample is from small enterprises with less than 10 employees. There is a close to 50/50 split between the sub-sectors (47.5% from pulp, paper and paperboard and 52.5% from woodworking). The least represented sub-sectors are builders' carpentry and joinery (6.8%) and pulp production (8.7%). Companies from 21 different countries replied to the online survey. There are many replies particularly from Austria, Germany and Sweden (corresponding to 35.9% of the total sample). Otherwise, the distribution is quite even across the remaining 17 countries. The three countries from which the most responses were received (Austria, Germany and Sweden) already cover over 70% of EU woodworking (NACE code 16, manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials), and of pulp, paper and paperboard (NACE code 171, manufacture of pulp, paper and paperboard) in terms of production value. Overall, the 21 countries cover over 98% of both woodworking and pulp,

[17] Upon the request of Finnish Forest Industries Federation, a small additional validation workshop was held on 15 February 2016 in Helsinki

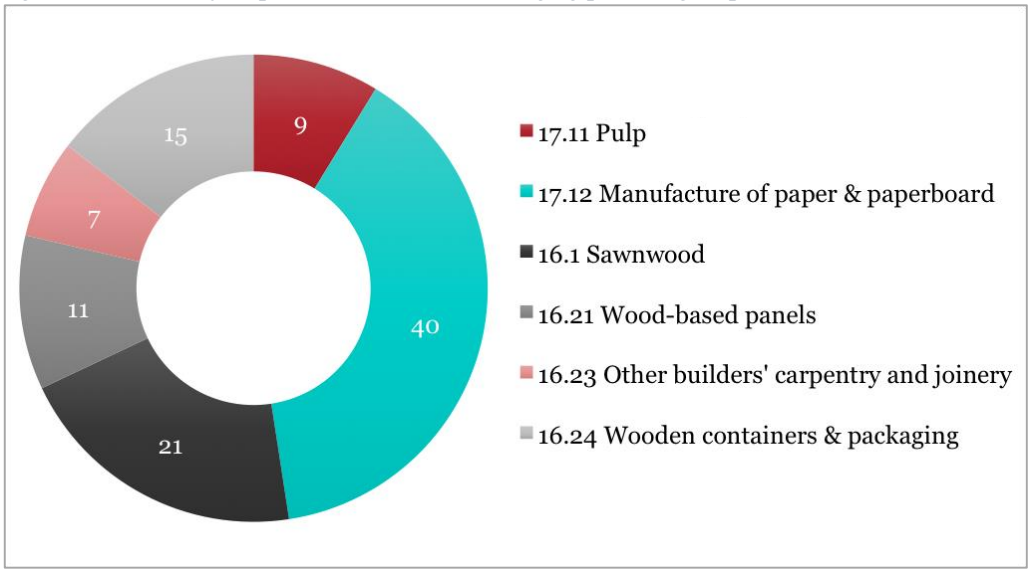
paper and paperboard sectors, as only countries with very little production value in these sectors are missing (e.g. Ireland, Greece, Croatia, Cyprus, Luxembourg, Hungary, and Malta)[18].

Table 6 Number of responses to the online survey by product group

Country	Panel of typical plants	Online Survey	Total number of responses
17.11 Manufacture of pulp	11	9	20
17.12 Manufacture of paper & paperboard	19	40	59
16.1 Sawnwood	4	21	25
16.21 Wood-based panels	6	11	17
16.23 Other builders' carpentry and joinery	4	7	11
16.24 Wooden pallets and other wooden packaging	5	15	20
Total	**49**	**103**	**152**

Source: Authors' elaboration

Figure 21 Number of responses to the online survey by product group



Source: Authors' elaboration

[18] Data for production value can be sources on Eurostat, Structural Business Statistics, Table [sbs_na_ind_r2], last available data 2014.

Table 7 Number of responses to the online survey by country

Country	Panel of typical plants	Online Survey	Total number of responses
Austria	6	11	18
Belgium	1	5	6
Bulgaria		3	3
Czech Republic		1	1
Denmark		1	1
Estonia	1	3	4
Finland	6	5	11
France	1	3	4
Germany	5	10	15
Italy	8	3	11
Latvia		4	4
Lithuania		3	3
Netherlands	2	4	6
Poland		4	4
Portugal	5	5	10
Romania	1		1
Slovak Republic		2	2
Slovenia		4	4
Spain	2	8	10
Sweden	7	15	22
United Kingdom	4	6	10
Total	**49**	**103**	**152**

Source: Authors' elaboration

The online survey was used to adjust the initial results calculated based on the pilot and in-depth interviews. Costs were adjusted by size, product group, legislative package and cost category. The survey results also account for country variability due to transposition of EU legislation into national legislation. For each category, the initial average cost figures were adjusted (upwards or downwards) based on the difference observed between the initial figure and the on-line survey results.

The idea of the adjustment is to take into account information from additional companies in the calculations. The set of interviewed companies was indeed limited in order to collect detailed information at the legislative level, on the evolution of costs in time and qualitative clarifications from the companies. Such detailed information was necessary to ensure a good understanding of the cost

data collected. However, as explained in section 3.4, while the typicality of interviewed companies was ensured to the extent possible, cost figures for some sectors could still be underestimated or overestimated because of specificities of interviewed companies that cannot be easily observed. Hence, information from a larger set of companies can help to address potential biases.

However, combining data from the interviews with data from the on-line survey might not improve cost figures if results from the latter source are even more biased (with the same direction of bias) than results from interview data. Survey data, while covering a larger set of companies, might not necessarily provide a more precise information at the company level. The analysis performed in section 3.4 gives an insight on the direction of a potential bias in the initial calculations. For example, cost figures for the sawnwood product group were likely to be underestimated if the calculations are based on the interviewed firms only. This allowed us to assess the **relevance of the direction of the adjustments**. Furthermore, the weight given to the initial cost figures is larger and survey results account only for 25% of the final cost figures (different weights were tested). This lower weight for the on-line survey reflects the importance of the validation process (time dedicated to interviews, workshops) that was applied to the initial figures before conducting the survey. Hence the adjustment consists of a marginal correction of the initial figures. The detail of the calculations with the survey are available in Appendix A.

The final cost of phytosanitary treatment for pallet producers was calculated separately in order to avoid extrapolating this specific cost to other products in the product group 16.24 Wooden pallets and other wooden packaging. The average cost for a single pallet was calculated based on the detailed information provided by the pallet producers during the in-depth interviews. This cost was multiplied by the number of pallets observed in Prodcom (Eurostat). As a consequence, the average cost related to the environmental legislative package was reduced from 3.5% to 2.8% of turnover for this product group.

Step 6: Aggregation of costs at EU level

To present total costs at EU level, during the last step the core multipliers were applied and data was presented in relative terms. Results are grossed up using turnover. Grossed-up costs are then presented as share of added value, gross and operating surplus for all sub-sectors. Depending on the availability of public and private data, €/tonne and percentage of EBIT and EBITDA were also used as comparators. Accordingly, this was only possible for pulp, paper and paperboard but not for woodworking.

3.6 Quantitative estimation of ETS indirect costs

This section is concerned with the impact of ETS on electricity prices, and more specifically on the extent that this effect is passed-through to the price that the pulp, paper and paperboard sector pays for electricity. A quantitative estimation of ETS indirect cost was only performed for the pulp, paper and paperboard sub-sector but not for the woodworking product group, as woodworking companies in general did not report any significant burden occurring from this ETS indirect costs and thus there was no basis for calculation. (Indirect costs related to the price of raw materials such as wood were also reported as significant to woodworking companies and are addressed qualitatively in section 5.1.3).

An explanation of the main effect of the ETS on electricity prices and subsequently on pass-on rates, along with a literature review on pass-on rates as well as an assessment of the pass-on rates to be used for the calculation of pass-on rate for the pulp, paper and paperboard sector, can be found in Appendix B.

For energy-intensive industries, like pulp, paper and paperboard, electricity prices can be a determinant factor in influencing competitiveness. The introduction of the ETS in 2005, has developed a market around carbon emission allowances (European Union Allowances: EUAs), traded as a commodity, and has triggered other industrial mechanisms of response and adaptation; one of these is

the extent by which the price paid for carbon allowances can be passed-on to industrial and final consumers (i.e. pass on rates).

The objective was to provide the indirect cost of ETS per year between 2005 and 2014. Such computation was only performed for the pulp, paper and paperboard sectors, as data were only available for this sub-sector.

The equation used to calculate the indirect costs is an adapted version of the one used in the steel and aluminium studies (CEPS, 2013):

$$\textbf{\textit{Indirect cost of ETS}}\ (€) = electricity\ purchased\ (kWh) \times carbon\ intensity\ of\ electricity\ \left(\frac{tonne\ of\ CO_2}{kWh}\right) \times CO_2\ price\ \left(\frac{€}{tonne\ of\ CO_2}\right) \times pass\ on\ rate - State\ Aid\ compensations\ (€)$$

Indirect costs were computed for pulp, paper and paperboard activities together, as the electricity purchase related to pulp, paper and paperboard separately were not available.

According to this equation, the five components of indirect costs were:

- **Electricity purchased:** amount of electricity in kWh purchased from the grid to produce pulp, paper and paperboard
- **Carbon intensity of electricity**: emission of CO2 in tonnes per kWh
- **CO2 price**: market price of CO2
- **Pass-on rate**: proportion of ETS costs that the electricity providers pass on to the pulp, paper and paperboard sub-sector - their customers, which can be also defined as the proportion of the price paid for carbon allowances that is passed on to the industry.
- **State Aid compensations**: compensations specifically addressing indirect costs of ETS for the pulp, paper and paperboard industry.

In order to assess the sensitivity of results, we considered different values for some parameters, where relevant, i.e. CO2 prices and pass-on rates. Hence, our analysis is performed with two CO2 prices for 2007 so as to take into account the transition between Phase I and Phase II of ETS, and different pass-on rates were used in the calculations.

3.6.1.1 Component 1: electricity purchased (kWh)

Data on electricity purchased from the grid at the country level between 2005 and 2014 are used for the indirect costs computation (source: RISI database, provided by CEPI). Data were converted from GWh to kWh. The data cover the following countries: Austria, Belgium, Czech Republic, Finland, France, Germany, Italy, Netherlands, Poland, Portugal, Slovak Republic, Spain, Sweden and United Kingdom. The data cover fewer countries than the ones included in the general cumulative cost exercise; however, they are representative of over 95% of EU production value of pulp, paper and paperboard and have thus not been adjusted as electricity purchased can be directly correlated with the production of pulp, paper and paperboard. All electricity data can be differentiated for each country; this allows to also differentiate the other components of the above equation by country.

The above formula only relates to electricity **purchased** from third-party electricity providers and not bio-electricity produced by pulp, paper and paperboard mills in order to isolate indirect costs from direct costs of ETS (the latter are taken into account in the direct compliance costs figures).

The steel and aluminium studies use a ratio kWh/tonne representing electricity intensity, instead of an absolute electricity figure. In this report, indirect costs were directly calculated in Euros instead of cost per tonne. This is due to the fact that electricity data are available for the production of pulp, paper and paperboard together. Hence, it is not possible to identify a specific cost per tonne of pulp and a cost per tonne of paper.

3.6.1.2 Component 2: carbon intensity of electricity (tonne of CO2/kWh)

Data on maximum regional carbon intensity of electricity were used to approximate the carbon intensity of electricity. As in the studies on steel and aluminium, such data were sourced in the Communication from the Commission: Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C158/04). This data source provides maximum regional carbon intensity per country for 2012. Given the lack of data to produce time series and which could be considered as rather stable, we used data from 2012 for the whole period.

The table below summarises estimates of CO2 emissions per kWh from electricity generation, per country, per year.

Table 8 Carbon intensity (CO2/Mwh and CO2/kwh per year)

Country	Mwh	Kwh
Austria	0.76	0.00076
Belgium	0.76	0.00076
Czech Republic	1.06	0.00106
Finland	0.67	0.00067
France	0.76	0.00076
Germany	0.76	0.00076
Italy	0.6	0.0006
Netherlands	0.76	0.00076
Poland	0.88	0.00088
Portugal	0.57	0.00057
Slovak Republic	1.06	0.00106
Spain	0.57	0.00057
Sweden	0.67	0.00067
United Kingdom	0.58	0.00058

Source: Communication from the Commission: Guidelines on certain State aid measures in the context of the greenhouse gas emission allowance trading scheme post-2012 (2012/C158/04).

3.6.1.3 Component 3: CO2 price

Spot prices and future prices for allowances (European Allowances: EUA) on auction markets (main market is the European Energy Exchange EEX) provide the prices of CO2 used for the calculations. We suggest to use the prices from the steel and aluminium study until 2012. The prices are calculated as follows:

- 2005: yearly average spot price, reported daily by the European Environment Agency)
- 2006-2012: yearly average of settlement prices for December future of the same year (source: EEX).
- Prices for 2013 and 2014 have been added using yearly average sport price based on weekly data points.
- As 2007 corresponds to the end of Phase I of the ETS and to the beginning of Phase II, we provide scenarios with the actual yearly average of settlement prices for the December future price of the same year (price=0.74), which reflects the drop in the spot price due to an over-allocation of permits, and – as an alternative – a computation based on the average of weekly settlement prices for the December future price of the next year, namely 2008 (price=19.56) - this includes market expectations and possibly reflects price trends).

Table 9 CO2 price (euros per tonne)

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
21.82	18.62	0.74 or 19.56	23.03	13.31	14.48	13.77	7.56	4.47	5.95

Source: CEPS (2013) and EEX.

Future prices are used between 2006 and 2012, not spot prices. Historical spot prices for EUA over this period were not available from EEX. These spot prices would have been a direct reflection of the effective prices on the market. However, the study uses future prices with a short horizon (December of the year in this case). As future prices converge to spot prices when approaching maturity, such future prices are expected to be a good proxy of the effective CO2 price on the market, even if prices in first months of the year will be a reflection of short-term expectations.

3.6.1.4 Component 4: pass-on rate

The steel and aluminium studies used a fourth component in the equation (so-called pass-on rate) according to different scenarios: rate being equal to 1 (upper-bound scenario) i.e. a pass-on of full costs, 0.8 (intermediate scenario) and 0.6 (lower bound scenario), i.e. only 60 % of costs passed on.

In this report, different scenarios for the rate are used and measure indirect costs accordingly. A thorough analysis and choice of pass-on rates should be ideally done at country level (to take into account differences in the electricity markets). However, this level of detail is not possible in the context of this study as the literature does not provide relevant pass-on rates for each country and for the whole time period. Based on a thorough-going analysis of literature (see Appendix B), it is proposed to use pass-on rates of 0.5 and 1 for all countries.

3.6.1.5 Component 5: State Aids compensations

Compensation via subsidies occurred from 2014 onwards and so should ideally be subtracted from the calculation of indirect costs. Such cases of compensations are consultable in the COMP database on cases (http://ec.europa.eu/competition/elojade/isef/index.cfm). Table 10 presents the amounts of the compensations reported in this database. However, identified amounts of compensation schemes are provided for a list of sub-sectors and cannot be split in a straightforward way. As compensations were only introduced from 2014 onwards, results from 2005 to 2013 will not be affected by this change.

Table 10 State Aids compensation including the pulp, paper and paperboard sector[19]

Country	Expenditure (in millions)
United Kingdom[20]	2014: GBP 19.632
Germany	2014: EUR 314.2
Spain	2014: EUR 0 (5 million EUR 2013-2014)
Netherlands	2014: EUR 53.455
Greece	2014: EUR 14.4
Lithuania	2014: EUR 0 (13.1 million EUR 2014-2020)
Slovakia	250 million EUR 2014-2020

Source: DG COMP database, http://ec.europa.eu/competition/elojade/isef/index.cfm, as consulted on May 2016

[19] State Aids compensation schemes are drafted for a group of sectors and public data does not allow any disentangling of aid per sector. Sectors under the different schemes (in different countries) cover different sectors.

[20] The Carbon Price Floor compensation scheme is outside the scope of this decision.

4 Overview of the relevant legislation

This chapter examines European Union legislation and related policies that have been identified as having a high relevance for the forest-based industry in terms of generating costs. The aim is to characterise through 'legislative packages' the EU legislation (e.g., directives, regulations) and policy documents (e.g., strategies) that impose a direct and/or indirect cost on the industry.

From the first screening that indicated that as many as 570 policies may have an impact on EU forest-based industries (see section 3.2), 245 pieces of legislation and related policy instruments were initially selected for inclusion in this cost assessment (e.g. excluding forestry related legislation). Following the prioritisation process, as outlined in section 3.2, 57 policy entries (often covering more than one piece of legislation), were grouped into eight legislative packages based on shared policy objectives and types of associated costs. The selected legislation within the scope of the study includes regulations, directives, laws or other legal acts in force at any time for the period 2005-2014, even if they were later repealed or amended by other legislation. Communications (non-legal policy acts) have in some instances also been included when they are directly related to specific legislation or when they have been noted to be of particular importance to some subsectors.

The emphasis of the present chapter is to provide an overview of the legislation and to identify the types of cost carried by the forest-based industries due to specific pieces of legislation under the respective legislative packages. It should be noted that some pieces of legislation, although being adopted before the end of 2014 (e.g. Industrial Emissions Directive 2010/75/EU), have not been included in the quantitative aspects of the cost assessment since they came into force after the end of 2014. Legal acts relevant to the forest-based industry being adopted or repealed after the designated study period was only considered qualitatively when reflecting on effects leading up to 2030 (see Section 5.9).

4.1 Production steps affected by legislation

Regulatory requirements occur at different steps in a production chain: regulation can impact the cost of raw material and energy, the cost of labour, the cost of equipment and maintenance, the cost of safety and the cost of placing products on the market. Thus the cost of legislation affecting the forest-based industries varies between subsectors and depends on the structure and the complexity of the manufacturing process (e.g. number of manufacturing steps and type of equipment, etc.). Some subsectors are affected by many pieces of legislation and some pieces of legislation require measures that are more expensive than others.

EU legislation and policies that incur direct or indirect costs for forest-based industries correspond to a complex web of legislative and policy documents. This presents one of the core challenges as regards to assessing costs and impacts on the value chains and its variants. That is, few policies can be said to have a direct and unambiguous cost impact for one single stage of processing for one single value chain.

To illustrate this problem, the basic forest-related value chains in this assessment start with the wood being transported (as such excluding upstream forestry activities). It continues with various phases in manufacturing wood and wood-fibre products, further processing, marketing and consumption, and ends with recycling or disposing of wood-based materials. All steps (primary to tertiary processing) of the value chains have different importance for the respective sub-sectors included in this assessment (woodworking and pulp, paper and paperboard manufacturing). Each sub-sector is also subject to varying effects from given legislation, and aside from varying effects; several pieces of legislation that were expected to have an impact on the forest-based industries set unclear targets.

Taking this complexity into account, the following sub-sections will clarify the types of policy areas as classified by legislative package that have a cost impact. In addition, the type of cost linked with the legislative package will be clarified. Distinction is made between **monetary obligations** such as fees, costs arising from **administrative burden** (such as the preparation of dossiers, notifications, applications or other necessary information) and costs arising from **substantive obligations** (including **capital and operational expenditures**) such as testing, investment in laboratory equipment, labour, etc.

4.2 Package 1: Competition legislation

4.2.1 Overview of the legislative package

EU competition law does not necessarily make one think about forest-based industries, but it does affect how all enterprises operate within the EU. For example, to preserve well-functioning product markets, the Commission must prevent anti-competitive behaviour (e.g. agreements between companies that restrict competition). This applies to forest-based industries as much as it does to any other sector. The EU competition rules essentially include anti-trust procedures, preventing anti-competitiveness rules and rules on mergers and acquisitions etc. More specific to this cost assessment are the guidelines that cover national regional aid and state aid for environmental protection and the revised state aid guidelines (financial compensation for indirect emissions).

4.2.2 Type of cost linked with the legislative package

Monetary obligations, administrative burden and substantive obligations:

The legal regime of EU state aid (see revised state aid guidelines SWD/2012/131) aims - due to direct or indirect government interventions - at avoiding distortions of competition and trade among member states in the internal EU market. It therefore creates no, or very little, regulatory costs for the forest-based industries. Instead, it is one factor that shapes the competitive environment in which the industries operate within the EU. **Thus, after discussion with the F-BI, its costs were not calculated in the study.**

The current guidelines on state aid for environmental protection and energy 2014-2020 (2014/C/200/01) will be in force until the end of 2020 and aim at limiting support to renewable energy while making it more cost-effective to reduce actual energy costs. For instance, to increase cost efficiency, feed-in tariffs will be replaced by a bidding process. Small installations can be exempted from this process. This will have an effect on future costs, dealt with qualitatively.

For energy-intensive sectors (such as the production of pulp, paper and paperboard) some support is still allowed under these guidelines so as not to put them in a disadvantaged position compared to other companies in the global trading arena. In order to reduce distortions of competition for companies, Member States may grant aid in the form of tax reductions for undertakings that are energy intense and to companies that are exposed to international trade. Operating and investment aid for the production of renewable electricity, the production of biofuel and cogeneration, as well as energy infrastructure, is also possible under these guidelines. State aid legislation is essentially about balancing the negative effects of aid on competition with its positive effects in terms of common interest. This also entails efforts at ensuring that competitiveness is enhanced while avoiding subsidy races between Member States.

Table 11 Overview of Competition legislation

Package 1: Competition legislation													
	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Group 1. Measures affecting sectoral competitiveness													
Revised State aid guidelines (financial compensation for indirect emissions) (SWD/2012/131) ★										◆			
Guidelines on State aid for environmental protection and energy 2014-2020 (2014/C 200/01) ★												◆	

◎ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

4.3 Package 2: Climate and Energy legislation

4.3.1 Overview of climate legislation

There are many policy documents on climate change that have direct implications for the forest-based industries. At the EU-level, most of the policy instruments concerned with climate change are furthermore interlinked with energy legislation, however, these will be introduced separately. It should nevertheless be noted that while climate and energy correspond to two distinct policy fields, they cannot be entirely separated from each other when considering forest-based industries. They are even bundled together, for example, in the EU climate and energy package, which has been designed to help the EU reach its targets for the reduction of emissions of greenhouse gases by 20% before 2020.

The EU Emissions Trading System (ETS), launched in 2005, presents one cornerstone of the EU's policy to combat global warming and it is considered as key to reducing industrial greenhouse gas emissions cost-effectively. It is currently in its third phase, running from 2013 to 2020. The ETS works on a 'cap and trade' principle. A cap is set on the total amount of greenhouse gases that can be emitted. Companies then receive allowances as a share of the cap and they can trade allowances with one another in case they are not used (Directive, 2003/87/EC). For example, the system allows the use of credits from projects to enhance forest sinks in third countries under the Joint Implementation/Clean Development Mechanisms established under the Kyoto Protocol. Although, in Phase 3, auctioning is the default method for allocating emission allowances to companies participating in the ETS (before allocation was mainly free), some industries will continue to receive a share of allowances for free until 2020 and beyond. Free allocation is carried out on the basis of benchmarks of greenhouse gas emissions performance.

A reform of the ETS is currently ongoing. As a first step of this reform, the EU recently adopted a decision to create a market stability reserve for the ETS (Decision 2015/1814). The aim of the reserve is to correct the large surplus of emission allowances which has built up in the ETS and to make the system more resilient in relation to supply-demand imbalances. The Commission has at this stage also issued a second proposal, which represents a broader review of the ETS (European Commission 2015, COM/2015/337) that aim to take the Council's guidance on the role the EU ETS should play in achieving the EU's 2030 greenhouse gas emission reduction target and make it law. The proposed changes may bring additional changes to the carbon-trading market and have implications for the future of the forest-based industry.

The auctioning of greenhouse gas emission allowances is further regulated by two Commission Regulations (176/2014 and 1031/2010). Sectors and sub-sectors considered to be exposed to a significant risk of carbon leakage between 2015-2019 will receive a higher share of free allowances (Commission Decision 2014/746/EU). The first carbon leakage list was applicable for the free allocation of allowances in 2013 and 2019. The carbon leakage list for 2020-2024 is currently being prepared (Stakeholder consultation analysis, issued 17.12.2014). Among those sub-sectors considered for free allowances are manufactures of articles from cork, pulp, paper and paperboard.

Following the revision of the EU ETS Directive in 2009, several Commission Decisions (e.g., 2011/278/EU regarding the harmonised free allocation of emission allowances and 2013/447/EU and concerning the standard capacity utilisation factor) and one Commission Regulation (601/2012) on monitoring and reporting of greenhouse gas emissions have been adopted and are considered as relevant to the forest-based industries since they specify detailed rules that have to be taken into account. These include factors necessary to enable authorities to calculate the amount of free allocation to be provided to new installations in the period 2013 to 2020 as well as updated rules for monitoring and reporting of emissions that are applicable from Phase 3.

The 2030 climate and energy policy framework (European Commission, 2014b) builds on the 2020 climate and energy package. It puts forward a new governance framework based on national plans to assess progress over time as well as a reform of the EU ETS to address the surplus of emission

allowances that has built up in recent years and a binding target to increase the share of renewable energy and energy efficiency (following the review of the Energy Efficiency Directive) by 2030. The framework highlights the significant inter-linkages between climate change and energy as well as other policy areas (e.g. environment and transport). It also demonstrates that the policy areas defined for this assessment are somewhat broad. For instance, the 2020 climate and energy package does not address energy efficiency targets directly, however, they are introduced in the 2030 framework.

Land Use, Land Use Change and Forestry (LULUCF) represents another cornerstone of the EU's emission-reduction efforts. It is part of the Roadmap for Moving to a Competitive Low Carbon Economy (European Commission, 2011a) and provides accounting rules that are meant to help strengthen the capacity of forests to preserve and capture CO2 (Decision, 529/2013/EU). While forests and forestry are not part of this assessment, the LULUCF accounting rules address a gap in EU's greenhouse gas inventory opening up for the prospect of preserving forests as carbon sinks in the future. This has been indicated as one contributor to increasing indirect costs of raw materials. However, efforts towards using forests for carbon sequestration rest with the Member States. So therefore prospects to integrate and valorise carbon sequestration under current regulations and schemes are limited and the direct impact of LULUCF on the forest-based industries is difficult to pinpoint with any certainty. LULUCF also includes three "harvested wood products" (HWP: sawnwood, wood-based panels, paper). However, the EU's rules for accounting these are yet to be adopted as legislation.

The Commission report on indirect land-use change related to biofuels and bioliquids (European Commission 2010) did not suggest concrete approaches for how to tackle risks arising from indirect land use change (ILUC) from increased biofuels demand and related greenhouse gas emissions, it did however acknowledge the problem and set the scene for further action. This was picked up in the new rules that came into force in 2015 that amend the current legislation on biofuels, in particular the Renewable Energy Directive and the Fuel Quality Directive, to reduce the risk of indirect land use change and to prepare the transition towards advanced biofuels (Directive 2015/1513). The Commission has in addition acknowledged sustainability concerns surrounding biomass production. However, in the absence of a EU sustainability scheme, it has suggested voluntary criteria to tackle the problem, which may have contributed to increasing indirect costs as raw material prices have risen. For instance, by promoting the use of ligno-cellulosic resources as feedstock for biofuels (without excluding pulpwood) it becomes a multiplying factor that increase costs. Furthermore, the revision of the Renewable Energy Directive and Fuel Quality Directive aiming at addressing ILUC, may create an additional incentive to convert pulpwood into liquid fuel, which in turn may generate tensions on the procurement market. It is also unclear what the implications of the recent proposal for a regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework (COM/2016/479) may have.

4.3.2 Overview of energy legislation

Although most of EU energy legislation does not target specific sectors, including the forest-based industries, it does affect the availability and the price of energy. Energy legislation affects direct energy costs when forest-based industries produce their own electricity as well as indirectly when they buy and sell it on the grid. When Member States impose taxes on energy consumption, energy intensity, CO2 emissions of specific energy sources and renewable energy schemes funding, the impact of EU energy legislation on costs is direct. Furthermore, in this case, EU energy legislation have been indicated to indirectly impact costs as power producers have passed on part of their added costs to forest-based companies purchasing power from the grid.

The Energy Efficiency Directive (2012/27/EC) repealed among other legislative acts, the Combined Heat and Power Directive (2004/8/EC). It establishes a common framework of binding measures for the promotion of energy efficiency to ensure the achievement of the 20-20-20 targets. Member States are requested to set their own energy efficiency plans and energy efficiency targets for the period 2014–2020 and must submit those to the Commission. Under the directives provisions, large enterprises (not SMEs) are obliged to carry out energy audits every four years to identify ways to

reduce energy consumption. National energy efficiency measures are implemented on the basis of voluntary agreements, taxes, or incentives including subsidies, tax discounts or a pay back of CO2 certificates. The requirements of the Energy Efficiency Directive generate direct costs incurred from substantive obligations for investments in energy monitoring systems, efficient boilers and cogeneration units as well as costs incurred from information obligations related to energy audits and to administrative procedures for permits where new power production units are installed. It should nonetheless be noted that there are also clear incentives to comply with obligations as established by the directive as increased energy efficiency also generates energy cost savings. These (or any) types of benefits are however not accounted for in this report as it is a cost assessment.

The Third EU Energy Package (directives 2009/72 and 2009/73, regulations 714/2009 and 715/2009) refers to the functioning of the EU internal energy market. Its aims at unbundling energy suppliers from network operators while strengthening regulators independence as well as creating cross-border cooperation and increased market transparency. To better support the national implementation of the Third Energy Package the European Commission (2012) has reviewed its transposition and as a matter of fact proposed an Action Plan for both Member States and the European Union, which does not generate direct costs for the forest-based industries as energy prices have dropped following deregulation.

The Energy Taxation Directive (2003/96/EC) sets minimum rates for energy taxation related to energy-bearing products (mineral oils, coal, natural gas and electricity) and the CO2 emissions of specific energy sources. It also aims to help reducing market distortions resulting from national energy legislation and that the measures adopted under different national energy legislations and those adopted under the ETS Directive are consistent with the 2020 objectives. The directive impacts the sectors not covered under ETS (pulp, paper and board are covered by ETS) by imposing a minimum tax rate based on the CO2 and the energy content of the energy consumed. The Commission presented a proposal to revise the directive in 2011, but this has been unsuccessful and the proposal was withdrawn in 2015.

The Renewable Energy Directive (Directive 2009/28/EC) establishes a common framework for the use of energy from renewable sources in order to limit greenhouse gas emissions and to promote cleaner transport. Member States have taken on binding targets to increase the share of renewable energy in their energy consumption by 2020. Meeting the targets of the legislation will require large-scale changes to current land-use patterns. The mechanism of funding for implementing national schemes to develop the production of renewable energy is left to each Member States which, in most of the cases, use taxes and levies included in energy bills. Levies imposed by Member States vary significantly across Europe, however, these requirements may result in direct costs incurred from monetary obligations (renewables levy) charged by Member States via energy bills. This relates more directly to forest-based industries as it concerns the use of forest biomass for energy generation.

The Renewable Energy Directive (RED) illustrates the significant inter-linkages between climate and energy legislation at the EU level. It also highlights the connection between biomass production and wood mobilisation and the forest-based industries, although this is not part of this assessment. For instance, the non-binding Biomass Action Plan (European Commission 2005) was developed to promote production and use of biomass as an alternative source of energy. It has been argued by some in the forest-based industries that this non-legally binding component of the EU's renewable energy policy has generated indirect costs due to increasing electricity prices, transport fuels and raw material costs as a consequence of raw material competition. However, no hard evidence has been presented for this and, logically, it is only some of the legal provisions of RED which could have an impact on biomass markets. The RED also requires developing a sustainability scheme for biofuels and bio-liquids used for transport to avoid unsustainable biomass production because of an increasing demand for renewable energy. In 2010 the Commission set biomass sustainability recommendations for Member States and is currently considering if and how such criteria should be made mandatory. The EU has also adopted a Fuel Quality Directive (2009/30/EC) with the mandatory target to reduce greenhouse gas intensity of fuels used in transport by 6% while adhering to sustainable production.

Table 12 Overview of Climate and Energy legislation

Package 2: Climate & Energy legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Group 1. Climate Change													
EU Emission Trading System (Decision 1359/2013/EU; 2009/29/EC; 2003/87/EC; 96/61/E)	ETS		First phase			Second phase				Third phase			
*Reform of the European carbon market (COM/2014/20)**												◆	○●
Auctioning of greenhouse gas emission allowances (Commission Regulation (EU) No 176/2014; Commission Regulation (EU) No 1031/2010)								○●				●●	
Carbon leakage list 2015-2019 (Commission Decision 2014/746/EU)												○●	
Carbon leakage list 2020-2024 (Stakeholder consultation analysis, issued 17.12.2014)												◆	
Harmonised free allocation of emission allowances (Commission Decision 2011/278/EU)									○●				
Standard capacity utilisation factor (Commission Decision 2013/447/EU)											○●		
Monitoring and reporting of greenhouse gas emissions (Commission Regulation (EU) No 601/2012)										○●			

Package 2: Climate & Energy legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Commission decision on the standard capacity utilisation factor pursuant to Article 18(2) of Decision 2011/278/EU (Commission Decision 2013/447/EU)											○●		
Policy framework for climate and energy in the period from 2020 to 2030 (COM/2014/15)												◆	
Addressing the challenges of deforestation and forest degradation to tackle climate change and biodiversity loss (COM/2008/645) ★						◆							
Land Use, Land Use Change and Forestry (LULUCF) (Decision 529/2013/EU) ★											○●		
Group 2. Energy													
Renewable Energy Directive (Directive 2009/28/EC; Directive 2001/77/EC; Directive 2003/30/EC)	○●						○	●					
*Proposal for a new RES directive (COM/2012/595)***										◆			○
Energy Efficiency Directive (2012/27/EC and Council Directive 2013/12/EU; Directive 2004/8/EC)	○●									●	○	●	
Implementing the Energy Efficiency Directive (COM/2013/762)											◆		
Promotion of cogeneration based on a useful heat demand in the internal energy market (Directive 2004/8/EC)	○			●								●	
Third Energy Package													
Common rules for the internal market in electricity (Directive 2009/72/EC;	○●						●		●				

Package 2: Climate & Energy legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Directive 2003/54/EC)													
Common rules for the internal market in natural gas (Directive 2009/73/EC; 2003/55/EC)	○●						●		●				
Conditions for access to the natural gas transmission networks (Regulation 715/2009; 1775/2005)			○●				●		●				
Conditions for access to the network for cross-border exchanges in electricity (Regulation 714/2009; 1228/2003)	○●						●		●				
Energy Taxation Directive (Directive 2003/96/EC)	○●												
Group 3. Other													
Report on indirect land-use change related to biofuels and bioliquids (COM/2010/811) ★								◆					
Report on sustainability requirements for the use of solid and gaseous biomass sources in electricity, heating and cooling (COM/2010/11) ★								◆					
Biomass Action Plan (COM/2005/628) ★			◆										

○ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

* Please note that the proposal was adopted during this assessment as Decision (EU) 2015/1814 of the European Parliament and of the Council of 6 October 2015 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading scheme and amending Directive 2003/87/EC.

** Please note that the proposal was adopted during this assessment as Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources.

4.3.3 Type of cost linked with the legislative package

Monetary obligations: Climate & Energy

Several industries falling under the scope of ETS have received allowances in excess of their real emissions and have banked these to cover further expansion of their production capacity or to generate profits from trading. However, such benefits are not assessed here. Nevertheless, one of the major cost sources of this package concerns the purchase of CO2 allowances under the ETS system. These costs can vary depending on the market price of CO2 in the trading system, the amount of free allowances accessible in a given year, and the benchmark value setting the amount of free allowance based on the average best 10% of operators in the sector. The ETS also have significantly different impacts on each respective sub-sector, which essentially depends on how energy-intensive each sub-sector is.

Renewable energy levies are charged based on the consumption of electricity. There are however significant differences across countries and also between sub-sectors in the forest-based industries as some Member States exempt some energy-intensive companies from the renewable electricity support levies for competitiveness reasons. In addition, some companies produce their own renewable energy and may receive subsidies for this. In other cases, companies producing their own energy from renewable sources may pay certification fees that are counted as a cost.

The Energy Efficiency Directive requires an independent energy audits for large companies (see Art. 8.4.). In case of non-compliance with auditing provisions, Member States may decide the level of penalty.

Energy products and electricity are only taxed under the Energy Taxation Directive when they are used as motor or heating fuel. Energy from renewable resources is exempted from this tax. It should also be mentioned that the directive specifically allows Member States a total or partial exemption or reduction in the level of taxation for energy used and electricity produced from combined heat and power generation (so-called “cogeneration” or “CHP”) which affects costs for the forest-based industries.

Substantive obligations: Climate & Energy

Substantive obligations resulting from ETS include investments for emission abatement equipment, energy and process efficiency beyond the so-called business as usual. Such investments are made for the purpose of reducing emissions, hence, reducing the purchase of emissions allowances and investments that would not be needed in the absence of ETS. It should also be noted that the ETS may cause industrial consumers to face an extra indirect cost that arises from increased production costs. This would principally be due to ETS compliance costs for electric utilities that in turn pass on their costs to client companies. This does however vary considerably between Member States and sub-sectors depending on their activities.

For companies to contribute to energy efficiency and renewable energy targets, investments in equipment are often necessary. Personnel and other operating costs are also associated with these investments. For example, some companies that produce in-house electricity have invested in equipment that combine heat and power generation, resulting in additional capital and personnel costs for the installation and operating costs during the operation of the co-generators.

Administrative burden: Climate & Energy

Compliance with the EU ETS is managed at the factory level and administrative burdens are as such borne by the companies themselves. These can include one-off costs for the start-up process once the ETS is going into operation at the company level (this include necessary investments for monitoring compliance and training of staff), recurring personnel costs, training for the familiarisation of the system, external expert costs (hiring a verifier) and investments into infrastructure necessary for monitoring. It also encompasses recurring cost for monitoring, reporting and verification, including personnel costs, operating costs and external costs for verification (consultants, experts etc.). Regulatory changes between the ETS phases also bring some costs for the industry. For instance, direct emissions reported under the ETS system determine free allowances, based on benchmarks, as well as

the leakage list. Thus, amending the "carbon-leakage list" under the ETS Directive across phases may in turn cause companies which are not on the list to face increasing direct and indirect costs due to a shortage of free allowances.

Similar types of costs are associated with the issuance, renewal and updating of environment permits. Administrative burden are born during the inspections for checking compliance with the legislation after the issue of permits.

The energy audits that large companies are obliged to perform at least every four years incur personnel costs for the organisation, implementation and documentation of the audit, including any costs for hiring external consultants. The first audits should however only be performed during 2015 and will as such only affect the cost during the future period in this assessment.

The certification process for companies producing electricity from renewable resources generates personnel costs for the preparation of all necessary documentation. Similarly, administrative burden are generated for the preparation of the necessary permits for cogeneration. For example, industrial players must in case of refurbishment of industrial installations generating waste heat at a useful temperature level with a total thermal input >20MW carry out a cost-benefit analysis to assess whether it is possible to introduce co-generation in heating (Directive 2004/8/EC).

4.4 Package 3: Environmental legislation

4.4.1 Overview of the legislative package

The cost assessment does not include forestry as part of the value chain and the emphasis in this legislative package is as such principally on policies related to industrial emissions, air quality, acidifying substances, wastewater emissions and waste incineration. This includes the Industrial Emission Directive (IED) (2010/75/EU) – as the successor of the IPPC Directive (2008/1/EC, as codified version of Directive 96/61/EC) starting from 1st of January 2014– the limitation of emissions of volatile organic components (VOC) from organic solvents Directive (1999/13/EC), the Large Combustion Plants Directive (LCPD) (2001/80/EC), and the Best Available Techniques (BATs) reference documents (BREFs). All these legislative acts are concerned with minimising pollution from industrial activities. Most of these legislative acts have furthermore been repealed and replaced by the IED at this stage, but are included in this assessment as the study period covers 2005-2014 during which time they were still in force.

They also include rules designed to prevent or reduce emissions into air, water and land and to prevent the generation of waste, in order to achieve a high level of protection of the environment as a whole. BREFs have been adopted for the production of pulp, paper and board (Commission implementing decision 2014/687/EU), large combustion plants (October, 2011), waste treatment (August 2006), surface treatment using organic solvents, including wood and wood products preservation with chemicals (August 2007), and wood-based panels (Commission implementing decision 2015/2119/EU). The relevant regulations (under the IED) set the conditions that industries should fulfil in order to receive permits, and Member States take the necessary measures to ensure that no installation is operated without a permit. The permit should include all the measures necessary to achieve a high level of environmental protection to ensure that the installation is operated in accordance with the general principles governing the basic obligations of the operator. The permit includes emission limit values for polluting substances, or equivalent mitigations measures, emission monitoring equipment and appropriate installations to prevent emissions to air, water, soil and groundwater. An important element of the permits is the requirement to adopt the BATs to achieve a high level of environmental protection. It should furthermore be noted that it is only the BATs that are presented on the Commission implementing decision, not the whole BREF reference document. 'BAT conclusions' is a document containing the parts of a BAT reference document (BREF) laying down the conclusions on best available techniques. These documents are the reference for setting the permit conditions to installations covered by the IED.

The Directive on the Limitation of Emissions of Certain Pollutants from Large Combustion Plants ("LCPD": Directive 2001/80/EC) also sets limits for emissions of pollutants (e.g. sulphur dioxide, nitrogen oxides and dust) emitted from large combustion plants. It requires significant cuts in emissions starting 2008, with some exclusions for the years 2008-2015, if the operator agrees to not operate the respective plant for more than 20.000 hours. The LCPD directive was replaced by the IED Directive with effect from 1 January 2016, but has been included here due to it being in effect during the study period 2005-2014.

The Waste Incineration Directive (2000/76/EC) aims at reducing negative effects on the environment caused by the incineration and co-incineration of waste. Respective incineration and co-incineration plants must have permits specifying, among other things, categories and quantity of waste to be able to carry out their activities. Limit values for air emissions are also set by this directive. Residues must be reduced to a minimum or recycled according to the directive. Member states are required to establish penalties in case of non-compliance. The Waste Incineration Directive was also replaced by the IED with effect from 7 January 2014 and has been included here due to it being in effect during the study period 2005-2014.

There is a substantial body of legislation related to ambient air quality and emissions to air. Among these are the Air Quality Framework Directive (96/62/EC), the ambient air quality and cleaner air directive (2008/50/EC) and the Clean Air Legislative package (consisting of a communication on the 'clean air programme for Europe' and three legislative proposals on emissions and air pollution). The Clean Air Legislative package covers aspects concerned with reducing national emissions of certain pollutants (European Commission 2013), limiting emissions into the air from medium-sized combustion plants below 50 MW such as energy plants (European Commission 2013). The Air Quality Framework Directives specifies all pollutants for which air quality standards and objectives that have to be introduced by Member States. The ambient air and cleaner air directive, while merging existing legislation into one single legal act, sets standards and target dates for reducing concentrations of fine particles. The total emission limit for four pollutants responsible for: acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia) are set by the National Emission Ceilings Directive (2001/81/EC) by each Member State. On-going discussion around the Clean Air Legislative package may however mean an extension of the emission limits past the present application deadline of 2020 as well as potentially new reduction commitments.

The Waste Framework Directive (2008/98/EC) establishes basic concepts and definitions related to waste management and introduces the extended producer responsibility and the polluter pays principle as well as two new recycling and recovery targets (concerning household waste as well as construction and demolition waste) to be achieved by 2020 at the latest. The two principles have direct cost implications for the industry as the principle of extended producer responsibility includes the acceptance of returned products and the waste that remains after those products have been used, as well as the subsequent management of the waste and financial responsibility for such activities. This includes obligation to provide publicly available information as to the extent a product is re-usable and recyclable. This principle leads to direct compliance costs, including administrative burdens due to information obligations. The polluter pays principle, which states that the costs of waste management shall be borne by the original waste producer or by the current or previous waste holders, also leads to substantive obligations for the forest based industry. Other waste-related legislation is concerned with landfill (Directive 99/31/EC and Decision 2000/738/EC), Waste Water Treatment (Directive 91/271/EEC), and packaging waste (PWD: Directive 94/62/EC).

It is, aside from industry-specific legislation, also relevant to note that some environmental policy and legislation affect the industries directly but at an earlier stage of the value chain. Amongst these is the Environment Action Programme, which has significantly shaped the development of the EU environment policy since the early 1970s and in extension also forest-based industries. The framework for the Seventh Environment Action Programme (7th EAP) was accepted by the Parliament and Council in 2013 (Decision, 1386/2013/EU), and it proposes nine priority (or thematic) objectives that draw on a number of recent initiatives in the field of environmental policy, including the Resource

Efficiency Roadmap (European Commission, 2011b), the EU 2020 Biodiversity Strategy (Resolution, 2011/2307(INI)) and the Low Carbon Economy Roadmap (European Commission, 2011a). These policy documents highlight the interrelations between different policy areas at different stages of the value chain, including stages that are not included in this assessment.

The legally binding **Natura 2000** network arguably represents a cornerstone of the EU environmental policy that, arguably, also affects earlier parts of the value chain not included in this assessment. It is composed of the Birds Directive (2009/147/EC), which sets out a bird-protection regime and the Habitats Directive (92/43/EEC), which sets out protection regime for habitats and other species on EU level. It aims to facilitate an integrated conservation approach that combines conservation goals with traditional land uses. The type of actions under the Natura 2000 network are principally seen as having indirect implications for the forest-based industries, especially as it may have caused prices for raw materials to increase. It was only evaluated on a qualitative basis in the in-depth interviews. It has been estimated that the amount of wood not available for industry due to biodiversity legislation is 68 million tonnes per year (EFI 2008).

The Environmental Liability Directive (2004/35/EC) establishes a framework, based on the polluter pays principle, to prevent or remedy environmental damage on protected species and natural habitats, water and soil. Companies carrying out dangerous activities as listed in the directive fall under strict liability, companies pursuing other activities not directly covered by the directive are liable for fault-based damage to protected species or natural habitats. This can create enforcement costs (however, not part of this cumulative assessment exercise) after a causal link between activities and damages have been established.

Phytosanitary regulations – covering a collection of food safety and animal and plant health related regulations – set criteria for goods entering the EU as these must be in accordance with sanitary and phytosanitary requirements to prevent the entry and spread of diseases and pests into new areas. In this case, forest-based industries may be affected when there are requirements for phytosanitary certificates for regulated articles. It is in particular manufacturers of wood packaging that are affected by specific rules targeting their products (wooden pallets and other wooden packaging) that incorporate the standard for phytosanitary treatment and related marking (e.g. ISPM 15 FAO/IPPC). For instance, any wood packaging for export must meet the requirements of the country where it was manufactured as well as the requirements of the destination country. Direct costs (fees, charges and administrative burden) are related to attaining a certificate as well as in that should a consignment fail inspection, the importer will have to carry the penalty cost.

Table 13 Overview of Environmental legislation

Package 3: Environment legislation													
	Pre 2004	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Group 1. Industrial Emissions													
Industrial Emissions Directive (Directive 2010/75/EU)								○			●		●
Reducing emissions of volatile organic compounds (VOCs) (Directive 1999/13/EC)	○●							●					
Waste incineration (Directive 2000/76/EC) replaced by the IED (Directive 2010/75/EU) but applicable until January 2014	○●							●				●	
Integrated pollution prevention and control (IPPC Directive) (Directive 2008/1/EC) replaced by the IED (Directive 2010/75/EU) but applicable until January 2014						○●						●	
Limitation of emissions of certain pollutants from large combustion plants (Directive 2001/80/EC)	○●												
Best Available Techniques References (BREFs)													
Production of Pulp, Paper and Board (Commission implementing decision 2014/687/EU)												○	
Production of Wood-based Panels (Final draft - July 2014)													○
Wood and Wood Products Preservation with Chemicals (Review just started)													
Waste Treatment (Reference document - August 2006)				○									

Package 3: Environment legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Surface Treatment using Organic Solvents (Reference document - August 2007)					○								
Group 2. Air Quality													
Clean Air Legislative package (COM/2013/918) ★											◆		
Proposal Directive on reduction of national emissions of certain atmospheric pollutants (COM/2013/920) ★											◆		
*Proposal Directive on the limitation of emissions of certain pollutants into the air from medium combustion plants (COM/2013/919)** ★											◆		○
Air Quality framework Directive (Directive 96/62/EC)	○●												
National Emission Ceilings (NEC) (Directive 2001/81/EC)	○●												
Ambient air quality and cleaner air for Europe (Directive 2008/50/EC)						○		●					
Group 3. Waste Management													
Waste Framework Directive (Directive 2008/98/EC)						○●							
Waste Water Treatment Directive (Directive 91/271/EEC)	○●												
Packaging and Packaging Waste Directive (Directive 94/62/EC)	○●												●
*Proposal for a new Packaging and Packaging Waste Directive (COM/2013/761)***											◆		○

Package 3: Environment legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
*Proposal for amending Directives 2008/98/EC on waste, 94/62/EC on packaging and packaging waste, 1999/31/EC on the landfill of waste, 2000/53/EC [...] (COM/2014/397)******												◆	
Landfill of waste (Directive 99/31/EC)	○●												
Implementation of Directive 1999/31/EC on the landfill of waste (Decision 2000/738/EC)	○●												
Group 4. Environment													
Environmental liability with regard to the prevention and remedying of environmental damage (Directive 2004/35/CE)	○●												
Phytosanitary Import Regulation (e.g., International Standards for Phytosanitary Measures No. 15 (ISPM 15) developed through the International Plant Protection Convention)	○●												
7th Environment Action Programme (Decision 1386/2013/EU) ★											○●		
Natura 2000 (including Habitats Directive 92/43; Birds Directive 2009/147) ★	○●						○	●					

○ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

* Please note that the proposal was adopted during this assessment as Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants.

** Please note that the proposal was adopted during this assessment as Directive (EU) 2015/720 of the European Parliament and of the Council of 29 April 2015 amending Directive 94/62/EC as regards reducing the consumption of lightweight plastic carrier bags.

*** Please note that the proposal on waste has been withdrawn and a new package has been proposed (see COM/2015/0593, COM/2015/0594, COM/2015/0595, COM/2015/0596).

4.4.2 Type of cost linked with the legislative package

Monetary obligations

Under the scheme of the IED, companies have to pay charges and fees associated with industrial activities at the national level that require a licence and/or emission permit. There are monitoring agencies and/or inspection requirements that may generate direct charges. These include for example costs related to the inspection and monitoring requirements or permits for incineration and co-incineration plants. Other costs can be associated with control, monitoring or inspection requirements linked to air quality standards. Taxes and fees might also apply when wastes end up in landfills, which vary according to national legislation.

Substantive obligations

Companies operating under a permit based on IED must invest in BATs. These may generate, in general terms, three types of cost in connection with investment costs (i.e. resources invested in the retrofitting of plants and/or in the adoption of more environmentally-friendly technologies), and operating expenses (i.e. incremental expenses associated with environmental protection investments, such as the maintenance of new equipment or facilities, or the implementation of other environmental protection measures, such as the incremental expenses associated with the use of higher quality raw materials).

Compliance costs arise for the forest-based industries because of establishing BATs for permitted installations. Permit conditions are regularly updated by Member States (see Art. 14/3). There are also compliance costs for permits as regards to waste treatment (incineration) for companies that treat waste themselves. Indirect costs only arise through an increased cost for employing waste-trading companies further down the value chain as well as upstream, where all supply of paper for recycling is also under the waste legislation.

The Air Quality Directive set limits for emissions to air and requires monitoring, control and emissions abatement equipment, such as exhaust fumes recycling and treatment, sulphur, dust and particulate matters removal, NOx and VOC catalytic burners, and process equipment that goes beyond "business-as-usual" practices. Personnel costs and other operating costs are also associated with the investments noted above.

Investments for waste-water treatment can include the installation of secondary or tertiary treatment and related measurement systems to monitor an installation. Investment is also necessary for collecting and processing returned products and wastes in accordance with the principle of extended producer responsibility. Personnel costs and other operating costs are also associated with these obligations. Indirect costs arise in the form of higher costs paid by operators as a result of the effects of EU environmental legislation on operators active in other stages of the value chain, typically suppliers of key inputs. In the case of EU environmental legislation, indirect costs relate to the higher prices of electricity paid by producers as a result of compliance costs incurred by power plants in order to conform to emission limits stipulated in EU legislation.

Administrative burden

Administrative burden associated with the IED refer to expenses that incur for the fulfilment of administrative obligations as stipulated in the legislation, such as the costs related to the registration, the notification or the permitting of certain activities or the costs sustained for the supply of data or information for monitoring or policy making purposes. Two categories of administrative burden incurred by producers were considered, namely, the costs associated with the issuance/renewal/updating of the Integrated Environmental Permits (IEP) and costs connected with carrying out of inspections for checking compliance with the conditions based on which the IEP was issued.

To comply with the waste management legislation, several documents and information should be provided depending on the type of product and the waste management method applied. These include:

the preparation of waste documentation for checks at landfill gates, the provision of publicly available information as to the extent to which the product is re-usable and recyclable, packaging and labelling of hazardous wastes as well as keeping records for the waste management of hazardous products, including information such as the quantity, nature and origin of the waste, and, where relevant, the destination, frequency of collection, mode of transport and treatment method foreseen in respect to the waste. This may generate a significant increase in administrative burden since companies producing or dealing with non-hazardous waste will have to keep records on the quantity, nature and origin of the waste.

Administrative burden associated with phytosanitary certification and inspection arise for those companies that import from non-EU countries (including wood, plants and plant products other than wood) and/or export to countries that require certification. For instance, if a specific good does not comply with the import requirements they may be rejected and companies would effectively loose the shipment. There is consequently an interest in ensuring that the phytosanitary certification is properly applied, which in turn generate an administrative burden for the company in question.

4.5 Package 4: Forest-related legislation

4.5.1 Overview of the legislative package

This assessment focuses on industries that are dependent on forest products (in this case woodworking as well as pulp, paper and paperboard industries) and on EU legislation that impose a direct cost for forest-based companies. It is as such relevant to note that the right to formulate forestry policy in the EU is retained by each Member State, which has its own national forest laws and regulations. Legal action with an impact on forest-based industries is as such principally taken in other policy areas (e.g. energy, climate and the environment). Nonetheless, despite the absence of a EU forest policy, there is the EU Forest Strategy and the now concluded Forest Action Plan (FAP) that as non-legally binding documents provided a framework for forest action. The new forest strategy was issued in September 2013 (European Commission, 2013b) and it responds to the new challenges facing the forest-based sector. The strategy identifies key principles needed to strengthen sustainable forest management and improve competitiveness and job creation, in particular in rural areas, while ensuring forest protection and delivery of ecosystem services. The strategy also specifies how the EU wishes to implement forest-related policy. One of the main developments has for example been to bring the forest strategy in line with the 20-20-20 targets. The strategy and the action plan is not part of this assessment, as it was not considered to generate any significant costs for the forest-based industries during the prioritisation process. It is only noted here as it provides a background for what is generally considered as forest-related policy at the EU level.

For this cost assessment, forest-related policy rather refers exclusively to the EU Timber Regulation (Regulations 995/2010, 607/2012 and 363/2012) and the Forest Law Enforcement, Governance and Trade (FLEGT) Regulations (Regulations 2173/2005 and 1024/2008), concerned with stopping the circulation of illegally logged wood. The FLEGT Regulations aims to reduce illegal logging by strengthening sustainable and legal forest management, improving governance and promoting trade in legally produced wood outside the EU. As part of the process to tackle these issues, the EU Action Plan for Forest Law Enforcement, Governance and Trade (the FLEGT Action Plan) was published in 2003 to help improve forest governance and reduce levels of illegal wood harvesting and related trade, including the prevention of the import of illegal wood into the EU from FLEGT partner countries. FLEGT's prime aim is to improve the supply of legal wood in those countries and to increase the demand for wood coming from responsibly managed forests. It also covers aspects such as promoting public procurement policies, supporting private-sector initiatives and . The FLEGT Action Plan, and especially its Voluntary Partnership Agreements (VPAs) between wood-producing countries and the EU, aims to ensure that wood from those countries being sold in the EU is verifiably legally logged and traded. VPAs are based on the national laws in each producing country (as bilateral trade agreements) and all have to date been endorsed by the national government, civil society and companies, as well as the main EU institutions (Commission, Council and Parliament). The VPAs ensure that wood can be traced back to its point of origin. This is foreseen via legality assurance schemes (LAS), which provide

traceability for any wood consignment from its point of origin in the forest right down to its point of export to the EU. At the latter, a "FLEGT legality licence" may be issued which must accompany that consignment to the EU and which forms part of the administrative procedure for release to the EU market.

The EU Timber Regulation (EUTR: Regulation, 995/2010) as part of the implementation of the FLEGT Action Plan, came into effect in 2013 . The EUTR lays down the obligations of operators who place wood and wood products on the EU market for the first time. It prohibits the selling of illegally harvested wood or wood products derived from such wood and requires those operators to exercise "due diligence". The EUTR outlines the due diligence obligations as a so-called Due Diligence System (DDS). To this end, operators may devise their own DDS or use a proprietary scheme, hired or loaned from a monitoring organisation (MO). Wood carrying a FLEGT licence, or CITIES permit, is considered to comply with the EUTR.

It furthermore requires traders (i.e. those downstream of the first placing on the EU market) of wood and wood products to keep records of their suppliers and customers. The Commission has also adopted procedural rules for the recognition and withdrawal of recognition of monitoring organisations (Commission Delegated Regulation 363/2012) and has also adopted an implementing regulation on the risk assessment and risk mitigation measures that are part of the due diligence system, as well as on the frequency and nature of checks that competent authorities will conduct on the monitoring organisations, to ensure they comply with all requirements (Commission Implementing Regulation 607/2012). In addition to the regulation itself, the Commission has also released the EU Timber Regulation Guidance Document in 2013 (European Commission 2013e). The Guidance Document provides explanations on certain aspects of the EUTR and it attempts to explain the provisions of the EUTR. For instance, the document defines operators according to how the wood is made available on the EU market, which varies depending on whether the wood is harvested inside or outside the EU.

Together, the EUTR and the other FLEGT regulations aim at preventing illegal wood being placed on the EU market, and thus indirectly to help promote sustainable forest management in countries which supply wood to the EU.

An independent evaluation on the effectiveness of the EU Timber Regulation - covering its first two years of implementation - has been published. (Terre Environnement Aménagement 2016). The EUTR evaluation report reviews the functioning and effectiveness of the EUTR according to the EU 'Better Regulation' guidelines. It notes, amongst other things, that the EUTR has been "highly relevant for tackling illegal logging and related trade by changing market behaviour patterns and progressively establishing supply chains free of illegally harvested timber".[21] However, it also notes that so far the overall implementation of the EUTR remains insufficient and that there are still four not fully compliant Member States, coupled together with them allocating insufficient resources to competent authorities in charge of enforcement of the EUTR. At the same time, awareness amongst the private sector still needs to improve, especially amongst SMEs and micro firms, whilst amongst those which are already aware of the EUTR and its implications, few - mostly the largest firms - engage monitoring organisations.

[21] See http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52016SC0033&from=EN.

Table 14 Overview of Forest-related legislation

Package 4: Forest-related legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Measures concerned with illegally logged wood													
EU Timber Regulation (Regulation 995/2010, Commission Implementing Regulation 607/2012 and Commission Delegated Regulation 363/2012)								○			●		
FLEGT Regulation (Council Regulation 2173/2005; Commission Regulation 1024/2008)			○●			○●							
A blueprint for the EU Forest-based Industries (woodworking, furniture, pulp & paper manufacturing and converting, printing) (SWD/2013/343) ★											◆		
Innovative and sustainable forest-based industries in the EU - A contribution to the EU's growth and jobs strategy (COM/2008/113) ★						◆							

○ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

4.5.2 Type of cost linked with the legislative package

Monetary obligations

The EUTR is not expected to generate any significant monetary obligations, as the associated costs are primarily associated with substantive and administrative burden, as will be outlined below. However, if a company has decided to outsource its due-diligence system, there may be fees and charges linked to the monitoring organisation in charge. Examples include using a system provided by a monitoring organisation and/or chain-of-custody certification schemes (e.g. PEFC Chain of Custody certification) to assist with compliance of EUTR requirements along the supply chain and as a tool to carry out risk assessment and risk mitigation in a due diligence system. However, it should be noted that outsourcing the DDS by buying such certified products does not mean outsourcing the liability for a firm to be in compliance with the DDS aspects of the EUTR. In this context, certification is only one tool to help address risk mitigation within a firm's overall due diligence approach.

FLEGT may include cover charges and fees associated with obtaining a validated FLEGT licence as part of the cost of certification for companies of the forest-based sectors.

Substantive obligations

Companies may have invested in new equipment and procedures, ranging from the procurement of new computers and software to developing new capacities for proper system implementation of the EUTR. This would for example concern capabilities to access information about the materials and/or assess and/or mitigate the risks associated with placing materials on the market as part of complying with EUTR requirements for a Due Diligence System (DDS).

While the FLEGT licensing system is set up in the producing country outside the EU, similar types of investments may be applicable to the FLEGT Regulations as part of developing due care procedures or wood legality assurance systems. Companies may invest in equipment or procedures aimed at eliminating illegally harvested wood from their supply chains.

Substantive costs may also include costs for maintaining these procedures and equipment acquired due to the EUTR and FLEGT.

Administrative burden

The most important impact from the EUTR is that it requires a proof of legality. That means the companies cannot do business-as-usual, where they just buy the products and expect them to be legal. Now they have to follow through and get verification of legality. Administrative burden are associated with personnel costs in connection with the operation of DDS systems or when assessing the risk of illegality of harvested wood and wood-based products.[22]

The FLEGT Action Plan includes a number of measures to ensure that wood and wood products imported into the EU have been legally harvested or manufactured from legally harvested wood. One of the key measures is a licensing scheme for the prevention of illegal logging and related trade coming into the European Union (EU). The licensing scheme is part of the VPAs that are negotiated with a number of countries. Administrative burdens are in this case associated with the personnel in charge of certification, practical strategies, tools and mechanisms to reduce the risk of importing illegal wood from the exporting country.

4.6 Package 5: Employment legislation

4.6.1 Overview of the legislative package

The EU complements policy initiatives taken by individual EU Member States by setting minimum standards in employment law. For forest-based industries, employment is as such influenced by

[22] Since printed products are not covered by the EUTR, non-EU producers putting printed products on the EU market do not have to carry the costs associated with compliance with the EUTR, which is to the disadvantage of EU producers.

several EU policies and measures. Amongst these is the Working Time Directive (Directive, 2003/88/EC) that aims at protecting workers' health and safety by establishing minimum standards applicable throughout the EU concerning working hours, including limits to weekly working hours and minimum daily rest periods. The Commission is currently reviewing the Working Time Directive and is carrying out an impact assessment, which builds on a previous consultation, studies and further analysis of possible options (European Commission, 2010), which may have implications for the future. For instance, basic rules governing the 48 hour limit on average weekly working hours, "on-call" rules, rights to daily rest breaks and paid annual leave, may bear costs for the industry.

Furthermore, there is a legal framework as regards to health and safety at work (Directive, 89/391/EEC), including the European Community Strategy for Health and Safety at Work for the 2007 to 2012 period (European Commission, 2007). This Strategy includes in particular Directive 2004/37/EC[23], Article 4(1) of which invokes the obligation on an employer to substitute a carcinogenic or mutagenic substance/mixture/process by a less hazardous one, insofar as it is technically possible, regardless of whether or not there is an OEL established in Annex III to that Directive. (This concerns substances/mixtures meeting the criteria for classification as a category 1A or 1B carcinogen/germ cell mutagen category 1A or 1B according to the CLP Regulation, regardless of whether or not there is a harmonised classification agreed at EU level, and also for so-called carcinogenic/mutagenic process-generated substances listed in Annex I to the Directive).

Directive 2004/37/EC also imposes an obligation on an employer to perform a risk assessment - of which a hazard assessment is a pre-condition (Article 3), as well as to provide workers' training (Article 11), including updates to take account of new or changed risks.

The Strategy has recently been updated by the adoption of the Strategic Framework on Health and Safety at Work 2014-2020 (European Commission, 2014a). In line with the Europe 2020 Strategy, the new framework identifies key challenges and strategic objectives for health and safety at work (e.g. prevention of work-related diseases), presents key actions (e.g. consolidating national health and safety strategies) and identifies instruments to address these (e.g. European Social Fund). The basis for the directive and subsequent strategies are to prevent risks, promote safer and healthier working conditions, with an emphasis on the well-being and health of workers. It also aims to improve company productivity and competitiveness.

Most of the arguments for worker health and safety are based on benefits; though it is stressed that the benefits of this legislation in providing protection are not covered by this CCA. However, it is important to remember that poor workplace safety and health costs money. What's more, case studies show that good OSH management in a business is linked to improved performance and profitability. For information on benefits, the reader may refer to the dedicated section of the EU OSHA web site on Good OSH is good for business (https://osha.europa.eu/en/themes/good-osh-is-good-for-business); Examples of the implementation, such as having to invest in occupational safety and health measures (e.g. training of personnel and having to buy new safety equipment). This is particularly relevant for some sub-sectors of the forest-based industries that are more labour-intensive and that may have riskier working environments than others. Examples concern carrying and handling heavy loads, the Classification, Labelling and Packaging (CLP) regulation and other types of exposure to chemicals, risks from loud noise and vibrations.

Three lists of indicative occupational exposure limits have been published since the year 2000 (Directive 2000/39/EC, 2006/15/EC, 2009/161/EC) as implementation of Directive 98/24/EC concerning risks related to chemical agents at work. Necessary preventive measures have to be taken and risks have to be reduced or eliminated in case chemical agents are present in a workplace. This can of course create costs both in terms of training on how to deal with chemicals as well as investments in equipment to prevent accidents.

[23] Directive 2004/37/EC of the European Parliament and of the Council of 29 April 2004 on the protection of workers from the risks related to exposure to carcinogens or mutagens at work (Sixth individual Directive within the meaning of Article 16(1) of Council Directive 89/391/EEC).

Table 15 Overview of Employment legislation

Package 5: Employment legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Group 1. Health and Safety at Work													
Working Time Directive (Directive 2003/88/EC)	○●												
Health and safety at work (Directive 89/391/EEC amended by 2007/30/EC)	○●												
First list of indicative occupational exposure limit values (Directive 2000/39/EC)	○●												
Second list of indicative occupational exposure limit values (Directive 2006/15/EC)				○	●								
Third list of indicative occupational exposure limit values (Directive 2009/161/EC)							○	●					

○ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

4.6.2 Type of cost linked with the legislative package

Monetary obligations

No specific monetary obligations have been identified for this package. However, depending on national legislation (e.g. social security systems), there may be fees, taxes or costs associated with ensuring health and safety in the workplace.

Substantive obligations

In order to comply with the health and safety standards and reduce risk, companies need to invest in safety equipment, including procedures to ensure the safety of the work equipment made available to workers, buying new personal protective equipment, or equipment to limit exposure to hazardous substances. Obligations include the provision of adequate, comprehensible information (e.g. written instructions) on the work equipment. There are also additional personnel and other operating costs for the maintenance and adaptation of equipment to meet changes in legislation or other systems to protect the health and safety of workers (e.g. risks related to chemical agents). Training is as such a recurring cost associated with health and safety standards.

Substantive costs associated with the Working Time Directive include procedures and equipment for extra protection for night work, systems put in place to monitor working hours, or protection and prevention facilities.

Generally speaking, requirements for health and safety are however most often part of a company's standard day-to-day practice and do not signify additional cost. Indicative examples are the requirement for good technical maintenance of the workplace, adequate hygiene conditions or good maintenance of equipment. In all these cases, this cost is regarded as "business as usual" and is excluded from the calculations.

Administrative burden

Administrative burdens associated with health and safety standards includes personnel costs for the preparation of audits and carrying out regular health checks, as well as for personnel in charge of assessing whether protective equipment satisfies all requirements, or developing new measures for handling hazardous substances, such as training on equipment having specified risks or on how to handle chemical agents.

The Working Time Directive generates an administrative burden associated with obligations to inform the authorities responsible for health and safety matters if the company is using night-time workers frequently, as well as personnel in charge of monitoring of working hours. Forest-based companies are also affected by obligations to ensure that they do not exceed the legal limit, rules governing "on-call" time (when the worker is on call) and the opt-out (the right of workers to opt out of the maximum 48-hour working week) from the Directive.

4.7 Package 6: Products legislation

4.7.1 Overview of the legislative package

There are several significant regulations that have a direct impact on how products can be developed and produced by forest-based companies. Amongst others, these include voluntary instruments, such as the EU Eco-labels (Regulation 880/92, 1980/2000, 66/2010) for tissue paper, converted paper products, newsprint paper, printed paper, copying and graphic paper and for wooden furniture and wooden floor coverings. Fees apply for the Eco-labelling process, however, since labelling is voluntary, companies may choose not to get a license.

In order to improve consumer product safety, the EU has applied a General Products and Safety Directive (2001/95/EC). The main requirement of the Directive is that companies must ensure that items on sale are safe for consumers and to take corrective action and inform consumers of the risks

associated with the products they supply when that is found not to be the case. They must take appropriate measures to reduce such risks and be able to trace dangerous products. Standards under this directive have been developed to further insure consumers' safety.

EU regulations have also been adopted as regards food packaging and food safety. Among these, two are particularly relevant for the forest-based industries producing products and materials that come into contact with food. Regulation (1935/2004) provides for a harmonised EU legal framework by laying down common rules for packaging materials and articles intended to come into contact with food. This is to avoid that food be contaminated, since that can be harmful to human health, and also that the food composition, taste and odour are not changed in unacceptable ways. 17 groups of materials and articles (including cork) were identified by this regulation where specific measures have to be adopted. Furthermore, the Good Manufacturing Practice (Directive 2003/94/EC) for materials and articles intended to come in contact with food (Regulation 2023/2006) provides for a well-controlled manufacturing process in conformity with regulation 1935/2004 through all stages of the manufacturing chain as related to food contact materials.

The Tobacco Products Directive (2001/37/EC; 2014/40/EU) was included as part of the legislation concerned with packaging, as it sets in place more stringent rules specifically for tobacco and related products, such as pack design, including shape, size and materials. The directive lays down rules for the manufacture, presentation and sale of tobacco and related products. For instance, producing companies are obliged to hand in detailed reports on ingredients used in their tobacco products.

Other cornerstones for product-related policies are measures that relate to human health. EU chemicals legislation applies to all sectors including the forest-based industries and deals with chemicals along e entire supply chains. Most important amongst these may be the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Regulation 1907/2006; 2013/505/EU), which provides a comprehensive legislative framework for chemicals manufacture and use in Europe. It introduced an integrated system of registration and authorisation for all chemical substances and products containing chemical substances produced or supplied in the EU. In addition, previous legislation regulating restricted chemicals was introduced in REACH. It has shifted the responsibility for ensuring that chemicals produced, imported into, sold and used in the EU are safe from public authorities to the industry.

REACH has assigned technical, scientific and administrative aspects of the implementation of the regulation to a EU agency, the European Chemicals Agency (ECHA). Companies manufacturing or importing chemicals in quantities of one tonne or more per year must register in a central database . To obtain the right to market, companies should provide information on the properties of substances as well as the management measures for a proper use and handling. This information varies according to the tonnages in which the specific substances are manufactured or imported. Firms are also requested to identify and manage hazards linked to substances manufactured or marketed in the EU. Companies must identify and manage any hazards linked to the substances they manufacture and market in the EU and the associated risks. They must demonstrate how to use their products safely and inform users of any risk management measures they should take to ensure safe use throughout the supply chain.

The Biocidal Product Regulation (ECHA Regulation 528/2012) concerns the placing on the market and use of biocidal products. All those products require authorisation before they can be placed on the EU market. A dedicated register is used for submitting applications and to exchange data and information between companies, ECHA and Member States.

The Classification, Labelling and Packaging (CLP: Regulation 1272/2008) entered into force in January 2009. It has progressively replaced previous legislation on dangerous substances (amended twice, in 2010 and 2015) and became fully effective in 2015. It ensures that hazards linked to chemicals are clearly communicated to EU workers and consumers. The CLP classification and labelling method is based on the United Nations' Globally Harmonised System. Any supplier of chemicals must classify, label and package substances and mixtures according to the CLP Regulation. Obligations apply along

the whole supply chain and each operator (such as manufacturers, distributors, transporters, manufacturers of mixtures) must abide by these rules. When a hazardous substance is placed on the market, ECHA must be notified of its classification and labelling within one month of placing the substance on the market for the first time. The classification of substances and preparations placed on the market depends on the toxicology and the hazard of the substance. The classification of substances can be reviewed on a voluntary basis (self-classification) or at the demand of national authorities, in some cases, the decision on the classification of substances is even taken at Community level. Directive 2014/27/EU amended legislation referring to a previous classification and labelling system in accordance with the CLP Regulation.

Directive 2004/18/EC laid down the rules for an open market regarding public procurement and the application of rules for the award of public works, supplies and services contracts. Under it, thresholds for public procurement contracts were calculated anew every two years and the process of bidding for public contracts was improved and made less costly and bureaucratic, thus enabling companies to compete more effectively. It has since been repealed and replaced by Directive 2014/24/EU on public procurement, which came into effect in April 2016.

In 2013, the Commission launched a new initiative on a Single Market for Green Products Facilitating better information on the environmental performance of products and organisations (COM/2013/196). The initiative addresses barriers faced by companies that want to market green products in different countries since they would need to comply with different schemes that are in place. A three-year testing period to develop product- and sector-specific rules was launched to overcome these problems. A Commission recommendation regarding the use of common methods to measure and communicate the life-cycle environmental performance of products and organisations accompanies that communication.

The legal framework guiding construction products is the Construction Products Regulation (305/2011), which repealed Council Directive 89/106/EEC. This regulation sets out the conditions for marketing construction products and the related use of CE marking. Furthermore, criteria for assessing construction products' performance are outlined. Certain obligations are also put on operators. For example, manufacturers must provide a performance declaration and technical documentation, and affix the CE marking to the product. Importers and distributers must both check that the product is accompanied by technical documentation and that it bears the CE marking. This regulation is also accompanied by a Strategy for the Sustainable Competitiveness of the Construction Sector (European Commission 2012), so as to support the construction sector in meeting its challenges as part of the Europe 2020 initiative, as well as to further strengthen the construction sector and so reduce distortions (e.g. lacking common objectives, data and the mutual recognition of approaches) in an effort to boost competitiveness and support sustainable growth in the sector.

The construction sector is also significantly inter-linked with energy policy, such as the Energy Efficiency Directive, given that buildings are responsible for 40% of energy consumption and 36% of CO2 emissions in the EU. Directive 2010/31/EU on the energy performance of buildings (amending Directive 2002/91/EC) aims at improving the energy efficiency of buildings in the EU. Energy used for heating, hot water, cooling, ventilation and lighting is covered. For instance, EU countries are obliged to establish inspection schemes for heating and air-conditioning systems.

Table 16 Overview of Products legislation

Package 6: Products legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Group 1. Production													
EU Eco-label (Regulation No 880/92; 1980/2000; 66/2010)	○●						●○	●					
Eco-label for converted paper products (Commission decision 2014/256/EU)												○●	
Eco-label for wooden furniture (Commission decision 2009/894/EC)							○●						
Eco-label for wooden floor coverings (Commission decision 2010/18/EC)								○●					
Eco-label for newsprint paper (Commission decision 2012/448/EU)										○●			
Eco-label for printed paper (Commission decision 2012/481/EU)										○●			
Eco-label for copying and graphic paper (Commission decision 2011/333/EU)									○●				
Commission Recommendation on the use of common methods to measure and communicate the life cycle environmental performance of products and organisations (2013/179/EU)											○●		
Group 2. Protection of human health													
General product safety (Directive 2001/95/EC; Commission communication 2014/C 220/02; Directive 87/357/EEC)	○●												

Package 6: Products legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) (Regulation 1907/2006; Commission Implementing Decision 2013/505/EU)				○●							○●		
Biocidal Product Regulation (ECHA) (Regulation 528/2012)										○	●		
Regulation on classification, labelling and packaging of substances and mixtures (CLP Regulation) (Regulation 1272/2008)						○	●						●
Group 3. Packaging													
Regulation on materials and articles intended to come into contact with food (Regulation 1935/2004)		○		●									
Good Manufacturing Practice for materials and articles intended to come in contact with food (Commission Regulation 2023/2006)				○		○							
Tobacco Products Directive (Directive 2001/37/EC; 2014/40/EU)	○●											○	
Group 4. Construction													
Construction Products Regulation (CPR) (Regulation 305/2011; 89/106/EEC)	○●								●●				
Energy performance of buildings (Commission Delegated Regulation 244/2012; Directive 2010/31/EU; 2002/91/EC)	○			●				●		●			
Strategy for the sustainable competitiveness of the construction sector and its enterprises (COM/2012/433) ★										◆			

Package 6: Products legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Resource efficiency opportunities in the building sector (COM/2014/445) ★												◆	
Group 5. Other measures													
Public works contracts, public supply contracts and public service contracts (Directive 2004/18/EC)	◎		●									●	
Building the Single Market for Green Products Facilitating better information on the environmental performance of products and organisations (COM/2013/196) ★											◆		

◎ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

4.7.2 Type of cost linked with the legislative package

Monetary obligations

Monetary obligations are mainly related to the registration and/or certification cost associated with some products. These can include fees associated with attaining an Energy Performance Certificates under the Directive on Energy Performance of Buildings and fees associated with applications for authorisation of a new substance to come into contact with food or an annual license fee associated with labelling products under the EU Eco-label.

According to the requirements of REACH, CLP and Biocidal Products, all substances registered by ECHA are subject to a fee. The registration fees vary, depending on the volume of substances — the higher the volume the higher the fees — and the size of companies — so that small and medium sized companies pay less than large companies[24]. Fees are determined based on four categories of tonnage, namely 1-10 tonnes/year, 10-100 tonnes/year, 100-1000 tonnes/year, and over 1000 tonnes/year.

Net registration fees paid to register chemical substances also includes dossier costs (cost of the dossier information) sometimes paid through a letter of Access agreement (LOA).

The CLP Regulation foresees that fees are set for requests to use an alternative chemical name and for requests for harmonisation of classification and labelling of substances in the EU. For both fees, small and medium sized reductions are foreseen for each company size category (medium, small and micro sized).

Substantive obligations

Changes in the standards for products and substitution of materials often requires changes in the production methods, testing and the design of products, generating additional capital expenditures, employment costs and operating costs at company level.

REACH, CLP regulation – as did their precursory regulations - typically generate capital expenditures and operating costs related to testing, investments in laboratory equipment, employment, labelling equipment, databases, printing, staff training etc. It may also require changes in the companies using or manufacturing the chemicals as new risk management measures may be required (e.g. personal protective equipment).

Eco-label regulations, being entirely voluntary, do not impose any specific obligation on operators and they do not have any immediate impact on the forest-based industries. However, being aimed at orienting consumers' preferences, they may nonetheless exert a significant influence. This is particularly the case when eco-labels and are used in public procurement, which for certain products accounts for a large share of their final consumption. Substantive costs associated with eco-labels include costs from life-cycle assessment, training of personnel to fulfil eco-design requirements, obligations connected to distribution and labelling, or providing information about product supply chains.

Substantive costs associated with the regulation on construction products and energy performance of buildings include investments in systems for the Assessment and Verification of Constancy of Performance (AVCP – under Regulation (EU) No 305/2011) or upgrading technical building systems to comply with energy performance requirements. This would include personnel costs associated with maintaining the AVCP system and regular inspections of heating and air-conditioning systems.

The Food Contact Directive may include investment in procedures and equipment that allow companies to trace and label food-contact materials or specific measures adopted for controlled materials and articles, or establishing a quality-assurance system and a quality-control system. It

[24] It should be noted that, as regards all types of cost arising from REACH, costs for SMEs may be under-estimated, as indicated in the study: "Monitoring the impacts of REACH on innovation, competitiveness and SMEs" (see http://ec.europa.eu/growth/sectors/chemicals/reach/studies/index_en.htm).

would also include costs for maintaining any quality-assurance system and quality-control system in place. Related external laboratory cost may also arise, since limit values and related testing methods are not harmonised and companies operating in the Single Market may have to multiply compliance testing for countries they sell into.

Administrative burden

Information obligations are an important aspect of the cost generated by the legislation in this group. The most common requirement across the various pieces of legislation is the issue of a declaration, or the application for a certificate of compliance with the standardised specifications defined in the regulation. The declaration or the application should be accompanied by the necessary documentation, creating costs across the whole supply chain, as all firms contributing to the production of the product should provide the necessary documentation and should be properly certified for their products. For some products, the information requirements are quite demanding, as the preparation of a product safety report is required.

During the pre-registration phase of REACH, the cost is mainly related to the time spent by personnel in familiarising themselves with the requirements and the registration process, and to gather and fill in the information using the online system. During the registration phase, the cost increases involve the preparation of dossiers providing extensive amount of information that include: substance identity, physicochemical properties, mammalian toxicity, eco-toxicity, and environmental fate (including abiotic and biotic degradation), information on manufacture and uses, and risk management measures. To avoid overspending and duplication of costs, REACH imposes that manufacturers and importers of substances share available data. Each registrant who manufactures or imports a substance must sell the available data it owns, or purchase data owned by others, by participating in a Substance Information Exchange Forum (SIEF).

The various types of administrative cost are: personnel cost associated with the representation at a SIEF; supply chain communication to identify exposure scenarios, data gathering and elaboration; preparation of the chemical safety report or contributing to the costs of preparing the shared components of a registration dossier; production of extended safety data sheets, and supply of revised safety data sheets to downstream customers[25]. It also includes costs associated with the purchase of data from other members of the SIEF, using consultants to prepare registration dossiers, and contracting with companies, and the preparation and submission of complex dossiers, which requires certified laboratories for testing.

Authorisation of Substances of Very High Concern (SVHC), as foreseen in REACH legislation, requires the action of competent authorities', ECHA and the European Commission. These include: response to Candidate List consultations, preparation of chemical safety assessments and justifications for authorisation, and opinions of the ECHA Committees. The authorisation to use a SVHC for a certain period is granted by the European Commission.

Companies also have information obligations under the legislation regulating the classification, labelling and packaging of substances and mixtures (CLP). Their obligations might include the preparation of harmonised classification dossiers; notification to the C&L inventory; informing consumers and downstream users; proposing new harmonised hazard classification.

Administrative burdens associated with the regulation on construction products and energy performance of buildings include: personnel for the AVCP and issuance of the declarations of performance or personnel needed to calculate the energy performance of buildings. It could also include costs associated with documenting the performance of products, training staff to do an AVCP or on the methodology for calculating the energy performance of buildings.

[25] It should be stressed that the amount of information depends on the tonnage band. Higher volumes require more information.

The Food Contact Directive may include personnel to check compliance, ensure traceability and labelling of active and intelligent materials and articles, or managing any quality assurance system in place. It could also include costs associated with maintaining documentation regarding the specifications, manufacturing formulae and product processing, as well as the training of personnel to manage the quality-assurance system and a quality-control system.

4.8 Package 7: Transport legislation

4.8.1 Overview of the legislative package

Transport policies have been noted as a significant (direct and indirect) cost for forest-based industries as well as being interlinked with other policy areas, such as climate and energy. Amongst the policies included in this legislative package is the legislation for regulating sulphur content of marine fuels (Directive 2012/33/EU), waste shipment (Regulation 1013/2006) and road safety for national and international journeys (Directive 2015/719, 2002/7/EC; 96/53/EC, Regulation 661/2009; 1230/2012)

The Directive regulating the sulphur content of marine fuels imposes indirect costs for some sub-sectors in the forest-based industries as investments costs are passed on. In this case, Member States have to ensure that ships in the Baltic, the North Sea and the English Channel are using fuels with a sulphur content of no more than 0,1% since the beginning of 2015. Higher sulphur contents are still possible, but only if the appropriate exhaust cleaning systems are in place. As with many other directives in this assessment, the argumentation for the sulphur directive is in terms of public health benefits, however, these types of opportunity costs are not reflected.

There is furthermore the Waste Shipment Regulation (Regulation, 1013/2006), which covers procedures for trans-boundary shipments. This regulation implements the provisions of the Basel Convention and includes a ban on the export of hazardous wastes to non-OECD countries and the export of waste for disposal. Different regimes apply to shipments of wastes for disposal and for recovery, as well as to hazardous and “green-listed” (non-hazardous) wastes. The regulation was amended in 2014 (Regulation, 660/2014) and aims at strengthening, simplifying and specifying the procedures for controlling waste shipments to improve environmental protection. It sets out a system of control for the movement of waste. The Regulation specifies the documentation to be provided and the security measures to be taken during transportation. The system must take into account the principles of self-sufficiency, proximity of waste for disposal and prior informed consent. This should reduce the risk of waste shipments not being controlled. The Regulation concerns almost all types of waste shipped, including national and transit transports, except radioactive waste and a few other types of waste.

The transport package is also concerned with road-haulage specifications, which affect for example the dimensions and maximum weights authorised for transport (Directive 2002/7/EC appealing directive 96/53/EC), common rules for certain types of carriage of goods, speed limitations and testing of exhaust emissions, etc. (e.g., Directive, 2006/94/EC, and 2006/38/EC). There is currently an on-going review of the road haulage directive and a report was released in 2015 concerning the proposal for a new directive (Parliament, 2015), which may have some implications when considering future developments.

Table 17 Overview of Transport legislation

Package 7: Transport legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Sulphur content of marine fuels (Directive 2012/33/EU; Directive 2005/33/EC; Directive 1999/32/EC)	○●		●	●						●		●	
Waste Shipment (Regulation 1013/2006)				○●									
Road safety: dimensions and maximum weights authorised for both national and international journeys (Directive 2015/719, 2002/7/EC; 96/53/EC, Regulation 661/2009; 1230/2012)	○●												

○ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

4.8.2 Type of cost linked with the legislative package

Monetary obligations

Monetary obligations are mainly associated with the "sulphur tax" and other related fees, such as charges for determining notifications under the Waste Shipment Regulation.

Substantive burden

The "Sulphur Directive" has raised some concern among shipping lines, as they fear that the reduction of the sulphur content in marine fuels to 0.1% by 2015 might lead to a serious disruption of the commercial dynamics of shipping in the Emission Control Areas (ECAs) and a considerable increase in vessel operating costs, as well as a lower competitiveness compared to other modes. This could mean a modal shift from sea to road, which would contradict the EC objective of promoting the use of sea and short sea transport. The types of substantive costs that can be found include investments in emission-abatement technologies, exhaust-gas cleaning systems, or other types of filtering equipment. It can also cover the maintenance of any filtering equipment that has been installed.

The Waste Shipment Regulation requires a financial guarantee or insurance and may include investments in infrastructure as all companies have a duty to manage the process in a way that protects the environment and human health. This would include the temporary storage, or recovery or disposal operations included in transporting waste, as well as systems to track and monitor the movement of non-hazardous or "green list" wastes. There are furthermore requirements to send notification (generating a notification cost) to obtain consent from the environmental regulator for the country from which the waste is being sent and the environmental regulator for the country where the waste is being received.

Road haulage rules, as regards the dimensions and maximum weights authorised for both national and international journeys, include investments related to requirements in dimensions and weights of vehicles, or proof of fulfilment by having two number plates for each vehicle.

Administrative burden

The directive on sulphur content of marine fuels generate costs concerned with the inspections on the sulphur content of marine fuel or the personnel in charge of filtering equipment.

The Waste Shipment Regulation generates an administrative burden in connection with registering shipment data after consent has been given and any training of personnel to manage, track and/or monitor the movement of wastes. Administrative burdens for road haulage rules also include training of personnel or on new vehicles.

4.9 Package 8: Trade legislation

4.9.1 Overview of the legislative package

In accordance with the World Trade Organization, the EU applies trade defence instruments that affect the operations of any enterprise, including those in the forest-based industries. The Commission monitors the application of trade defence instruments and follows up on the enforcement of measures. This includes anti-dumping and anti-subsidy measures (Regulation, 1225/2009, Regulation, 597/2009) to re-establish a competitive environment for the EU industry when harmed by dumped or subsided imports. A general concern for the EU forest-based industries is that competition with third countries is negatively affected by unfair trading practices that make other country products more competitive. Moreover, as noted in a comparative analysis[26], the EU's "lesser-duty rule", which limits the effects of the anti-dumping duty to the level of domestic injury caused by dumped imports, results in a lower average duty level in EU cases. When compared to the United States of America in terms of

[26] Rovegno, L. and H. Vandenbussche. 2011. A comparative analysis of EU Antidumping rules and application, Discussion Paper 2011-23, IRES, Université Catholique de Louvain.

the "Sunset Clause", which limits the duration of protection to five years, the EU presents a lower share of measures lasting beyond this limit as compared to other users of anti-dumping.

Irrespective of its trade defence instruments, the EU has common tariffs for all forest products (Regulation 2658/87, 2015/1754). For most forest products, the tariff level is zero, with the exception of some manufactured wooden and furniture goods. However, this also relates to tariff barriers and duties that applies to exports and protectionist subsidies for rival goods from the non-EU forest-based industries, e.g. export duties on roundwood were raised from 2.5 to 10 € per cubic meter from 2005 to 2010. This may create an uneven playing field that restricts forest products trade, and decrease the forest-based sectors competitiveness. For example, some sub-sectors face both duties on imported raw materials and semi-finished products as fixed by the EU, and tariffs on exports of finished products as fixed by foreign countries (European Commission, 2013a).

It should be noted that the trade legislative package was only prioritised by the pulp, paper and paperboard sector.

Table 18 Overview of Trade legislation

Package 8: Trade legislation	Pre 2004	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Trade Defence Instruments ★													
Anti-dumping (Regulation 1225/2009) ★							⊙	●					
Anti-subsidy (Regulation 597/2009) ★							⊙●						
Safeguards (against WTO members) (Regulation 260/2009) ★							⊙●						●
Safeguards (against non-WTO members) (Regulation 625/2009) ★							⊙●						●
Tariffs related to F-BI material, semi-products and final products (Regulation 2658/87, 2015/1754, SWD/2013/343)*	⊙●										◆		⊙

⊙ Adoption ● Transposition or enforcement by competent authorities; ● Repealed or amended; ★ Assessed qualitatively; ◆ Published and/or forwarded to the Parliament and/or Council.

* For more information please see the Commission Implementing Regulation on the tariff and statistical nomenclature and on the Common Customs Tariff (2015/1754) and the Market Access Database (http://madb.europa.eu/madb/euTariffs.htm).

4.9.2 Type of cost linked with the legislative package

Monetary obligations

Tariffs related to F-BI materials, semi-finished products and final products (SWD/2013/343) concern producers that face both duties on imported materials and tariffs in countries to which they export finished products.

The Trade Defence Instruments were only assessed qualitatively in this assessment.

Administrative burden

In this case, it was found that the trade legislative package did not generate any substantive obligations for pulp, paper and paperboard companies but that there is a marginal administrative burden associated with the package. Administrative costs are interlinked with costs associated with export procedure for goods leaving the EC customs territory. It can also be associated with tariffs related to F-BI material where, for example, lengthy administrative checks, may contribute to an increase in cost of trade in goods as well as creating an administrative burden for companies that are engaged in activities covered by EU customs legislation. These administrative costs are as such not generated by EU legislation but rather by the need to comply with import regulations in countries outside the EU.

5 Results of the cumulative cost assessment of the EU F-BI

This chapter provides an overview of the cumulative cost borne by the selected woodworking and pulp, paper and paperboard sub-sectors due to EU legislation. The costs have been estimated based on the methodology presented in Chapter 3 for each of the legislative packages outlined in Chapter 4.

5.1 Cumulative cost assessment for the overall woodworking sector

5.1.1 Scope

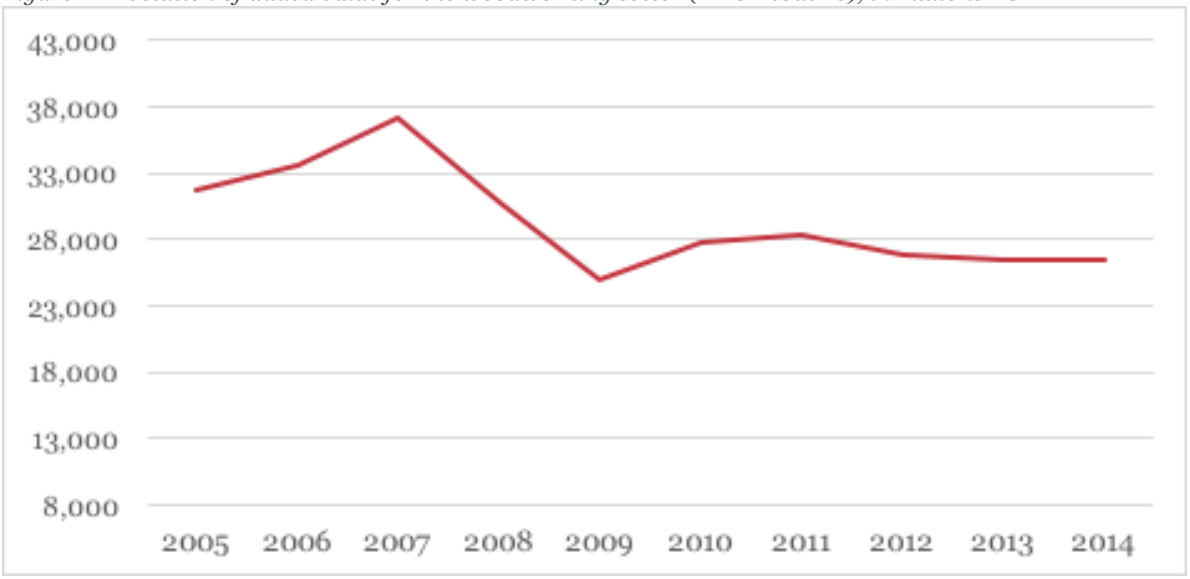
The section on the cumulative cost assessment for the overall woodworking sector provides an aggregated picture of EU regulatory costs (by a weighted sum of the values from each sub-sector, using turnover share as a weight) over the period 2005-2014 for the following sub-sectors:

- 16.1 Manufacture of sawmilling and planning of wood;
- 16.21 Manufacture of veneer sheets and wood-based panels;
- 16.23 Manufacture of other builders' carpentry and joinery;
- 16.24 Manufacture of wooden pallets and other wooden packaging.

The next sections will further cover each of these sub-sectors independently.

For the woodworking sector and its sub-sectors (as mentioned above), the following sections provide an evolution of the share of regulatory cost as a percentage of added value over the time period (2005-2014). It is important to note that, while it certainly illustrates the evolution of regulatory costs over ten years, the trend will also be impacted by the evolution of the ratio's denominator, i.e. the added value of the sector. As a matter of fact, recurrent peaks of regulatory costs as percentage of added value in 2009 may hence reflect the drop in added value due to the financial crisis and its subsequent difficult business environment. Nevertheless, although conclusions cannot be drawn on whether there has been a peak in regulatory costs per se for such a year, it is correct to mention that the share of regulatory costs (reflecting the regulatory burden) on added value has increased. The evolution of added value (denominator of all cost ratio), from 2005 to 2014, is as follows:

Figure 22 Evolution of added value for the woodworking sector (NACE code 16), in millions EUR



Source: Eurostat, Structural Business Statistics, last available data

5.1.2 Direct regulatory costs for the overall woodworking sector

The following six legislative packages were prioritised for the overall woodworking sector: climate and energy, environment, forest-related, employment, products and transport. Results highlighted two main legislative packages, namely, environment (mostly OPEX) and climate and energy (consisting of significant monetary obligations, CAPEX and OPEX) as the most important in terms of generating costs.

Regulatory costs for the sub-sector reach 1.25% of turnover, 4.72% of added value and 13.71% of gross operating surplus of companies, which can be broken down between legislative packages and cost categories as follows:

Table 19 Costs for the overall woodworking sector by package and comparison with main financial indicators – annual average for 2005-2014

	% Turnover	% AV	% GOS	Share of total regulatory costs
Climate & Energy	0.45%	1.71%	4.97%	36.3%
Environment	0.52%	1.96%	5.68%	41.4%
Forest	0.01%	0.05%	0.16%	1.2%
Employment	0.08%	0.29%	0.84%	6.2%
Product	0.12%	0.46%	1.34%	9.7%
Transport	0.07%	0.25%	0.72%	5.2%
Total	**1.25%**	**4.72%**	**13.71%**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

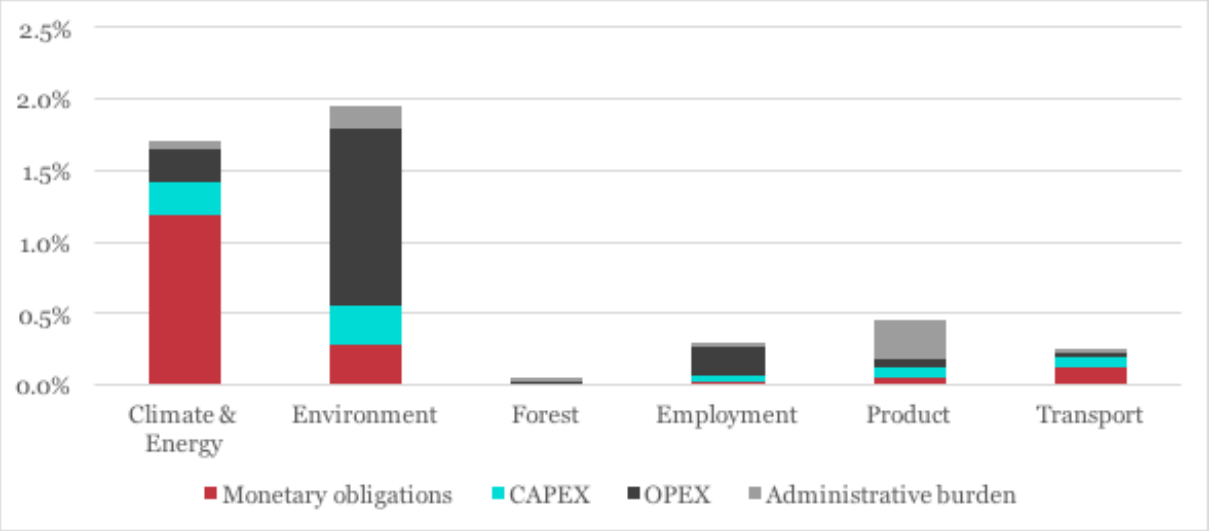
Table 20 Costs for the overall woodworking sector by cost category and comparison with main financial indicators – annual average for 2005-2014

	% of turnover	% of AV	% of GOS
Monetary obligations	0.4%	1.7%	4.8%
CAPEX	0.2%	0.7%	2.1%
OPEX	0.5%	1.7%	5.0%
Administrative burden	0.2%	0.6%	1.8%
Total	**1.3%**	**4.7%**	**13.7%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

Costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the regulatory costs.

Figure 23 Regulatory costs for the overall woodworking sector as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

The **environment legislative package** is the most important package, accounting for 41.4% of total regulatory costs for the overall woodworking sector (1.96% of added value). This large share of costs is attributable to large amounts of operating costs which are related to efforts in reducing volatile organic compound (VOC) emissions. For instance, oriented strand boards (OSB) are built of layers of strands bonded with a resin. These types of panels are primarily used in construction, roofing or as packaging material. The prevailing technology used to manufacture these panels causes the emission of VOCs during the production process as well as during the panels lifecycle. Costs are generated for companies when they invest in more environmentally-friendly production processes that decrease VOC emissions from resins. Operating costs also arise in relation to the EU environmental legislation because of the sub-sectors exposure to the Industrial Emissions Directive.

The **climate and energy package** accounts for 36.3% of total regulatory costs for the overall woodworking sector (1.71% of added value). This large share of costs is attributable to high rate of monetary obligations, mostly driven by the Renewable Energy Directive and the Energy Taxation Directive (ETD). Since the woodworking industry is quite energy-intensive, larger fees associated with the ETD apply directly to this sub-sector. The ETD covers sectors not covered under Emissions Trading System (ETS), such as e.g. the wood-based panels companies, by imposing a minimum tax rate based on the CO2 and the energy content of the energy consumed. These taxes are accompanied by a small amount of administrative burden. Larger companies are also effected by the Energy Efficiency Directive that oblige companies to conduct independent energy audits every four years, generating administrative burden starting from 2014.

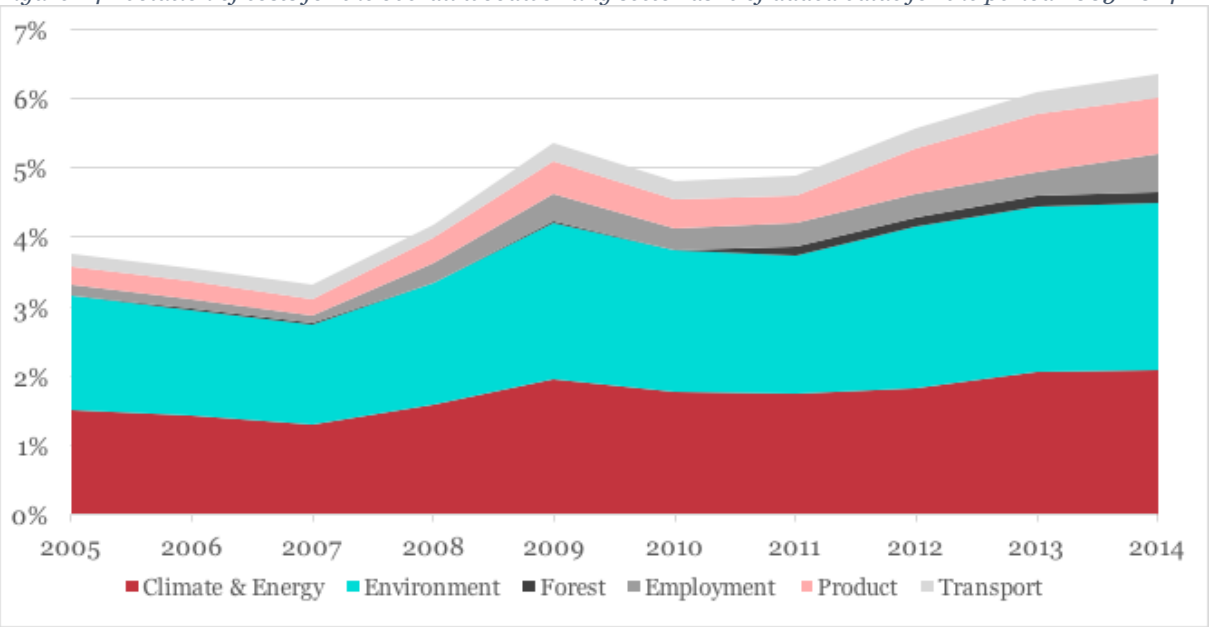
The **product legislative package** represents 9.7% of total regulatory costs of the legislation (0.46% of added value) and relate to, inter alia, the Construction Products Regulation and Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH). Significant administrative burden can be generated by these regulations in some cases, that are associated with information obligations, such as requirements for a declaration, or the application for a certificate, of compliance with the standardised specifications defined in the regulations. These declarations or the applications need to be accompanied with the necessary documentation (creating costs across the whole supply chain) as all

companies contributing to the production of the product need to provide the necessary documentation and should properly certify their products. This creates the notably high administrative burden for the carpentry and joinery sub-sector.

Other packages including **employment, transport and forest-related** legislation have less impact on the overall woodworking sector. It should be noted that for the forest-related legislation, in particular the application of the EU Timber Regulation, sawmill companies expressed that is was difficult to estimate the impact of the regulation in terms of costs. In line with previous findings, it has furthermore been noted that large companies may have found it easier to adopt new requirements (e.g. establishing a due diligence system) in contrast to small and medium-sized companies that have comparatively lower turnover to cover additional costs (European Commission (2016e).

Figure 24 presents a visualisation of the evolution of costs as a share of turnover over time (period 2005-2014) based on data from the panel of companies. The thickness of a layer is proportional to the share of the corresponding package in the total costs of the sector. The figure should be interpreted with caution, as this is an estimate of the trend based on a subset of companies and their recollections of past costs. While the thickness of layers is obtained based on primary data from the in-depth interviews (companies' books) and adjusted with the online survey, the evolution of costs over time only results from the in-depth survey (companies' books). Economic indicators of turnover and added value were sourced from Eurostat, Structural Business Statistics. Furthermore, investment costs were annualised using straight-line depreciation. Hence, it provides an idea of how costs have evolved over time for the different legislative packages and should be interpreted only for identifying years or periods over which larger costs are observed.

Figure 24 Evolution of costs for the overall woodworking sector as % of added value for the period 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

The analysis of cost trends between 2005 and 2014 demonstrate that costs relating to the climate and energy legislative package have dropped in 2007, rising again in 2008 and 2009 and again dropping slightly until 2012 with a new cost peak in 2013, which may be due to the evolution of the denominator of added value. Beyond the evolution of the added value of denominator, factors that may affect the evolution of regulatory costs relate to the European Union establishing, in 2008, a series of climate and energy targets, better known as the "20-20-20" targets, to be met by 2020 in its pathway towards a low-carbon economy. This led to the formulation of additional levies and fees included in energy bills to promote the production and use of renewable energy. Costs ratios associated with the climate and

energy package have been stable over time, with a modest increase in 2013. This increase may be due to the revision of the Renewable Energy Directive in 2009, reflecting increasing raw material costs.

The increase in cost ratios for the environmental package are linked to the adoption of the integrated pollution prevention and control directive (IPPC) in 2008, followed by the transposition of the IED in 2013 (it was adopted in 2010). Another explanation for the increase of share of costs between 2007 and 2009 is the revision of the Waste Framework Directive. This directive repealed the earlier one on waste as well as the Hazardous Waste Directive and the Waste Oils Directive, providing a general framework of waste management requirements and basic waste management definitions for the EU as well as introducing the waste hierarchy, polluter pays principle and extended producer responsibility (EPR). New targets under the directive for reuse and recycling, and the requirements for Member States to prepare waste prevention programmes, may be underlying the increase in costs for this sub-sector.

The product package appears to have a more significant cost impact starting from 2011. This can be explained by the fact that the EU Ecolabels directive has been revised in 2009 and came into effect 2010. Standard application and renewal fees are dependent on the annual turnover. Moreover, the increase of costs in 2011 may be due to early investments made in relation to the revised Construction Products Regulation (CPR) which was published in 2011 and came fully into force in 2013. For instance, from 2013, the CPR made it mandatory for manufacturers to apply CE marking to any of their products covered by a harmonised European standard or a European Technical Assessment. Wood-based panels used in construction and the Construction Products Regulation requires manufactures to provide a performance declaration, technical documentation and affix a CE marking. REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) entered into force in 2007. It affects the production as it, for example, encompasses rules and standards for formaldehyde which is widely used in composite wood products.

The following table provides results for the first (2005) and last (2014) years over the period, along with ranges of direct regulatory costs over the period (2005-2014):

Table 21 Direct regulatory costs for the woodworking sector - First year, last year, ranges min-max

	First year (2005)	Last year (2014)	Min	Year	Max	Year
Climate & Energy	1.5%	2.1%	1.31%	2007	2.08%	2014
Environment	1.6%	2.4%	1.44%	2007	2.41%	2014
Forest	0.0%	0.2%	0.01%	2007	0.15%	2014
Employment	0.1%	0.5%	0.12%	2007	0.55%	2014
Product	0.3%	0.8%	0.24%	2007	0.84%	2014
Transport	0.2%	0.3%	0.179%	2005	0.33%	2014

Source: Authors' elaboration

5.1.3 Indirect regulatory costs for the overall woodworking sector

Woodworking companies did not report any significant burden occurring from ETS indirect costs. Only one company has reported that suppliers passed-on the costs of ETS, but without more detailed information. However, indirect costs related to the price of raw materials were reported as significant to woodworking companies and are addressed in this section. Given the rather scattered information provided by companies in the in-depth interviews, only a qualitative analysis of indirect costs for the woodworking product groups was possible for panels producers (NACE code 16.21), under the climate and energy policy package.

Companies in the panel sector consistently reported to be affected by indirect costs to be attributed to climate and energy policies, and more specifically to the Renewable Energy Directive (Directive 2009/28/EC). Companies reported that the directive has contributed to increasing the raw material costs (mainly wood), and led to the substitution of wood-based panels by less expensive materials when possible.

The incentives to burn wood for fuel use, linked to the Renewable Energy Directive, are supposed to have triggered a mechanism causing relative competition for wood, its scarcity in some localities and creating upward pressures on its price generally. More specifically, the National Renewable Energy Action Plans (NREAPS) include incentives to burn wood; the effect of the latter on wood availability and prices is widely debated[27]. Wood has always been used as a source of energy; wood fuels have been traditionally used in CHP plants especially in countries like Finland, Sweden, France, Austria, Portugal and Denmark. Wood is also an important component for biomass fuels for energy generation[28].

In this panorama, a strong competition for companies producing wood for commercial use can be established against wood-based fuels for bioenergy, including with producers of wood chips, other wood-processing residues and pellet producers. The competition is particularly strong for panel producers, since they compete with wood-based fuels for bioenergy for wood (pulpwood, logs and forest residues), industrial residues (chips and sawdust) and recycled material (recovered wood)[29]. Pellets are the most economical way of transporting wood fuels and the EU28 is currently the largest global producer of wood pellets (the production amounted to 13.1 million tonnes in 2014; risen of 97% between 2009 and 2014)[30]. The increase of wood for raw material use in the EU27 bioenergy sector between 2000 and 2011 (ca. +82 million m3 RWE) is noticeably higher than the increase of wood raw materials in the woodworking sector as a whole[31].

In the last years, relatively high oil and gas prices have led to a reassessment of the use of wood for bioenergy use. The European Commission estimates that biomass used for heating, cooling, and electricity will constitute 42% of the 20% renewable energy target for 2020[32], and that the total consumption of renewable energies (i.e. including wood, solar, hydro power, etc.) has doubled between 2004 and 2013[33]. If from one side the 20% target for renewable energies aims at securing energy supply in the EU and reduces dependency on imports from abroad, from the other, the amount of wood for fuel use, due to the increase in the total wood consumption volume[34], would be equivalent to today's total wood harvest in the EU[35]. As a consequence, Europe is likely to face a conflict of interest due to the lack of sufficient raw material supply to be used for both forest-based industries and renewable energy use. The European Innovation Partnership on Raw Materials calls for a new comprehensive approach to mobilise the existing forest resources widely: "there will be a conflict of interest for Europe due to the lack of sufficient raw material supply to be used for both forest-based

[27] http://www.technologist.eu/build-or-burn-competition-for-wood-on-the-rise/, and Indufor (2013), Study on the Wood Raw Material Supply and Demand for the EU Wood-processing Industries

[28] Indufor (2013), Study on the Wood Raw Material Supply and Demand for the EU Wood-processing Industries, Final report to DG GROW, p.134. For Indfuor the share is 55% of total renewable energy sources in EU27, page 180.

[29] Indufor (2013), Op. Cit. page 216. The table reported by Indufor also shows how other sectors compete with bioenergy in fewer varieties of wood type.

[30] http://ec.europa.eu/eurostat/statistics-explained/index.php/Forestry_statistics_in_detail#Wood_as_a_source_of_energy

[31] Indufor (2013), Ibidem.

[32] Indufor (2013), Ibidem.

[33] http://ec.europa.eu/eurostat/statistics-explained/index.php/Forestry_statistics_in_detail#Wood_as_a_source_of_energy

[34] However it must be noticed that, comparing the renewable energy gross inland consumption for EU28 in 2004, wood decreased its share in the total renewable energies mix, passing from 55% in 2004 to 46% in 2013. Conversely, wind, solar, and other biomass from municipal waste have increased their relative shares compared to 2004. The use of wood in the mix varies intensively also by country, reaching almost three quarters for Estonia, Lithuania, Finland, Poland and Latvia, while being low in Malta and Cyprus, for example (See http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_from_renewable_sources).

[35] https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/enhancing-cascade-use-wood-integrating-intensified-mobilisation-forest-resources . Cascade use of wood implies using first wood as primary product, then re-use and/or recycling and eventually use wood as energy source.

industries and renewable energy use. A new comprehensive and well-balanced approach is needed, e.g. the raw materials for wood pellets are various by-products of sawmill and wood working industries. Consequently, mobilizing the existing forest resources widely will enhance the cascade [use of wood] concept"[36].

Ultimately, the above-mentioned incentives for renewable energies have *de facto* created an otherwise inexistent demand for renewable energies. Two mechanisms by which these incentives work are the feed-in tariff and the feed-in premium that applies to electricity generation: the feed-in tariff is a long-term minimum price to generate renewable energies, especially electricity, while the feed-in tariff is a premium added on the top of the market price to consumers. Only recently (2012-2013) these premiums have been reduced by Member States due to the economic downturn. As Indufor (2013) reports, climate policies such as the ETS are another driver of the use of biomass for energy production[37].

Nonetheless, as most companies declared during in-depth interviews, a quantitative estimate of the effect of the competition with bioenergy is hardly possible. The calculation would require an estimation of the equivalent price of the market distortion caused by the subsidies in the EU28 countries under analysis, which is outside of the scope of this report. As a consequence, it is not possible to provide a quantification of the total burden (direct and indirect costs burden) of the Renewable Energy Directive in this report.

Company case study – indirect costs due to raw material wood price variations

One of the companies interviewed provided a detailed analysis of the wood cost variations in the period 2005-2014 as supporting documentation on the indirect costs due to climate and energy policies.

The company argued that the competition with bioenergy and pellets is the most important source of indirect costs for panel producers. The company, which operates in more than one country, mentioned that, in order to analyse the evolution of wood cost mixes it is important to capture the country-by-country differences, and to observe the timing of the implementation of support for national policies for bioenergy. They also pointed out that the measures were first and more strongly implemented in Germany[38], that the crisis held back the implementation of renewable energy policies in Spain and, that in Portugal, the sawmill industry in particular saw a strong business opportunity to use the pro-bioenergy measures in other Member States to export pellets, rather than using the wood for domestic combustion[39]. The figure below synthesises the wood mix cost variation (in €/m3) paid by the company in three European locations, from 2005 to 2014. Each wood mix refers to a production line input; in the case of Germany two MDF input mixes are presented, corresponding to two different German regions. As it is possible to see, the trend reflects the explanation provided by the company.

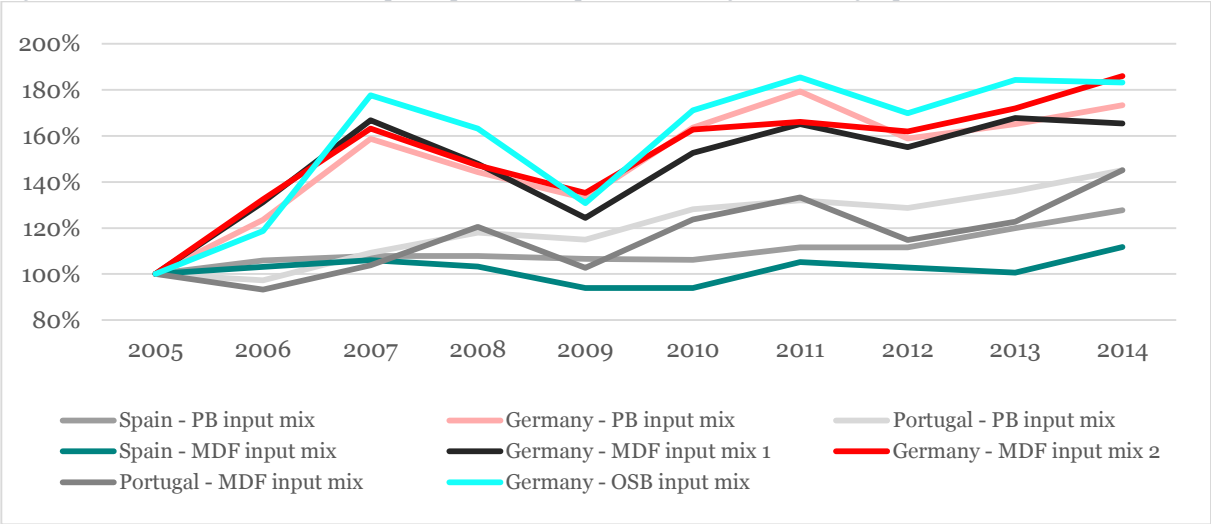
[36] https://ec.europa.eu/growth/tools-databases/eip-raw-materials/en/content/enhancing-cascade-use-wood-integrating-intensified-mobilisation-forest-resources. Cascade use of wood implies using first wood as primary product, then re-use and/or recycling and eventually use wood as energy source.

[37] Indufor (2013), Op. Cit. page 182

[38] Federal Ministry of Food, Agriculture, and Consumer protection (2009), National Biomass Action. National Biomass Action Plan for Germany. Retrieved from http://www.bmel.de/SharedDocs/Downloads/EN/Publications/BiomassActionPlan.pdf?__blob=publicationFile

[39] Nunes, L.J.R., Matias J.C.O. and Catalão, J.P.S., Wood Pellets as a Sustainable Energy 1 Alternative in Portugal. . Retrieved from http://webx.ubi.pt/~catalao/RENE-D-14-02100R2F_Paper_Clean.pdf

Figure 25 Wood mix cost variation, panel producer, Spain, Germany and Portugal plants, in €/m3



Source: authors' elaboration made on company raw data, panel producer company

It is important to mention that it is not possible to drive generalised conclusions on the effect or magnitude of bioenergy support policies on wood cost increases for the panel industry, based on one company report. The evolution of wood costs reported by the company aims at showing that companies in the panel sector have expressed concerns about indirect costs that materialised in an increase in the wood raw material costs. However, there is no robust, general evidence that competition with bioenergy and different timing in the implementation of policy support to bioenergy are the (only) driving causes of the increase in wood costs. The latter can have also been driven by other factors such as energy prices, the degree of labour market and wage rigidity and more generally global wood-market trends.

5.2 Cumulative cost assessment for sawmilling and planing of wood (16.1)

Eurostat definition of sawmilling and planing of wood

NACE Rev.2: C161
NACE Rev. 1.1: C201

This sub-sector includes sawing, planing and machining of wood, slicing, peeling or chipping logs, the manufacture of wooden railway sleepers, the manufacture of unassembled wooden flooring, the manufacture of wood wool, wood flour, chips, particles, the drying of wood, and the impregnation or chemical treatment of wood with preservatives or other materials. Eurostat, 2016.

The following six legislative packages were prioritised for the sawnwood sub-sector: climate and energy, environment, forest-related, employment, products and transport. The company survey confirmed the prioritisation and particularly highlighted three legislative packages, namely, climate and energy (consisting of significant monetary obligations, CAPEX and OPEX), transport (mostly consisting of monetary obligations and CAPEX) and environment (mostly consisting of administrative burdens) as the most important for cost generation.

Regulatory costs for the sub-sector reach 0.6% of turnover, 2.6% of added value and 6.9% of gross operating surplus of companies, which can be broken down between legislative packages and cost categories as reported in Table 22. It should however be noted that there may be a risk of underestimating the cost figures for the sawnwood sub-sector based on the interview data only.

Table 22 Costs for sawmilling and planing of wood by package and comparison with main financial indicators – annual average for 2005-2014

	% Turnover	% AV	% GOS	Share of total regulatory costs
Climate & Energy	0.3%	1.1%	3.0%	43.1%
Environment	0.1%	0.5%	1.5%	21.1%
Forest	0.0%	0.1%	0.3%	4.3%
Employment	0.0%	0.1%	0.1%	2.4%
Product	0.1%	0.2%	0.4%	6.3%
Transport	0.1%	0.6%	1.6%	22.8%
Total	**0.6%**	**2.6%**	**6.9%**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

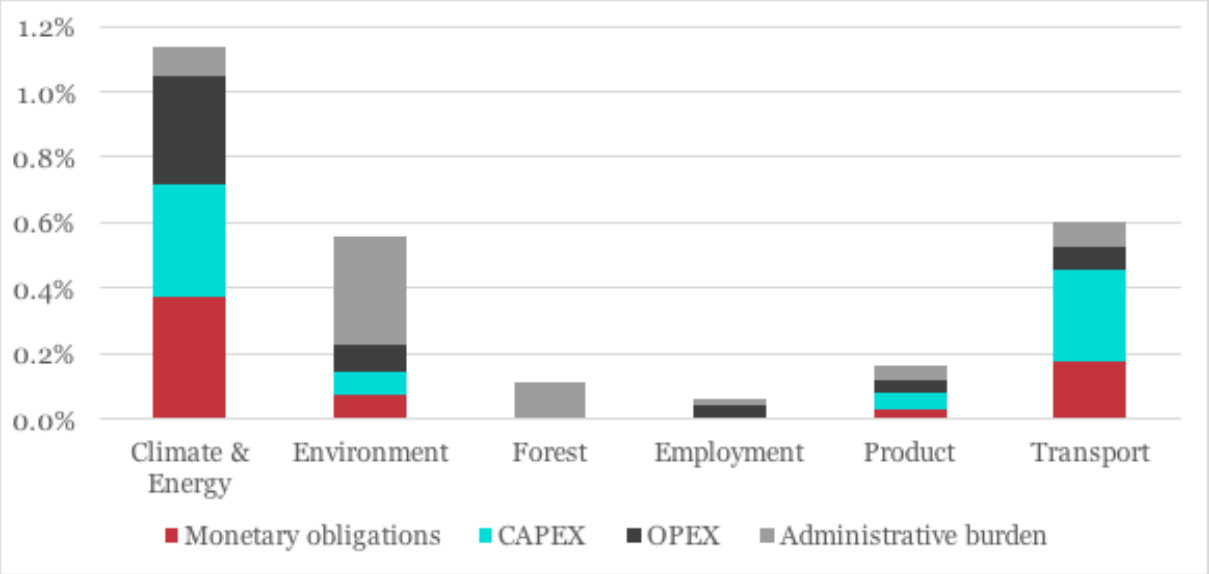
Table 23 Costs for sawmilling and planing of wood by cost category and comparison with main financial indicators – annual average for 2005-2014

	% Turnover	% VA	% GOS
Monetary obligations	0.1%	0.6%	1.7%
CAPEX	0.2%	0.7%	2.0%
OPEX	0.1%	0.6%	1.4%
Administrative burden	0.2%	0.7%	1.8%
Total	**0.6%**	**2.6%**	**6.9%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

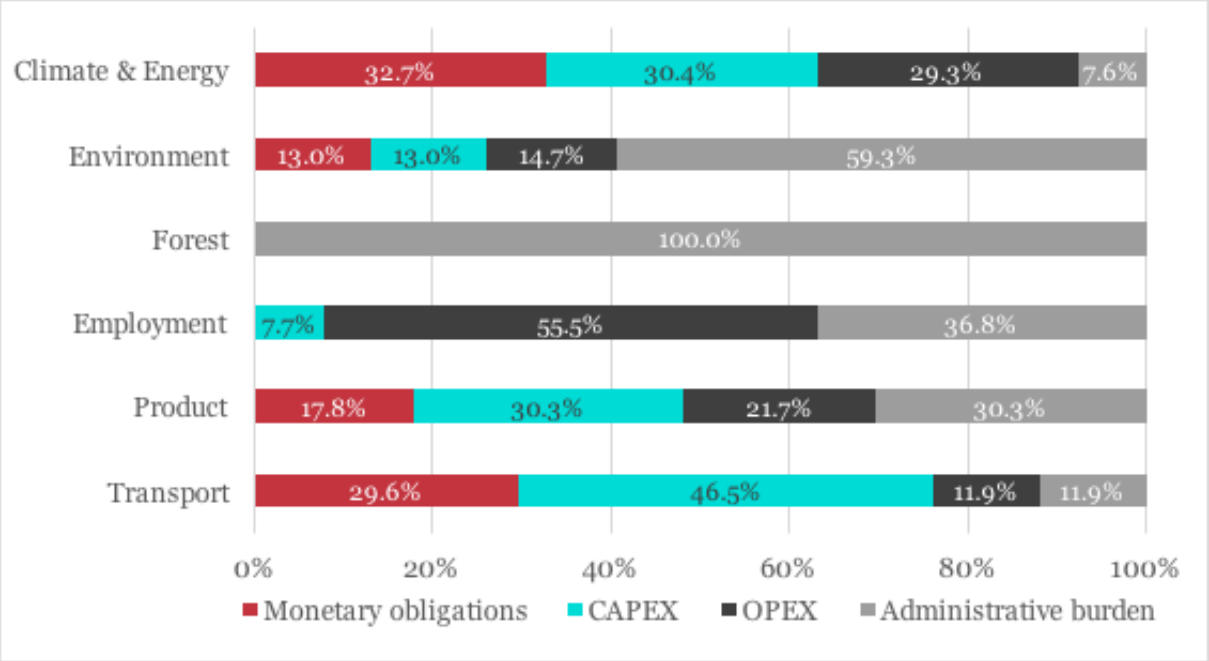
Costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the regulatory costs.

Figure 26 Regulatory costs for sawmilling and planing of wood as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

Figure 27 Share of categories of costs for sawmilling and planing of wood by package – annual average for 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

The **climate and energy legislative package** accounts for 43% of total regulatory costs of legislation (1.1% of added value). The large share of costs is attributable to the Renewable Energy Directive, the Energy Taxation Directive, and the Energy Efficiency Directive, especially yearly fees for certification under the RED and EED. Substantive obligations refer inter alia to investments in new management systems under RED and EED, along with their subsequent personnel and consultant

costs to implement them. The ETS is not applicable as part of the climate and energy package in this case.

The **climate and energy package**, as a whole, generate monetary obligations (a third of the climate and energy package's regulatory costs) and operating costs (29% of this package's regulatory costs) for the sawnwood sector because of the directives on renewable energy, energy taxation and energy efficiency.

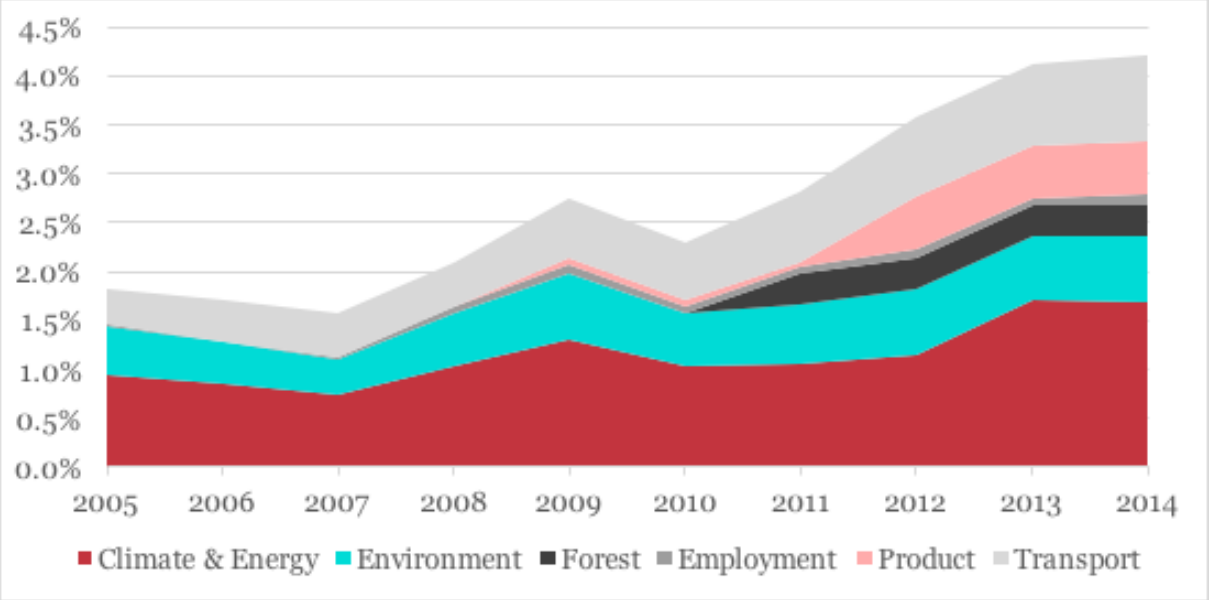
Sawnwood is shipped and transported across the globe and within Europe and therefore road regulation plays an important role as such, with a **transport legislative package** accounting for 23% of total regulatory costs for this sub-sector (0.6% of added value). The dimensions and maximum weights authorised for both national and international lorry journeys are regulated by the directives concerned with road regulation[40], generating investment costs (46% of the legislative package) for new equipment to comply with EU legislation as well as additional personnel (12% of the legislative package) since companies need to adapt their volumes of transport. For instance, the recent Directive 2015/719 (which amends Directive 96/53/EC) grants derogations on the maximal lengths to make heavy goods vehicles greener by improving their aerodynamic performance. Although the transport legislation cost is high when it is compared with other packages, it is very low when it is compared with added value (0.6% of added value). There are also costs associated with the Sulphur Directive, which may concern investments and maintenance of emission abatement technologies, exhaust gas cleaning systems, or other types of filtering equipment.

The **environment legislative package** is the third most important package, representing 21% of total costs (0.51% of added value). The Industrial Emissions Directive (IED), which came into force in 2013, as well as the IPPC Directive that has been in place since 2008, create administrative burden for sawnwood companies (59% of the legislative package). IED costs relate to registration, notification or permitting of certain activities or costs sustained for the supply of data or information for monitoring. The IPPC Directive impacts on firms' costs via permits that take into account the whole environmental performance of the plant based on Best Available Techniques Reference Documents (BREFs). Furthermore, an administrative burden for phytosanitary certificates and inspections arises for those companies that import from, or export to, non-EU countries.

The **forest-related legislative package** accounts for 4.3% of total regulatory costs (0.1% of added value) and mostly consists in administrative burden (100% of the legislative package) associated with the import in roundwood and sawnwood to and within trade Europe under the EUTR.

[40] Directive 2002/7/EC of the European Parliament and of the Council of 18 February 2002 amending Council Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic.

Figure 28 Evolution of costs for sawmilling and planing of wood as % of added value for the period 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

The analysis of cost trends between 2005 and 2014 demonstrate that the share of costs on added value relating to the **climate and energy legislative package** has dropped in 2007, rising again in 2008 and 2009 and again dropping slightly until 2012, which may be due to the evolution of the denominator of added value with the financial crisis. We also see a new cost peak in 2013. Beyond the evolution of the added value of denominator, factors that may affect the evolution of regulatory costs relate to the EU establishing, in 2008, a series of climate and energy targets, better known as the "20-20-20" targets, to be met by 2020 in its pathway towards a low-carbon economy. This led to the formulation of additional levies and fees included in energy bills to promote the production and use of renewable energy. This may have generated the increase in costs that can be observed for 2009.

Voluntary Partnership Agreements from the **forest-related legislative package** would normally incur costs, by putting an administrative burden on the producer country as well as the companies that are trading in wood products to be exported to the EU (e.g. establishing a wood legality assurance system). However, since FLEGT licensing has not yet occurred, such costs have been delayed. (In any case, in practice its effect is as one variant of compliance with the EUTR, so that costs from FLEGT licensing and the EUTR are not cumulative. Nevertheless, with the adoption of the EUTR in 2010, companies would have started to prepare for its transposition into member –state law and application from 03/03/2013.

The **product legislative package** shows a significant cost impact starting from 2011. This can be explained by the fact that the EU Ecolabel Directive has been revised in 2009 and came into effect 2010. Standard application and renewal fees are dependent on the annual turnover. Administrative burden related to product certification (tests, expertise and/or inspection) are not included in those standard fees but rise additionally.

5.3 Cumulative cost assessment for manufacture of veneer sheets and wood-based panels (16.21)

Eurostat definition of manufacture of veneer sheets and wood-based panels
NACE Rev.2: C1621
NACE Rev. 1.1: C202

This sub-sector includes the manufacture of veneer sheets thin enough (e.g. 0.6 to 2.5 mm) to be used for veneering, making plywood or other purposes (whether smoothed, dyed, coated, impregnated, reinforced with paper or fabric backing, or made in the form of motifs), the manufacture of plywood, veneer panels and similar laminated wood boards and sheets, the manufacture of oriented strand board (OSB) and other particleboard, the manufacture of medium density fibreboard (MDF) and other fibreboard, the manufacture of densified wood and the manufacture of glued-laminated wood, laminated veneer wood. Eurostat, 2016

The following four legislative packages were prioritised for the wood-based panels sub-sector: climate and energy, environment, employment, and product legislative packages. The company survey confirmed the policy prioritisation and particularly highlights two legislative packages, namely, the climate and energy (mostly fees) and the environment (fees, CAPEX, OPEX) legislative packages. Other legislative packages are not significant in terms of generating costs.

Regulatory costs for the sub-sector reach 2.3% of turnover, 10.8% of added value and 28.3% of gross operating surplus of companies, which can be broken down between legislative package and cost categories as follows:

Table 24: Regulatory costs for manufacture of veneer sheets and wood-based panels by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	Share of total regulatory costs
Climate & Energy	1.5%	7.3%	19.1%	67.5%
Environment	0.6%	2.7%	7.0%	24.8%
Employment	0.1%	0.5%	1.3%	4.5%
Product	0.1%	0.3%	0.9%	3.2%
Total	**2.3%**	**10.8%**	**28.3%**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

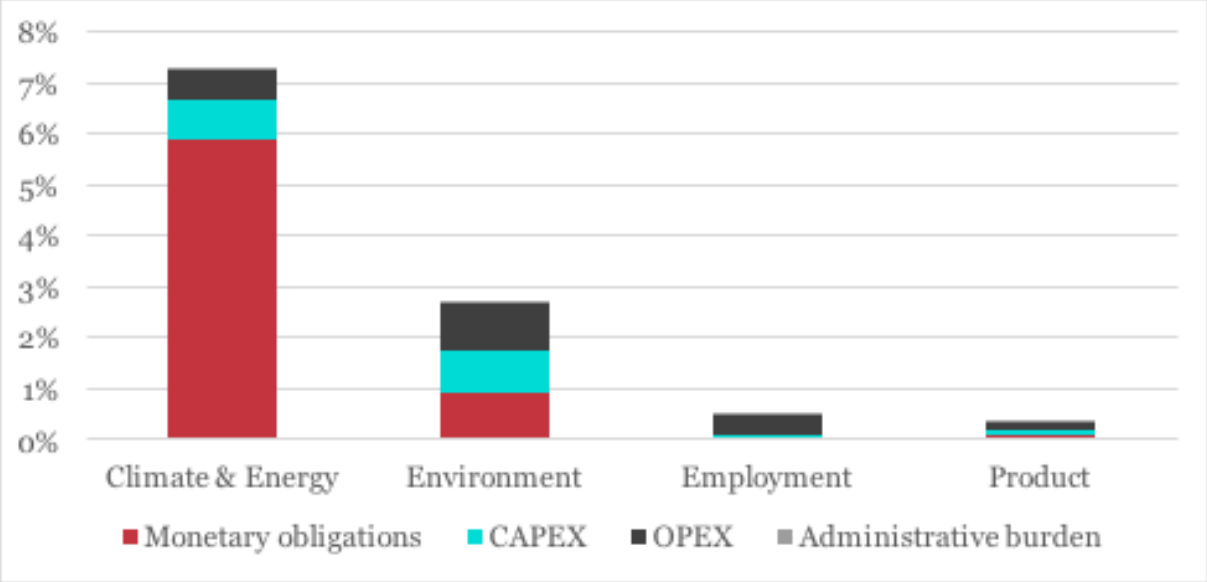
Table 25 Regulatory costs for manufacture of veneer sheets and wood-based panels by cost category and comparison with main financial indicators – annual average 2005-2014

	% turnover	% AV	% GOS
Monetary obligations	1.5%	6.9%	18.1%
CAPEX	0.4%	1.8%	4.6%
OPEX	0.4%	2.0%	5.2%
Administrative burden	0.0%	0.1%	0.4%
Total	**2.3%**	**10.8%**	**28.3%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

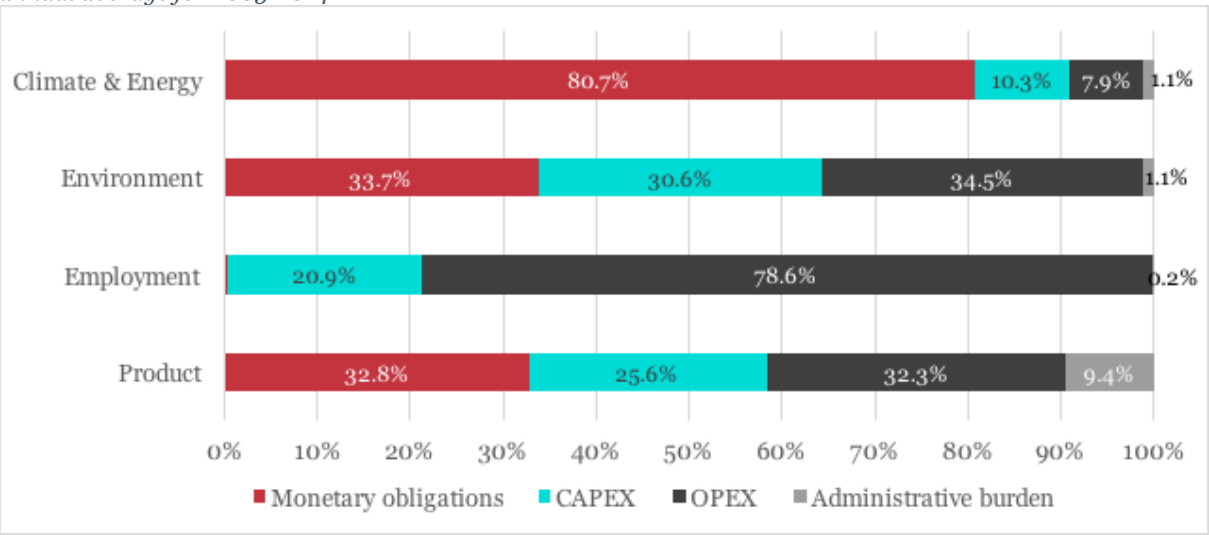
Costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the regulatory costs.

Figure 29 Regulatory costs for manufacture of veneer sheets and wood-based panels as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

Figure 30 Share of categories of costs for manufacture of veneer sheets and wood-based panels by package – annual average for 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

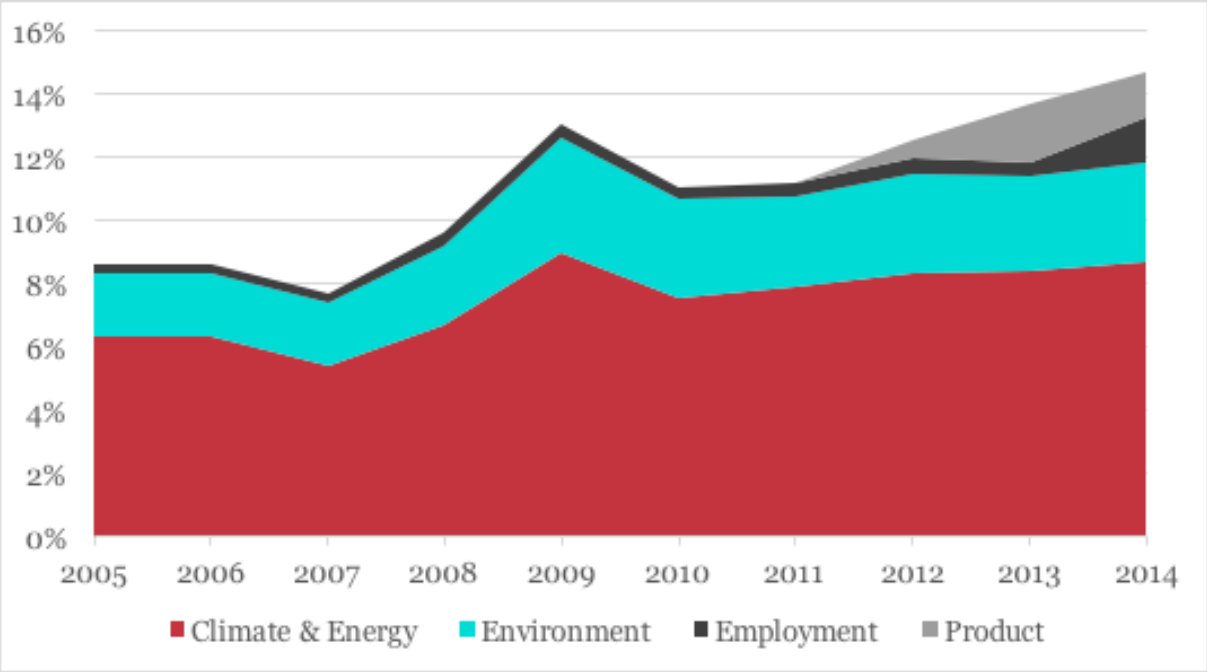
The **climate and energy legislative package** is the most important package in terms of regulatory costs, accounting for 67.5% of total regulatory costs (7.3% of added value). The EU ETS was not prioritised for the wood-based panels sub-sector, even though manufacturers of veneer wood panels and sawmill operators had fallen off the 2015-2019 carbon leakage list. This large share of costs is attributable to high rate of monetary obligations (80.7% of the package), mostly driven by the Renewable Energy Directive and the Energy Taxation Directive. Fees, levies and charges, mainly included in the energy bill, are added to each unit of gas or electricity purchased. Similar to sawnwood, it is rather the Renewable Energy Directive that has had a considerably impact on regulatory charges. Since the wood-based panels industry is energy intensive, larger fees apply directly to this sub-sector. The Energy Taxation Directive covers sectors not covered under ETS, such as the wood-based panels companies, by imposing a minimum tax rate based on the CO2 and the energy content of the energy consumed. These are accompanied by a notable administrative burden. Larger companies are also affected by the Energy Efficiency Directive that oblige companies to conduct independent energy audits every fourth year, generating administrative burden starting from 2014.

The **environmental legislative package** is the second most important legislative package, representing 24.8% of total regulatory costs (2.7% of added value). Environmental legislation principally generates CAPEX (34.5% of the package), fees (33.7%) and OPEX costs (30.6%) for wood-based panels production. These relate to industrial emissions and air pollution. For instance, the IPPC Directive was in force until 6 January 2014 and is not directly applicable to wood-based panel production, however, it regulates manufacturers that operate large combustion plants (>50MWth). Therefore, fees for permits as well as investments in new technologies to comply with the required standards generate higher operating costs. Monitoring and administrative burden are also linked to the issuing of permits. With the new Industrial Emissions Directive (2010/75/EU) in place since 2010, the impact of the BREFs is expected to increase.

The Waste Incineration Directive covers incineration and co-incineration plants, including those applied to wood waste that might contain halogenated organic compounds or heavy metals as a result of treatment with wood-preservatives or coatings. These do not necessarily originate from the manufacturing process as they might already be included in the raw materials coming on-site (DEFRA 2008, 18-19), which creates additional costs as regards to the disposal of waste. This also concern CAPEX and OPEX costs as related to efforts in reducing volatile organic compound (VOC) emissions. For instance, oriented strand boards (OSB) are bonded with a resin. The traditional technology used to manufacture these panels causes the emission of VOCs during the production process as well as during

the panels life cycle. Costs are therefore generated for companies when they invest in non-standard production processes to reduce VOC emissions.

Figure 31 Evolution of costs for manufacture of veneer sheets and wood-based panels as % of added value for the period 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

The analysis of cost trends (time frame 2005-2014) demonstrate that shares of costs relating to the climate and energy legislative package dropped in 2007, after which it reached a peak in 2009 and have since then decreased slightly, which may be due to the evolution of the denominator of added value. In contrast, other legislative packages have developed continuously without showing increasing costs, aside from the product legislative package that started to impact the sub-sector in 2011.

Beyond the evolution of the added value denominator, the increase in regulatory costs in climate and energy in 2008 can be related to the EU series of climate and energy targets in 2008, in its pathway towards a low-carbon competitive economy, which has contributed to a reinforcement of the Renewable Energy Directive. With the new target set for renewables set at 27% for 2030, it is likely that associated costs will continue to increase, largely from increasing pressure on wood raw-material supplies and hence their prices.

The legislative package on products started to impact the wood-based panel industry beginning in 2011 and may be due to early investments made in relation to the revised Construction Products Regulation (CPR). For instance, from 2013, the CPR made it mandatory for manufacturers to apply CE marking to any of their products covered by a harmonised European standard or a European Technical Assessment. Wood-based panels used in construction and the Construction Products Regulation require manufacturers to provide a performance declaration, technical documentation and affix a CE marking. REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) entered into force in 2007. Some annexes have been revised since then. This process has brought associated costs that may continue to increase in the future.

5.4 Cumulative cost assessment of manufacture of other builders' carpentry and joinery (16.23)

Eurostat definition of manufacture of other builders' carpentry and joinery
NACE Rev.2: C1623
NACE Rev. 1.1: C203

This sub-sector includes the manufacture of wooden goods intended to be used primarily in the construction industry (beams, rafters, roof struts, glued-laminated and metal connected, prefabricated wooden roof trusses, doors, windows, shutters and their frames, whether or not containing metal fittings, such as hinges, locks etc., stairs, railings, wooden beadings and mouldings, shingles and shakes, the manufacture of prefabricated buildings, or elements thereof, predominantly of wood, e.g. saunas, the manufacture of mobile homes and the manufacture of wood partitions (except free standing). Eurostat, 2016

The following six legislative packages were prioritised for the carpentry and joinery sub-sector: climate and energy, environment, forest-related, employment, products and transport legislative packages. Among these, product policy (generating almost only administrative burden) was noted as the costliest package, followed by the transport (principally fees), environment (OPEX), climate and energy policy (fees, OPEX and administrative burden) and the employment (OPEX) packages.

Regulatory costs for the sub-sector reach 0.4% of turnover, 1.3% of added value and 4.1% of gross operating surplus of companies, which can be broken down between legislative package and cost categories as follows:

Table 26: Costs for manufacture of other builders' carpentry and joinery by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	Share of total regulatory costs
Climate & Energy	0.07%	0.2%	0.7%	16.4%
Environment	0.08%	0.3%	0.8%	18.6%
Forest	0.00%	0.0%	0.0%	0.3%
Employment	0.04%	0.1%	0.4%	9.9%
Product	0.17%	0.5%	1.6%	39.5%
Transport	0.06%	0.2%	0.6%	15.3%
Total	**0.42%**	**1.3%**	**4.1%**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

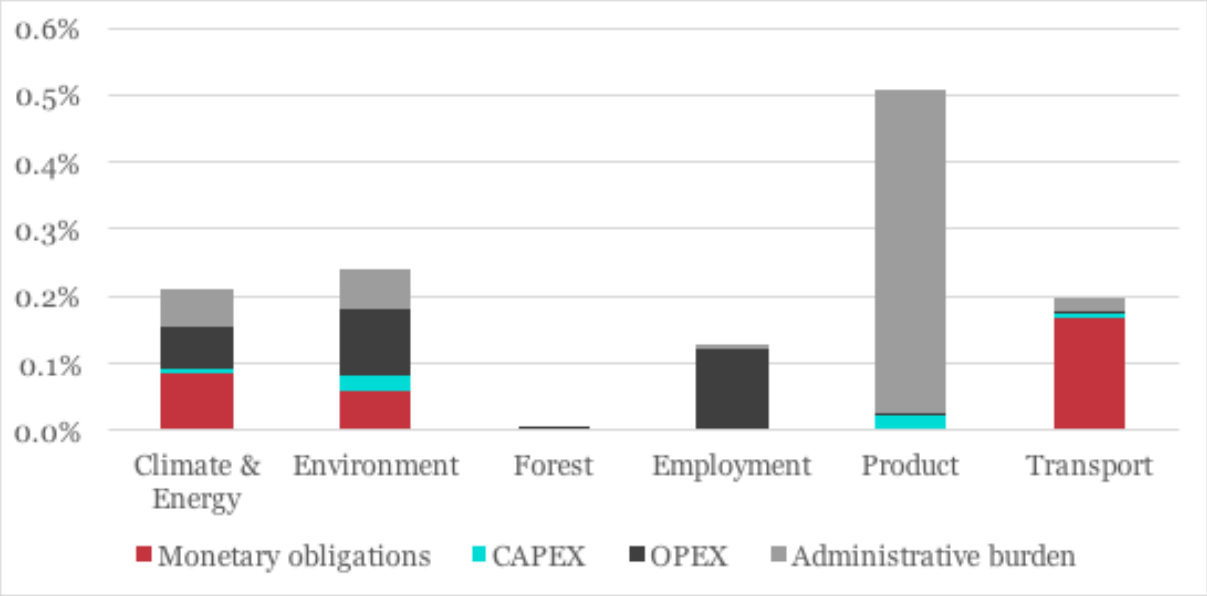
Table 27 Costs for manufacture of other builders' carpentry and joinery by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS
Monetary obligations	0.1%	0.3%	1.0%
CAPEX	0.0%	0.1%	0.2%
OPEX	0.1%	0.3%	0.9%
Administrative burden	0.2%	0.6%	2.0%
Total	**0.4%**	**1.3%**	**4.1%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, VA and GOS) from Eurostat, Structural Business Statistics.

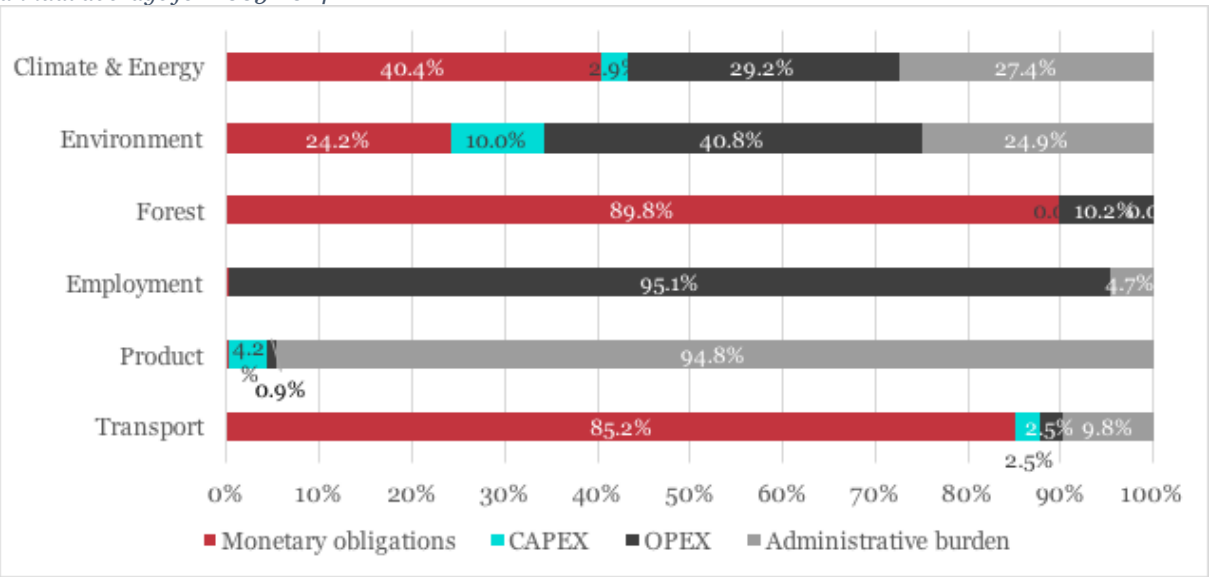
Costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the regulatory costs.

Figure 32 Regulatory costs for manufacture of other builders' carpentry and joinery as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

Figure 33 Share of categories of costs for manufacture of other builders' carpentry and joinery by package – annual average for 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

This sub-sector principally prioritised **the product legislative package**, representing 39.5% of total regulatory costs (0.5% of added value), related to the Construction Products Regulation and the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation. It is interesting in this case to note the significant administrative burden (94.8% of the package) these regulations generate for the carpentry and joinery sub-sector. These are associated with information obligations, such as requirements for a declaration, or the application for a certificate, of compliance with the standardised specifications defined in the regulations. These declarations or the applications need to be accompanied by the necessary documentation (creating costs across the whole supply chain) as all companies contributing to the production of the product need to provide the necessary documentation and should properly certify their products. This creates the notably high administrative burden for the carpentry and joinery sub-sector. Substantive obligations and administrative burden associated with the regulation on construction products (e.g. CE marking) include investments in systems for the Assessment and Verification of Constancy of Performance (AVCP). This creates personnel costs connected with maintaining the AVCP system, it would also create costs in terms of documenting the performance of products and the training staff to do an AVCP.

The **environment legislative package** accounts for 18.6% of total regulatory costs (0.3% of added value). Operating costs (40.8% of the package) arise, inter alia, in relation to the EU environmental legislation because of the sub-sectors exposure to the Industrial Emissions Directive. The Industrial Emissions Directive (IED), as well as the IPPC Directive that has been in place from 2008 to 2013, create an administrative burden (24.9% of the package) for carpentry and joinery companies. IED costs relate to registration, notification or permitting of certain activities or costs sustained for the supply of data or information for monitoring. The IPPC Directive impacts on costs via permits that take into account the environmental performance of the companies based on Best Available Techniques (BATs).

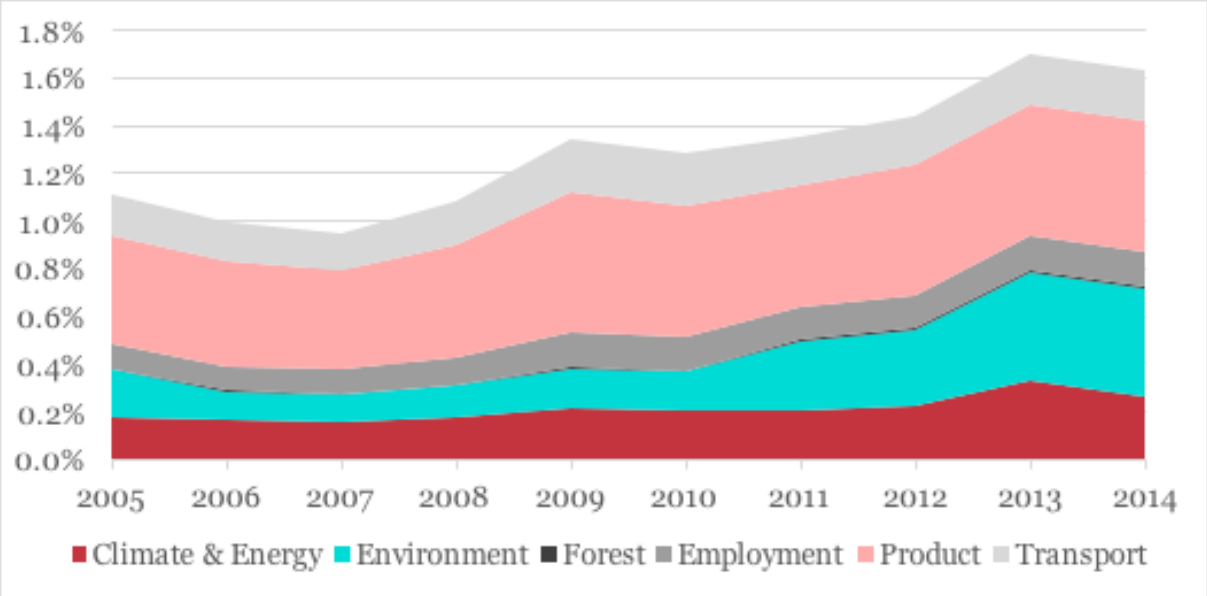
The **climate and energy package**, representing 16.4% of total regulatory costs (0.2% of added value), generate monetary obligations (40.4% of the package) and operating costs (29.2% of the package) for carpentry and joinery companies because of the directives on renewable energy and emissions trading. Fees, taxes and levies included in the energy bill because of the Renewable Energy Directive, revised, and back in effect in 2010, correspond to a significant part of the costs. The

purchase of CO2 allowances under the ETS system is also an important cost for this sub-sector. This would include administrative burdens (overall, 27.4% of the package), e.g. related to greenhouse gas emission permits or accounting, at the company level. Substantive obligations resulting from ETS include investments for emission abatement equipment, energy and process efficiency beyond the so-called business as usual. Investment costs are also linked to rising energy costs (as in indirect effect), which is often attributed to the directive on renewable energy and the increasing demand placed on raw materials.

The **transport legislative package** accounts for 15.3% of total regulatory costs (0.2% of added value). Carpentry and joinery companies are often dependent on road transport to move materials to construction site. Vehicle dimensions and maximum weights for national and international journeys are regulated by the EU Directive on Road Transport, to harmonise provisions in force in the EU member states. As such this has an impact on costs for companies since limits have been set as to how much (weight) and in what form (dimensions) products can be transported by road.

EU policy on occupational health and safety makes an important contribution to preventing accidents at work and ensuring safe occupational conditions for workers. Therefore, the **employment legislative package** accounts for 9.9% of total regulatory costs (0.1% of added value). For instance, the woodworking industry (as a whole) has one of the highest accident rates in manufacturing, most of which are caused by contact with moving machinery. Workers in the carpentry and joinery sub-sector may also, amongst other risks, be exposed to hazardous chemicals, solvents and other materials. This requires a company to invest in best practice control measures for safety, improved protective gear and new equipment methods. Operating costs (95.1% of the package) include the maintenance of equipment to ensure a safe and health working environment.

Figure 34 Evolution of costs for manufacture of other builders' carpentry and joinery as % of added value for the period 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

The analysis of cost trends (time frame 2005-2014) shows that costs ratios relating to the environmental legislative package dropped in 2006 and 2007 but have since then increased continuously until 2013. The costs ratios from the product legislative package has reached a peak in 2009 and has remained steady since then. The other legislative packages have stayed more or less stable in terms of generating costs for the sub-sector. We observe an overall decrease in regulatory

costs ratios between 2004 and 2007, followed by a steady increase thereafter, until 2009, which may be due to the evolution of the denominator of added value.

Beyond the evolution of added value, factors that may affect the evolution of regulatory costs may relate to the increasing costs for the environmental package due to the Industrial Emissions Directive (IED). The cost increases are linked to the impact of the IPPC, followed by that of the IED in 2013, which have triggered the noted changes in costs over time for the carpentry and joinery subsector. Costs associated with the climate and energy package have been stable over time, with a modest increase in 2013. This increase may be due to the impact of the Renewable Energy Directive, reflecting increasing raw material costs. It may also reflect the purchase of CO2 allowances under the ETS system, in particular as the third trading period began in 2013.

5.5 Cumulative cost assessment of manufacture of wooden pallets and other wooden packaging (16.24)

Eurostat definition of manufacture of wooden pallets and other wooden packaging
NACE Rev.2: C1624
NACE Rev. 1.1: C204

This sub-sector includes the manufacture of packing cases, boxes, crates, drums and similar packings of wood, the manufacture of pallets, box pallets and other load boards of wood, the manufacture of barrels, vats, tubs and other coopers' products of wood and the manufacture of wooden cable-drums. Eurostat, 2016

The following five legislative packages were prioritised for the wooden pallets and other wooden packaging sub-sector: climate and energy, environment, forest-related, employment and products legislative packages. The company survey confirmed this policy prioritisation but highlights that it is especially the environment (OPEX) legislative package that has generated costs. The other legislative packages are in fact not significant in terms of generating a large amount of costs for the sub-sector.

Regulatory costs for the sub-sector reach 4.4% of turnover, 16.4% of added value and 50.7% of gross operating surplus of companies, which can be broken down between legislative packages and cost categories as follows:

Table 28: Costs for manufacture of wooden pallets and other wooden packaging by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	Share of total regulatory costs
Climate & Energy	0.24%	0.9%	2.8%	5.5%
Environment	3.44%	12.8%	39.4%	77.6%
Forest	0.07%	0.2%	0.8%	1.5%
Employment	0.36%	1.3%	4.2%	8.2%
Product	0.32%	1.2%	3.7%	7.2%
Total	**4.43%**	**16.4%**	**50.7%**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

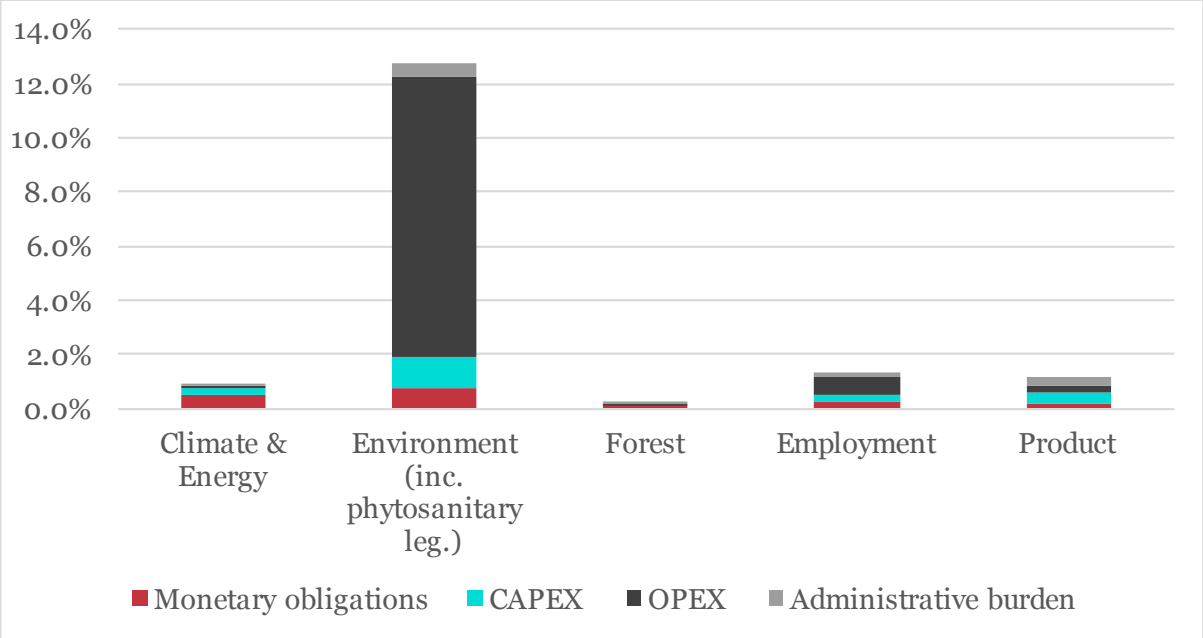
Table 29 Costs for manufacture of wooden pallets and other wooden packaging by cost category and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS
Monetary obligations	0.5%	1.8%	5.7%
CAPEX	0.5%	2.0%	6.0%
OPEX	3.1%	11.4%	35.3%
Administrative burden	0.3%	1.2%	3.7%
Total	**4.4%**	**16.4%**	**50.7%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

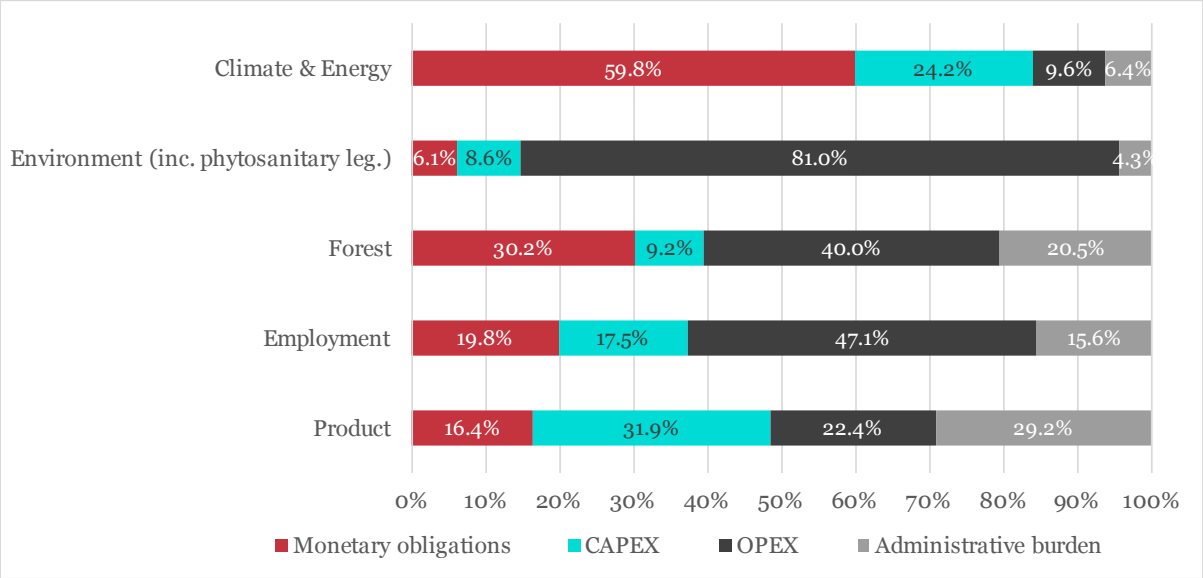
Costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the regulatory costs.

Figure 35 Regulatory costs for manufacture of wooden pallets and other wooden packaging as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

Figure 36 Share of categories of costs for manufacture of wooden pallets and other wooden packaging by package – annual average for 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

The **environment legislative package** accounts for 77.6% of total regulatory costs (12.8% of added value). Key legislation from this package relate to waste (Waste Framework Directive) as well as the Packaging and Packaging Waste Directive. It also relates to relevant parts of the phytosanitary regulations (e.g. rules on wooden packaging which incorporate the ISPM 15 standard for treatment and marking, which, although it is a standard developed by the International Plant Protection Convention from the U.N.'s Food and Agriculture Organization, it has been incorporated into the EU phytosanitary legislation) to prevent the introduction of harmful, plant-borne alien organisms. Significant investments have been necessary for companies to collect and process returned products and wastes in accordance with the principle of extended producer responsibility (e.g. costs of waste management are to be carried partly or wholly by the producer). Personnel costs and other operating and maintenance costs are also associated with these obligations.

There are in addition administrative burdens (e.g. control, inspection and testing) associated with obtaining certificates for those companies that import products as well as export them to non-EU countries. For instance, the applied treatment must be marked on the product (e.g. showing details of the processing agents that have been used) to certify that the wood packaging material has been subjected to an approved measure. It should be noted that the marking proves compliance with the requirements of all phytosanitary regulations in place, including the provision specified by the standard ISPM 15, as companies have passed the examinations for obtaining a license to use the marking.

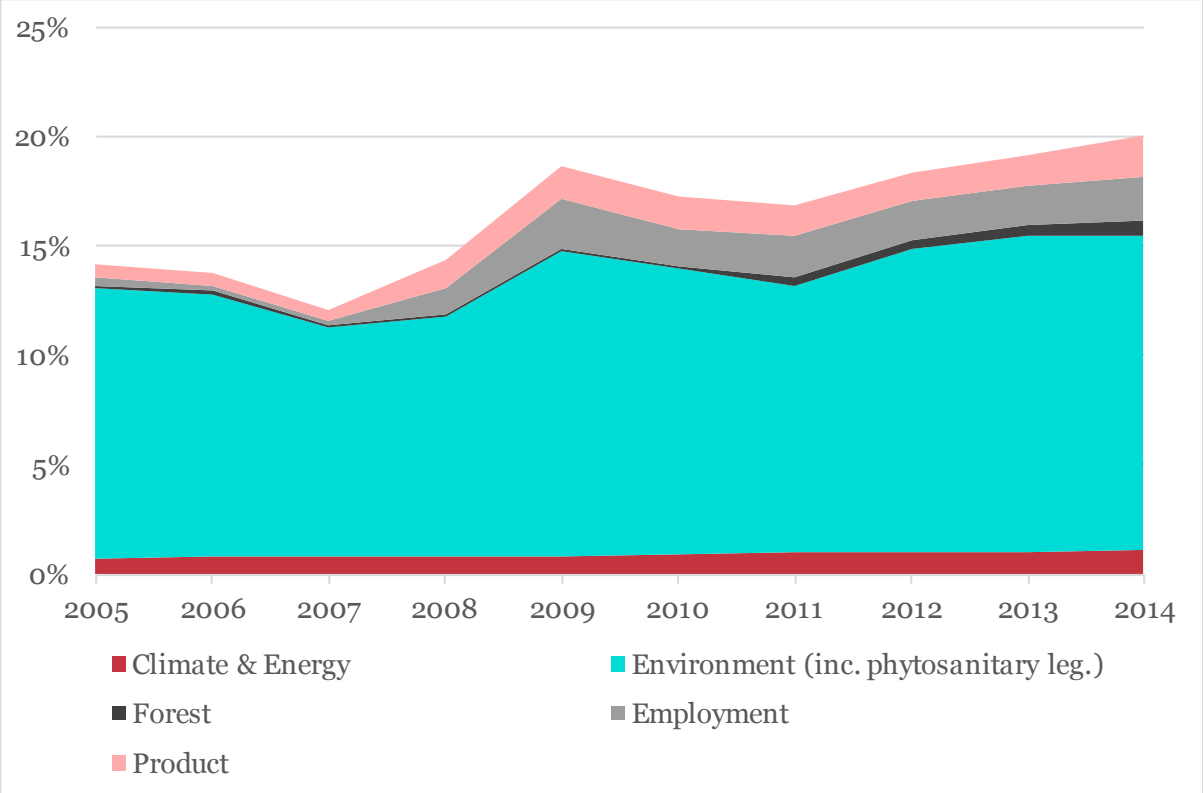
The **employment legislative package** is the second most important package, representing 8.2% of total regulatory costs (1.3% of added value). EU policy on occupational health and safety makes an important contribution to preventing accidents at work and ensuring safe occupational conditions for workers. For instance, workers in the wooden pallets and other wooden packaging sub-sector may be exposed to high physical demands as part of the woodworking process (e.g. handling of pallets). This can in turn present both health and safety hazards, such as representing a major risk for musculoskeletal disorders. In other parts of the woodworking sub-sector, such as sawmills, planing mills or panel mills, wood dust may be a problem. Such issues require a company to invest in measures to solve these types of problems, which may include a risk assessment and improved (or modified) machinery and methods as part of the manufacturing process. Related operating costs (47.1% of this

legislative package) include the maintenance of equipment to ensure a safe and health working environment.

Accounting for 7.2% of total regulatory costs (1.2% of added value), this sub-sector principally prioritised the **product legislative package** related to materials and articles intended as finished products (cases, boxes, crates, pallets, etc.) to come into direct or indirect contact with foodstuffs, as well as common methods to measure and communicate the life-cycle environmental performance of products and organisations. However, it should be noted that this legislation does not affect all the product groups within the sub-sector as a whole. It is interesting in this case to note that the overall costs for the products package is comparatively nominal. These include fees and charges (overall 16.4% of the package) associated with applications for authorisation of a new substance to come into contact with food are nominal. It is, to some extent, certain conditions on the manufacturing process (e.g. ensuring that production is in line with good manufacturing practices) that generate OPEX costs (22.4% of the package), while the reporting obligations (as linked to inspections and audits as well as regulatory compliance as regards permits, labelling, safety and provisions for ensuring traceability and the authorisation of substances) create the administrative burden (29.2% of the package) for the sub-sector.

The **climate and energy package** only accounts for 5.5% of package (0.9% of added value), mostly driven by monetary obligations included in the energy bill because of the Renewable Energy Directive. Other types of costs include maintenance costs (9.6% of the package) due to investments in state-of-the-art production capacity to reduce emissions of greenhouse gases and to improve energy efficiency.

Figure 37 Evolution of costs for manufacture of wooden pallets and other wooden packaging as % of added value for the period 2004-2015



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators (turnover, AV and GOS) from Eurostat, Structural Business Statistics.

The analysis of cost trends (time frame 2005-2014) demonstrate that share of regulatory costs on added value relating to the environment legislative package have dropped in 2007 and 2011 and have remained stable since 2012. As with the previous sub-sectors, we can observe a slight general decrease of costs ratios in 2007 (reaching a peak in 2009) and again decreasing thereafter. This is, as with the other subsectors, presumed to relate to the financial crises having an impact on producers of wooden pallets and other wooden packaging in 2008/2009, prior to which the high levels of business – "the calm before the storm", as reflected in turnover and added value were reflected in relatively reduced costs.

The overall most significant cost for producers of wooden pallets and other wooden packaging, by far, is the environmental legislative package. In this instance, the increase of costs ratios between 2007 and 2009 may be explained by the revision of the Waste Framework Directive. The directive introduced new targets for reuse and recycling, and requirements for Member States to prepare waste prevention programmes, which may be underlying the increase in costs ratios for this sub-sector. The increase in costs ratios between 2007 and 2009 are also for a considerable part generated by the implementation of phytosanitary regulations, in particular those incorporating ISPM 15 - which was itself reviewed in this period, with investments in heat treat capacity and costs for reorganising the premises and controlling and licensing schemes. This required companies to investment in heat treatment capacity and to make adjustments to the control and marking scheme.

The remaining legislative packages have negligible costs for the sub-sector in comparison. Interestingly, we do however see an increase in employment costs ratios around 2007, which would be linked to the introduction of the second (in 2007) and third (in 2010) list of indicative occupational exposure limit values.

5.6 Cumulative cost assessment for the overall pulp, paper and paperboard sector

5.6.1 Scope

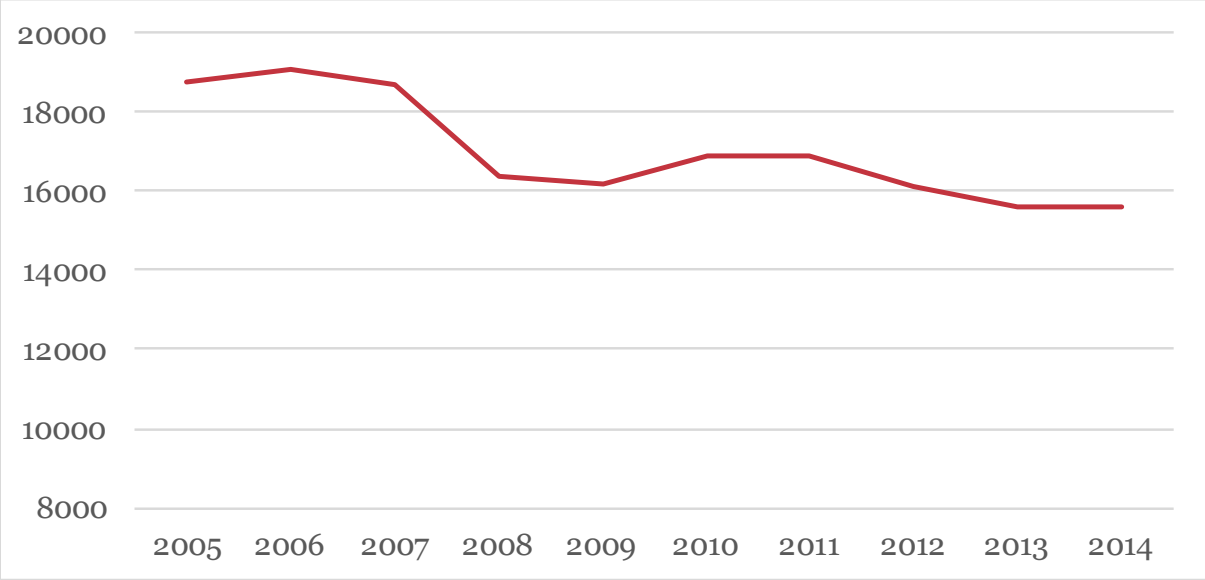
The section on cumulative cost assessment for the overall pulp, paper and paperboard sector provides an aggregated picture of EU regulatory costs (by a weighted sum of the values from each sub-sector, using turnover share as a weight) over the period 2004-2015 for the following sub-sectors:

- 17.11 Manufacture of pulp;
- 17.12 Manufacture of paper and paperboard

The subsequent sections will further cover each of these sub-sectors independently.

For the pulp, paper and paperboard sector and its sub-sectors (as mentioned above), the following sections provide an evolution of the share of regulatory cost as a percentage of added value over the time period (2005-2014). It is important to note that, while it certainly illustrates the evolution of regulatory costs over ten years, the trend is also impacted by the evolution of the ratio's denominator, i.e. the added value of the sector. As a matter of fact, recurrent peaks of regulatory costs as percentage of added value in 2009 may hence reflect the drop in added value due to the financial crisis and its subsequently difficult business environment. Nevertheless, although conclusions cannot be drawn on whether there has been a peak in regulatory costs per se for such a year, it is correct to mention that the share of regulatory costs (reflecting the regulatory burden) on added value has increased. The evolution of added value (denominator of all cost ratio), from 2005 to 2014, is as follows:

Figure 38 Evolution of added value for the pulp, paper and paperboard sector (NACE code 171)



Source: Eurostat, Structural Business Statistics, last available data

5.6.2 Direct regulatory costs for the overall pulp, paper and paperboard sector

The following seven legislative packages were prioritised for the pulp, paper and paperboard sub-sectors: competition, climate and energy, environment, forest-related, employment, products, transport and trade legislative packages. The results indicate that it is especially the climate and energy (monetary obligations, CAPEX) as well as the environment (CAPEX, OPEX) legislative packages that generated significant direct costs for manufactures of pulp, paper and paper products. Legislative packages concerned with employment, product and transport remained on a similar level as regards to generating costs. Nearly no direct costs have been reported for this subsector for the legislation forest-related and trade packages, for which the quantification exercise appeared to be difficult.

It can be noted that the manufacture of pulp, paper and paperboard sub-sectors demonstrate similar direct costs as the pulp sub-sector. It is therefore assumed that the prioritised legislation has a similar impact on the industry, with some exceptions.

Direct regulatory costs for the sub-sector reach 0.9% of turnover, 4.29% of added value and 10.76% of gross operating surplus of companies as an average for the period 2005-2014, which can be broken down between cost categories as follows in the table below. Other comparators are presented as well, i.e. regulatory costs as share of EBITDA, of EBIT and regulatory costs per tonne.

Table 30 Direct Costs for the overall pulp, paper and paperboard sector by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	% EBITDA	% EBIT	Share of total costs
Climate & Energy	0.37%	1.78%	4.46%	3.2%	9.1%	41.5%
Environment	0.29%	1.37%	3.45%	2.4%	7.0%	32.0%
Forest	0.02%	0.11%	0.27%	0.2%	0.6%	2.5%
Employment	0.08%	0.37%	0.94%	0.6%	1.9%	8.7%
Product	0.08%	0.38%	0.94%	0.7%	1.9%	8.8%
Transport	0.05%	0.21%	0.53%	0.4%	1.1%	4.9%
Trade	0.01%	0.07%	0.17%	0.1%	0.3%	1.6%
Total	**0.90%**	**4.29%**	**10.76%**	**7.6%**	**21.9%**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

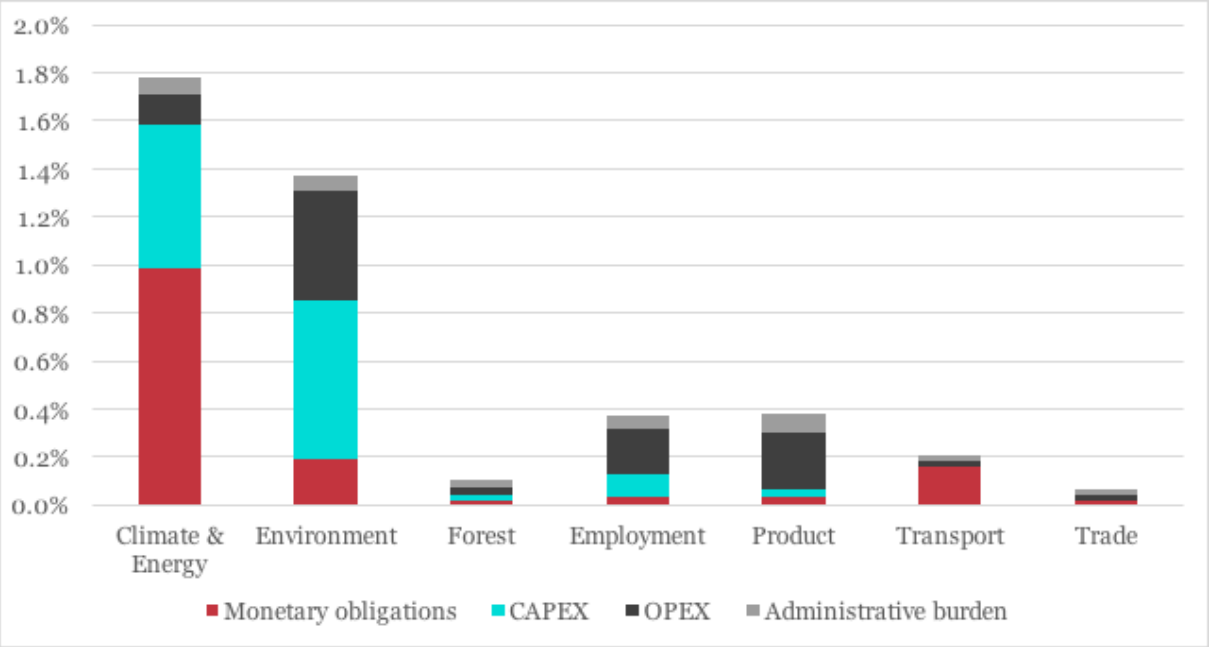
Table 31 Direct Costs for the overall pulp, paper and paperboard sector by cost category and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	% EBITDA	% EBIT
Monetary obligations	0.3%	1.5%	3.7%	2.6%	7.4%
CAPEX	0.3%	1.4%	3.5%	2.5%	7.2%
OPEX	0.2%	1.1%	2.7%	1.9%	5.5%
Administrative burden	0.1%	0.3%	0.9%	0.6%	1.8%
Total	**0.9%**	**4.3%**	**10.8%**	**7.6%**	**21.9%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

Costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the regulatory costs.

Figure 39 Direct Regulatory costs for the overall pulp, paper and paperboard sector as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

The key legislative package impacting the manufacture of pulp, paper and paperboard is **the climate and energy package**, accounting for 41.5% of total regulatory costs (1.78% of added value). The purchase of CO2 allowances under the ETS system is an important cost for this legislative package. Substantive obligations are also a significant cost item for the climate and energy package, in particular as regards to the ETS, including investments in emission abatement equipment, energy and process efficiency that is beyond business-as-usual expenditures. Investments to increase energy independence and to reduce emissions amongst pulp, paper and paperboard producers have been made, in some cases this means that mills are, in part, operated with an autonomous power supply that generates energy for its own use (e.g. integrated pulp, paper and paperboard mills), which in turn improve energy efficiency.

In addition to investments costs (e.g. investments in equipment or new systems of procedures needed to comply with the provision for a 20% reduction in greenhouse gas emission), the Energy Efficiency Directive foresees independent energy audits for large companies. Energy audits do also imply fees and regulatory charges, which brings additional administrative burden for pulp companies.

The **environmental legislative package** accounts for 32% of total direct regulatory costs for the sector (1.37% of added value). Key cost items for these pieces of legislation are investment in new installations as well as maintenance costs for equipment and supplies for IED permit are obliged to invest in Best Available Technologies (BATs). For instance, costs for permits for waste (as well as waste water) treatment are significant costs that arise for pulp producers. Several large companies will have their own landfills where operating costs for the maintenance of its equipment and supplies are also generated.

The **forest-related legislative package** accounts for 2.5% of total regulatory costs (0,11% of added value). Direct costs started to become more significant when the EUTR regulation was concluded in

2010 and when it came into force in 2013. However, compared to costs arising from the implementation of other legislation it appears to be of lower magnitude.

The **employment legislative package** accounts for 8.7% of total regulatory costs (0,37% of added value). Main cost items are operating costs and capital expenditures. With respect to these substantive obligations (CAPEX and OPEX) pulp, paper and paperboard companies invest in health and safety standards, buy personal safety equipment as well as equipment to limit exposure substances including hazardous ones in accordance with the EU regulation (as well as invest in training). Investment and operating costs also arise from the monitoring procedures and protective equipment for work at night that have to be established because of the Working Time Directive. Additional costs may furthermore arise due to on-call and standby time in the Working Time Directive.

The **product legislative package** is the third most important package, accounting for 8.8% of total regulatory costs (0.38% of added value), among which a large part refers to operating costs. Such substantive costs are mainly associated with the eco-label and include costs from lifecycle assessment, training of personnel to fulfil eco-design requirements, obligations connected to distribution and labelling, or providing information about product supply chains.

The **transport legislative package** represents 4.9% of total regulatory costs (0.2% of added value). This sub-sector uses all modes of transport to get its raw materials and its products delivered. Road is however predominant. Monetary obligations are principally associated with the additional cost of switching to low-sulphur fuel (marine gas oils - MGO). It has been suggested that this represents a cost increase of 13 to 25% of the overall costs in the SECA area[41]. As stated earlier, the EU Directive on road transport[42], by regulating vehicle dimensions and maximum weights for national and international journeys, affects the pulp, paper and paperboard and paper board producing companies in the same way it does affect woodworking companies. This may require investments related to the dimension and weight of vehicles or proof of fulfilment by providing a manufacturer's number plate with an additional plate showing dimensions or registration documents.

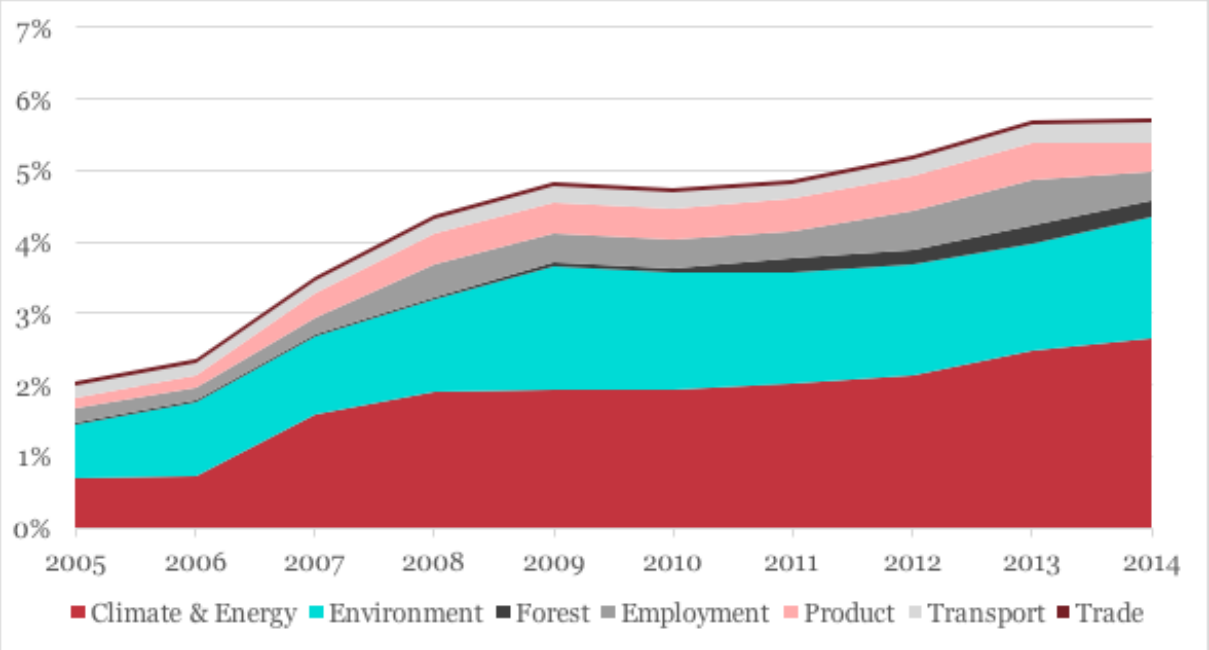
The **trade legislative package** accounts for 1.6% of total regulatory costs (0.07% of added value). Due to some specificities, such as the 'lesser duty rule' and the 'community interest', it has been suggested that the anti-dumping measures adopted by the EU are often of lower magnitude than in other countries. These trade defence measures thus do not restore a true level playing field for the European pulp, paper and paperboard industry when harmed by dumped or subsided imports. This puts the European industry at a disadvantage and creates trade diversion, to the advantage of non-EU countries.

[41] CE DELFT Study (http://www.cedelft.eu/publicatie/seca_assessment%3A_impacts_of_2015_seca_marine_fuel_sulphur_limits/1780),

And EU Parliament study on Shippers (http://www.europarl.europa.eu/RegData/etudes/STUD/2015/540338/IPOL_STU%282015%29540338_EN.pdf)

[42] Directive 2002/7/EC of the European Parliament and of the Council of 18 February 2002 amending Council Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic.

Figure 40 Evolution of direct regulatory costs for the overall pulp, paper and paperboard sector as % of added value for the period 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

The analysis of cost trends (time frame 2005-2014) demonstrate that direct costs ratios nearly tripled over the time period. Direct costs ratios relating to the climate and energy legislative package have increased significantly between 2006 and 2007, and have then remained stable until 2012 when we start seeing another increase in costs.

In contrast to other industries, the pulp, paper and paperboard industry cannot easily reduce its production since operating costs are high. It is as such presumed that the significant increase in costs for the pulp, paper and paperboard producing sub-sector in 2006-2007 is interlinked with investments to meet forthcoming legal obligations. This would be connected to the revision of the Renewable Energy Directive and the launch of the third phase of the ETS. For instance, pulp, paper and paperboard was covered by the ETS since its start in 2005. The second increase in 2012/2013 may also be linked to the ETS, e.g. from 2013 the ETS requires a reduction of -21% compared to 2005. The Energy Efficiency Directive also came into force during this period and it would also have been preceded by investments to meet new legal requirements.

The following table provides results for the first (2005) and last (2014) years over the period, along with ranges of direct regulatory costs over the period (2005-2014):

Table 32 Direct regulatory costs for the pulp, paper and paperboard sector - First year, last year, ranges min-max

	First year (2005)	Last year (2014)	Min	Year	Max	Year
Climate & Energy	0.706%	2.646%	0.706%	2005	2.646%	2014
Environment	0.739%	1.709%	0.739%	2005	1.730%	2009
Forest	0.024%	0.220%	0.024%	2005	0.244%	2013
Employment	0.189%	0.392%	0.183%	2006	0.634%	2013
Product	0.169%	0.416%	0.169%	2005	0.517%	2013
Transport	0.166%	0.280%	0.165%	2006	0.280%	2014
Trade	0.058%	0.072%	0.058%	2005	0.072%	2014

Source: Authors' elaboration

Results presented above apply to firms of the pulp, paper and paperboard industries where pulp mills sell their market pulp to third parties. As most mills included in our sample of companies are integrated companies, results are presented below for an average **integrated company** of pulp, paper and paperboard.

Table 33 Direct regulatory costs for the overall pulp, paper and paperboard sector by package and comparison with main financial indicators for an average integrated company – annual average for 2005-2014

	% turnover	EUR/tonne
Climate & Energy	0.42%	3.18 €
Environment	0.32%	2.46 €
Forest	0.02%	0.19 €
Employment	0.09%	0.67 €
Product	0.09%	0.68 €
Transport	0.05%	0.38 €
Trade	0.01%	0.12 €
Total	**1.00%**	**7.68 €**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

5.6.3 Indirect regulatory costs for the overall pulp, paper and paperboard sector

Companies undergoing the interview process as well as stakeholders taking the online survey have systematically reported the significant impact of ETS indirect costs of regulation, that occur when utility companies pass-on some of their ETS-related costs on the industry. Such indirect costs from electricity providers become particularly substantial as pulp, paper and paperboard are energy-intensive sectors.

The methodology followed to produce results on ETS indirect costs can be consulted as part of chapter 3. In order to provide a fair overview of its impact, we propose the following scenarios:

- Pass-on rates: i) 0.5 and ii) 1; based on an extensive analysis of all available literature.

- For the evolution of indirect costs per year, two alternative carbon prices for 2007 have been used: i) 0.74 €/tonne CO2 (spot price of 2007) and ii) 19.56 €/tonne CO2 (average of daily future prices of the next year)

Table 34 Indirect costs of ETS (million EUR) for the overall pulp, paper and paperboard sector

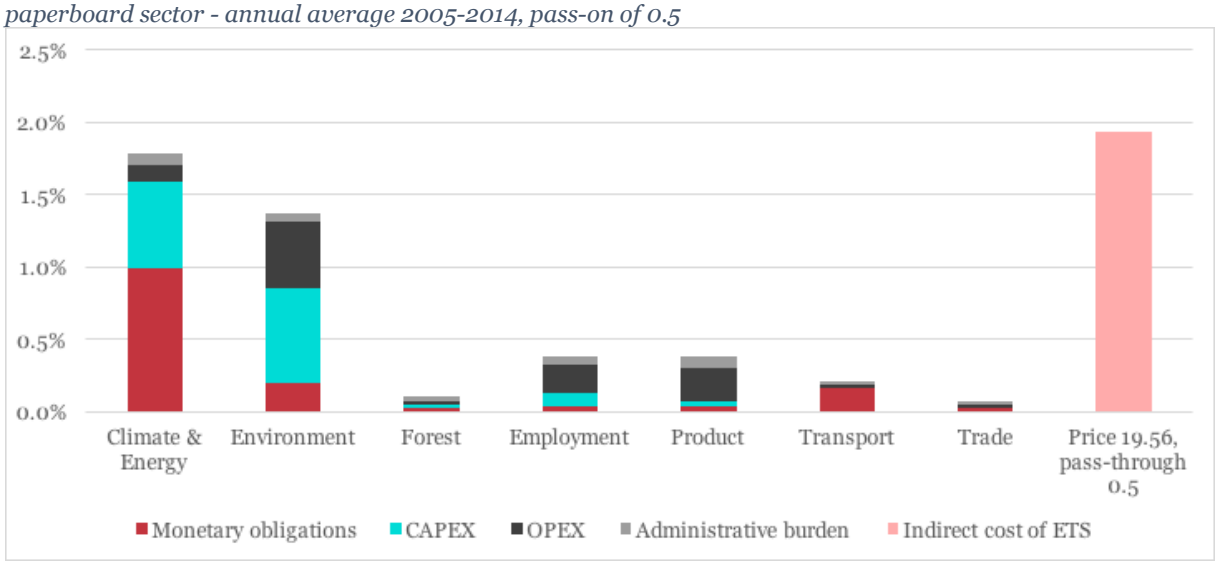
Indirect costs from ETS (in million EUR)				
	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
Hypothesis 1 Pass-on	0.5	0.5	1	1
Hypothesis 2 Carbon price 2007	0.74	19.56	0.74	19.56
2005	524.27	524.27	1,048.54	1,048.54
2006	481.03	481.03	962.07	962.07
2007	18.57	490.91	37.14	981.82
2008	535.11	535.11	1,070.21	1,070.21
2009	275.12	275.12	550.24	550.24
2010	321.90	321.90	643.80	643.80
2011	289.24	289.24	578.48	578.48
2012	154.92	154.92	309.84	309.84
2013	89.49	89.49	178.98	178.98
2014	118.04	118.04	236.09	236.09

Source: Authors' elaboration

5.6.4 Direct and indirect regulatory costs for the overall Pulp, Paper and Paperboard sector

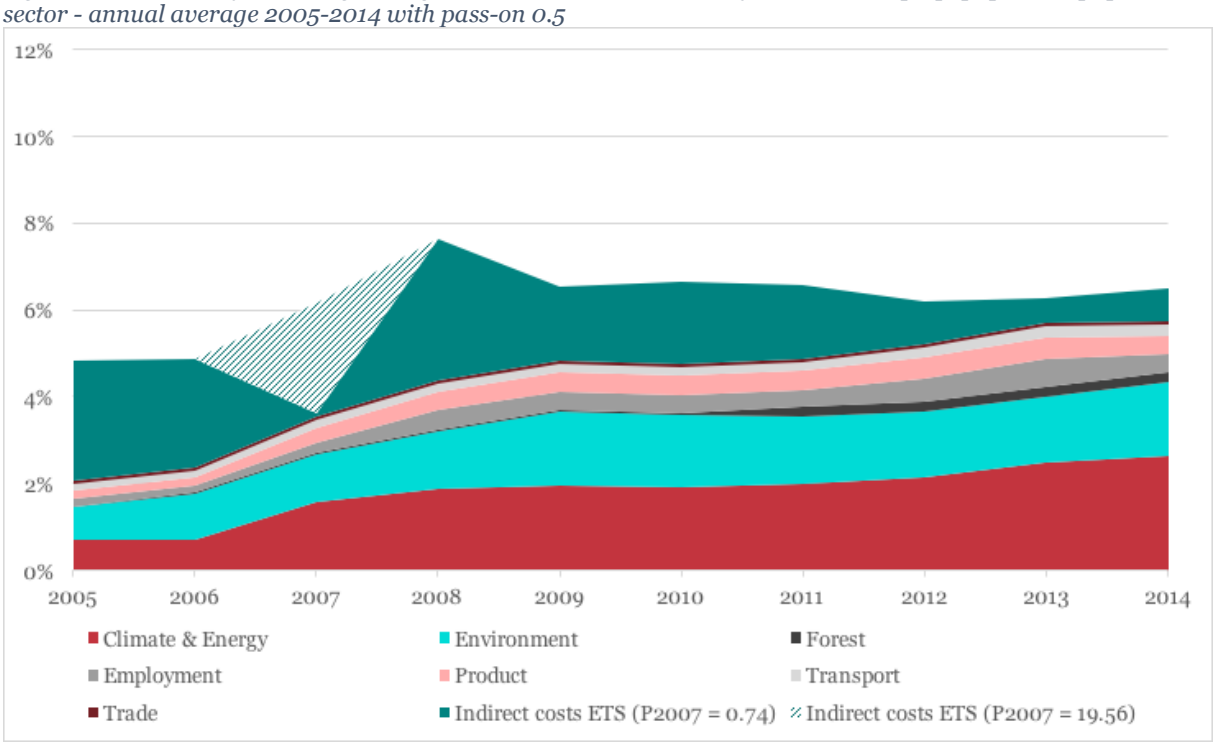
The following charts gathers the overall direct regulatory costs and indirect costs from ETS, as a share of added value and as an annual average for 2005-2014, with a pass-on rate of 0.5. Indirect costs from ETS are close to twice as much as direct costs from the climate and energy package, which contains, inter alia, direct costs from ETS.

Figure 41 Overall direct regulatory costs and ETS indirect regulatory costs for the overall pulp, paper and paperboard sector - annual average 2005-2014, pass-on of 0.5



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

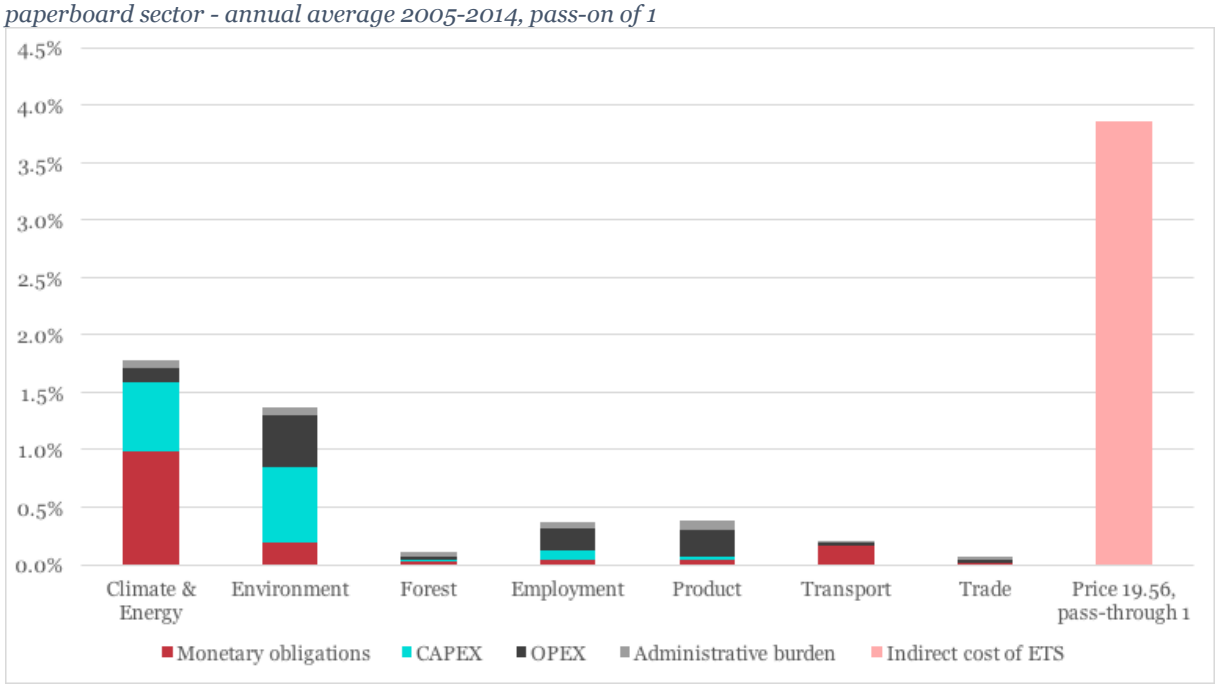
Figure 42 Evolution of direct regulatory costs and ETS indirect costs for the overall pulp, paper and paperboard sector - annual average 2005-2014 with pass-on 0.5



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

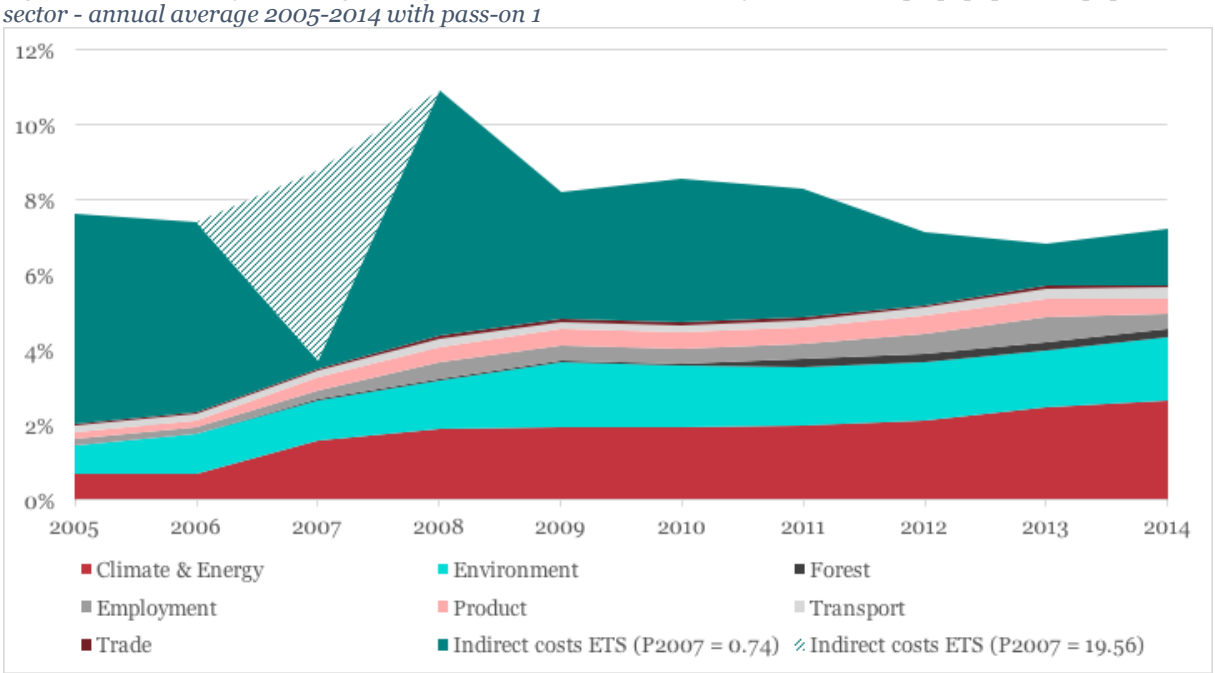
The following chart gathers the overall direct regulatory costs and indirect costs from ETS, as a share of added value and as an annual average for 2005-2014, with a pass-on rate of 1. Indirect costs from ETS are close to four times as much as direct costs from the climate and energy package, which contains, inter alia, direct costs from the ETS.

Figure 43 Overall direct regulatory costs and ETS indirect regulatory costs for the overall pulp, paper and paperboard sector - annual average 2005-2014, pass-on of 1



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

Figure 44 Evolution of direct regulatory costs and ETS indirect costs for the overall pulp, paper and paperboard sector - annual average 2005-2014 with pass-on 1



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

Finally, as mentioned in section 5.1.3, companies in the panel sector systematically reported to be impacted by indirect costs due to climate and energy policies, particularly by the Renewable Energy Directive (Directive 2009/28/EC). Companies reported that the directive has contributed to increasing the raw material costs (mainly wood), and led to the substitution of wood-based panels by less expensive materials when possible. By extension, this is likely to also be an issue for the pulp, paper and paperboard sub-sector, since they use the same types of fresh wood as part of their raw material intake.

5.7 Cumulative cost assessment of manufacture of pulp (17.11)

Eurostat definition of manufacture of pulp
NACE Rev.2: C1711
NACE Rev. 1.1: C2111

This sub-sector includes the manufacture of bleached, semi-bleached or unbleached paper pulp by mechanical, chemical (dissolving or non-dissolving) or semi-chemical processes, the manufacture of cotton-linters pulp and the removal of ink and manufacture of pulp from waste paper. Eurostat, 2016

All eight legislative packages were prioritised for the pulp-producing sub-sector: competition, climate and energy, environment, forest-related, employment, products, transport and trade legislative packages. The company survey did however only assess the direct regulatory costs for seven packages as the competition package was addressed qualitatively. The results indicate that it is especially the climate and energy (CAPEX, fees) as well as the environment (OPEX, CAPEX, fees) legislative packages that generated significant costs for pulp producers. Legislative packages concerned with employment, product (OPEX) and transport (fees) remained on a similar level as regards to generating costs. Nearly no costs have been reported by companies of this sub-sector for forest-related and trade legislative packages, for which the quantification exercise appeared to be difficult.

Direct regulatory costs for the sub-sector reach 1.2% of turnover, 4.9% of added value and 9% of gross operating surplus of companies as an average for the whole time period (2005-2014), which can be broken down between cost categories as follows in Table 35. Other comparators are presented as well, e.g. regulatory costs as share of EBITDA, of EBIT and regulatory costs per tonne.

Table 35: Direct regulatory costs for manufacture of pulp by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	% EBITDA	% EBIT	EUR/ tonne	Share of total regulatory costs
Climate & Energy	0.40%	1.7%	3.1%	3.4%	9.7%	0.87 €	34.6%
Environment	0.37%	1.6%	2.9%	3.1%	8.9%	0.79 €	31.7%
Forest	0.02%	0.1%	0.2%	0.2%	0.5%	0.04 €	1.8%
Employment	0.15%	0.7%	1.2%	1.3%	3.8%	0.34 €	13.4%
Product	0.14%	0.6%	1.1%	1.1%	3.3%	0.29 €	11.8%
Transport	0.07%	0.3%	0.5%	0.6%	1.6%	0.15 €	5.9%
Trade	0.01%	0.04%	0.1%	0.1%	0.2%	0.02 €	0.8%
Total	**1.2%**	**5.0%**	**9.1%**	**9.8%**	**28%**	**2.50 €**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

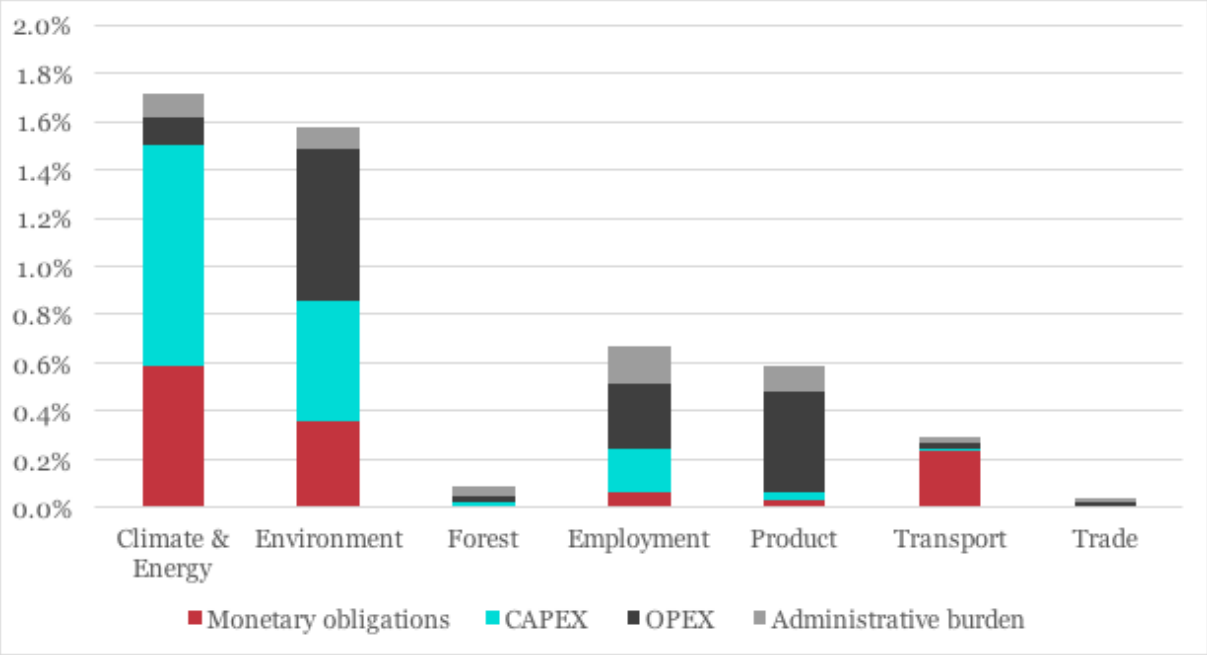
Table 36 Direct regulatory costs for manufacture of pulp by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	% EBITDA	% EBIT	EUR/ Tonne
Monetary obligations	0.3%	1.3%	2.4%	2.6%	7.3%	0.66 €
CAPEX	0.4%	1.6%	3.0%	3.2%	9.2%	0.82 €
OPEX	0.4%	1.5%	2.8%	2.9%	8.6%	0.76 €
Administrative burden	0.1%	0.6%	0.9%	1.0%	3%	0.26 €
Total	**1.2%**	**5.0%**	**9.1%**	**9.8%**	**28%**	**2.5 €**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

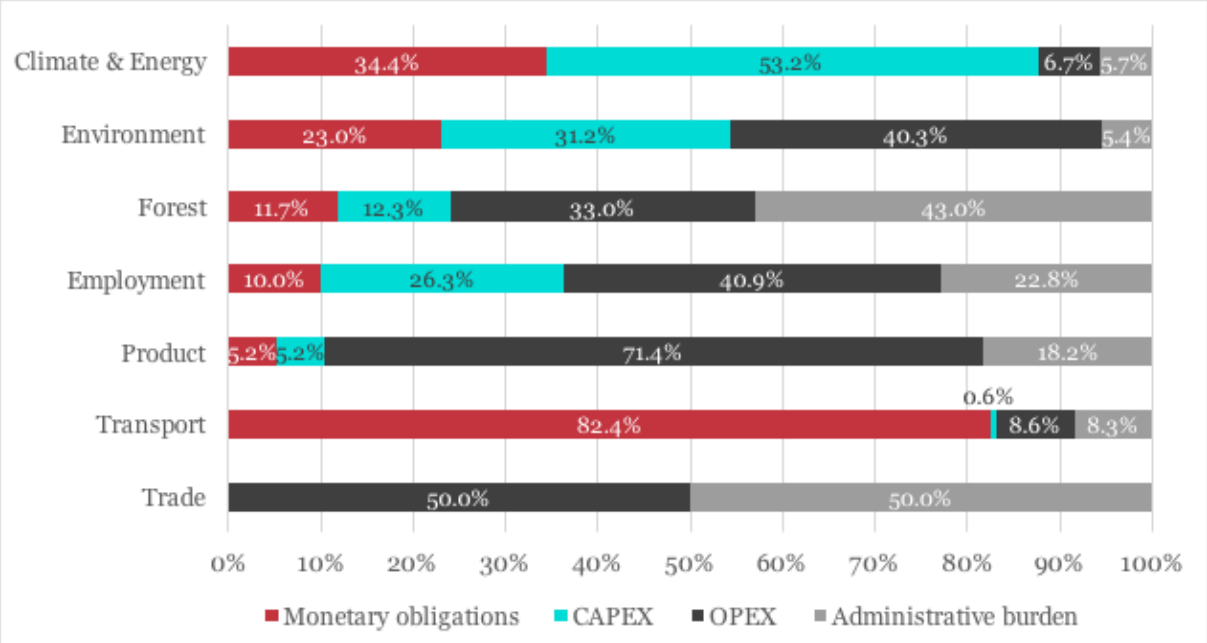
Direct costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the direct regulatory costs.

Figure 45 Direct regulatory costs for manufacture of pulp as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

Figure 46 Share of categories of direct regulatory costs for manufacture of pulp by package – annual average for 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

The key legislative package impacting the manufacture of pulp is the **climate and energy package**, accounting for 34.6% of total direct regulatory costs (1.7% of added value). The purchase of CO2 allowances under the ETS system is an important cost for the climate and energy package. Substantive obligations is the most significant cost item for this package (overall 53.2% of the package), in particular as regards to the ETS that include investments in emission abatement equipment, energy and process efficiency that is beyond business-as-usual expenditures. Investments to increase energy independence and to reduce emissions amongst pulp producers have been made, in some cases this means that mills are, in part, operated with an autonomous power supply that generates energy for its own use (e.g. pulp, paper and paperboard mills), which in turn improve energy efficiency.

The compliance of the industry with the ETS is however managed at the plant level, which also means that the administrative burden (e.g. related to greenhouse gas emission permits or accounting) is carried by the companies. Overall, administrative burden represents 5.7% of this package.

In addition to investments costs (e.g. investments in equipment or new systems of procedures needed to comply with the provision for a 20% reduction in greenhouse gas emission), the Energy Efficiency Directive foresees independent energy audits for large companies. Energy audits do however also imply fees and regulatory charges, which brings additional administrative burden for pulp companies. It should also be noted that benefits from increasing energy efficiency, such as heat recovery from the refiner steam, as part of reducing overall production costs are not accounted for in this assessment.

Accounting for 31.7% of total regulatory costs, the **environment legislative package** is the second most important one for this sub-sector (1.6% of added value). Within this package, monetary obligations reach 34.4% of the package, which are inter alia related to reducing industrial emissions (as linked to the Industrial Emissions Directive and IPPC Directive) –repealed by IED with effect on 7th January 2014. Capital expenditures and operating costs amount to respectively 53.2% and 6.7% of the package. Key cost items for these are investment in new installations as well as maintenance costs for equipment and supplies for IED permit are obliged to invest in Best Available Technologies (BATs). For instance, costs for permits for waste (as well as waste water) treatment are significant costs that arise for pulp producers. Several large companies will have their own landfills where operating costs for the maintenance of its equipment and supplies are also generated.

The administrative burden amounts to 5.7% of the package and relate to registration, notification or permitting of certain activities or costs sustained for the supply of data or information for monitoring according to the Industrial Emissions Directive (IED). The IPPC Directive, which was still in force during the study period, had an impact on costs in relation to permits that take into account the whole environmental performance of the plant based on BATs. For waste management documentation and depending on the product type (including hazardous waste) and waste management method will be required generating administrative burden for the pulp industry.

National Emission Ceilings for certain pollutants (Directive 2001/81/EC) sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia). Since member states had to limit their annual national emissions of those pollutants by 2010 to an amount not exceeding the emission ceilings, this directive generates investment and administrative for the pulp sector.

The **employment legislative package** accounts for 13.4% of total direct regulatory costs (0,7% of added value). Main cost items are operating costs and capital expenditures, respectively representing 40.9% and 26.3% of the package. With respect to these substantive obligations (CAPEX and OPEX) pulp companies do need to invest in health and safety standards, buy personal safety equipment as well as equipment to limit exposure substances including hazardous ones according to the EU regulation (as well as invest in training). Investment and operating costs also arise from the monitoring procedures and equipment protection for work at night that have to be established because of the Working Time Directive.

The administrative burden that are associated with this package (22.8% of the package) arise because of the preparation of audits, carrying out health and safety checks or developing new measures for the use and handling of hazardous substances. The Working Time Directive (2003/88/EC) generates additional administrative burden because of the personnel in charge of monitoring working hours of personnel as well as monitoring obligations in relation to night work.

The **product legislative package** represents 11.8% of total direct regulatory costs (0.6% of added value). Its main cost relates to the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation - as related to the costs for testing, investing in laboratory equipment, employment, labelling equipment and databases for chemicals to be used in pulp – and to the EU Ecolabel.

Operating costs are the main cost item for this package, representing 71.4% of the package. Such substantive costs are associated with the eco-label and include costs from lifecycle assessment, training of personnel to fulfil ecodesign requirements, obligations connected to distribution and labelling, or providing information about product supply chains. Information obligations and administrative burden, the second most important cost item accounting for 18.2% of total package, also arise in relation to REACH regulation, including costs for administrative personnel.

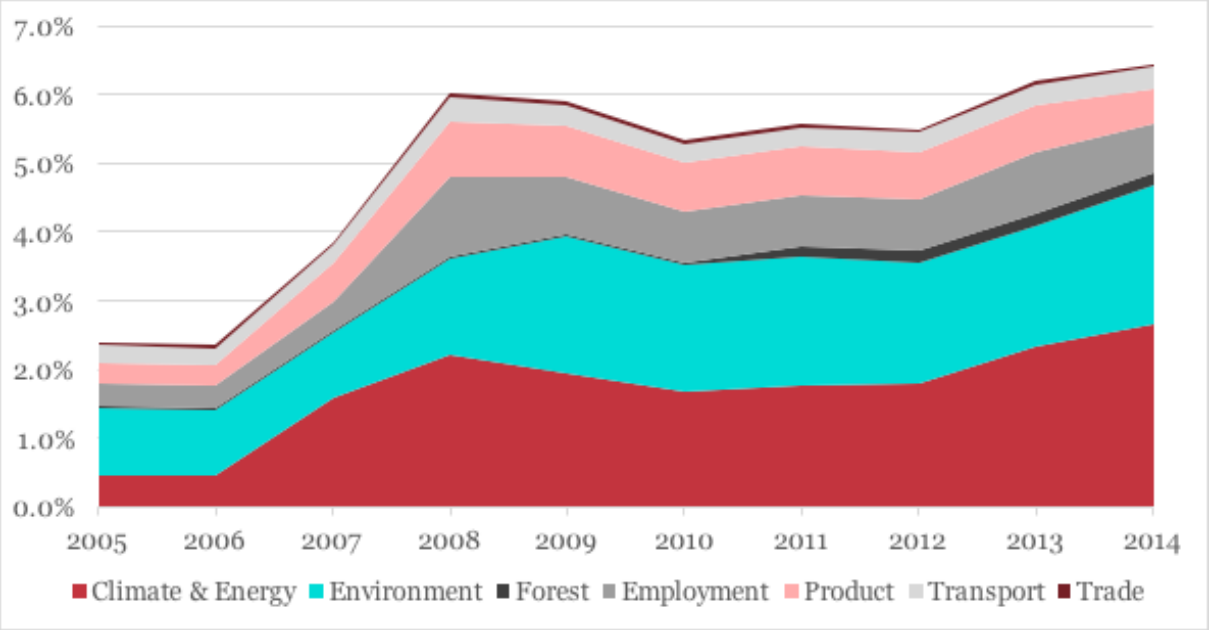
Monetary obligations represent 5.2% of the package, as all substances registered to the European Chemicals Agency (ECHA) are also subject to a fee, but registration fees vary depending on the volume of substances and size of companies (smaller ones pay less). Furthermore, fees associated with the applications for authorisation of a new substance to come into contact with food or an annual license fee associated with labelling products under the EU Ecolabel Regulation produce additional monetary obligations on the pulp industry. However, since the EU Ecolabel Regulation is entirely voluntary, it does not impose any specific obligation on the pulp industry by itself unless companies choose to use this label and meet the requirements and annual fees.

The **transport legislative package** represents 5.9% of total direct regulatory costs (0.3% of added value). This sub-sector uses shipping as well as road and rail to transport raw material to the pulp producers and its pulp customers. Monetary obligations amounting to 82.4% of the package, are the main cost item of this package and are principally associated with any sulphur tax or other related fees, such as charges for determining notifications under the waste shipment regulation. The Waste Shipment Regulation requires a financial guarantee or insurance and may include investments in infrastructure as all companies have a duty to manage the process in a way that protects the environment and human health. Pulp companies may have to pay higher fees for shipping waste as costs are passed on.

The EU Directive for road transport[43] also affects pulp producers by applying rules for limits on the dimensions and maximum weights for national and international journeys that are common to all EU member states. Thereby, pulp producing companies are limited in the weight and the dimension of material they are allowed to transport, hence leading to potential investments (capital expenditures and operating expenditures) in order to provide manufacturers' plate with an additional plate, displaying the dimensions and registration documents, and charges on excess weight.

[43] Directive 2002/7/EC of the European Parliament and of the Council of 18 February 2002 amending Council Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic.

Figure 47 Evolution of direct regulatory costs for manufacture of pulp as % of added value for the period 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

The analysis of cost ratios trends (time frame 2005-2014) demonstrate that direct regulatory costs ratios nearly tripled over the time period. Direct costs relating to the climate and energy legislative package have increased significantly between 2006 and 2007, and have then remained stable until 2012 when we start seeing another increase in costs. Costs for the environmental legislative package increased significantly in 2009.

In 2008, the EU set a series of climate and energy targets to, amongst other things, meet its "20-20-20" targets. However, in contrast to other industries, the pulp industry cannot easily reduce it production since operating costs are high. It is likely that the significant increase in costs for the pulp-producing sub-sector in 2006-2007 is interlinked with investments to meet forthcoming legal obligations. This was connected to the impact of the Renewable Energy Directive and the launch of the third phase of the ETS, both happening in 2009. For instance, pulp was covered by the ETS since its start in 2005. The second increase in 2012/2013 may also be linked to the ETS, e.g. from 2013 the ETS requires a reduction of -21% compared to 2005. The Energy Efficiency Directive also came into force during this period and it would have been preceded by investments to meet new legal requirements.

The environmental package is also characterised by high costs in this instance, with a significant increase of costs in the 2008-2009 period. This is interlinked to a number of directives that came into force during this period. Most notably amongst these was the Waste Framework, as well as the Directive for Ambient Air Quality and Cleaner Air (Directive 2008/50/EC). Together with the IED, this legislation has generated the increasing cost figures that can be found for the environmental package, and would have been preceded by significant investment costs as well as running operational and maintenance costs following on from the adoption.

Costs related to forest-related policies started to become significant after the EUTR regulation was concluded in 2010 and moreover it came into force in 2013. Compared to costs arising from the implementation of other legislative package, it does however appear to be less substantial.

It should be noted that indirect regulatory costs are described for the whole pulp, paper and paperboard sub-sector under chapter 5.6. and so are not included in the chapter for the manufacture of pulp only.

5.8 Cumulative cost assessment of manufacture of paper and paperboard (17.12)

Eurostat definition of manufacture of paper and paperboard
NACE Rev.2: C1712
NACE Rev. 1.1: C2112

This sub-sector includes the manufacture of paper and paperboard intended for further industrial processing, the further processing of paper and paperboard (coating, covering and impregnation of paper and paperboard, the manufacture of creped or crinkled paper and the manufacture of laminates and foils, of laminated paper or paperboard), the manufacture of handmade paper, the manufacture of newsprint and other printing or writing paper, the manufacture of cellulose wadding and webs of cellulose fibres and the manufacture of carbon paper or stencil paper in rolls or large sheets. Eurostat, 2016

The following eight legislative packages were prioritised for the manufacture of paper and paperboard sub-sector: competition, climate and energy, environment, forest-related, employment, products, transport and trade legislative packages. The company survey did however only assess direct costs for seven packages as the competition package was addressed qualitatively. The results indicate that it is especially the climate and energy (fees, CAPEX) as well as the environment (CAPEX, OPEX) legislative packages that generated significant costs for manufactures of paper and paper products. Legislative packages concerned with employment, product and transport remained on a similar and lower level over time as regards to generating costs. Nearly no costs have been reported by companies of this sub-sector for the forest-related and trade legislative packages, for which the quantification exercise appeared to be difficult. Overall, it can be noted that the manufacture of paper and paperboard sub-sector demonstrate similar costs as the pulp sub-sector.

Direct regulatory costs for the sub-sector reach 0.9% of turnover, 4.1% of added value and 10.9% of gross operating surplus of companies, which can be broken down between cost categories as follows in the table below. Other comparators are presented as well, e.g. regulatory costs as shares of EBITDA, of EBIT and regulatory costs per tonne of sold product.

Table 37: Direct regulatory costs for manufacture of paper and paperboard by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	% EBITDA	% EBIT	EUR/ tonne	Share of total regulatory costs
Climate & Energy	0.37%	1.8%	4.7%	3.1%	9.0%	2.82 €	42.5%
Environment	0.28%	1.4%	3.6%	2.4%	6.8%	2.13 €	32.1%
Forest	0.02%	0.1%	0.3%	0.2%	0.5%	0.17 €	2.6%
Employment	0.07%	0.3%	0.9%	0.6%	1.7%	0.53 €	8.0%
Product	0.07%	0.3%	0.9%	0.6%	1.8%	0.55 €	8.3%
Transport	0.04%	0.2%	0.5%	0.4%	1.0%	0.32 €	4.8%
Trade	0.01%	0.1%	0.2%	0.1%	0.3%	0.11 €	1.7%
Total	**0.9%**	**4.2%**	11.1%	**7.4%**	**21.1%**	**6.6 €**	**100.0%**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

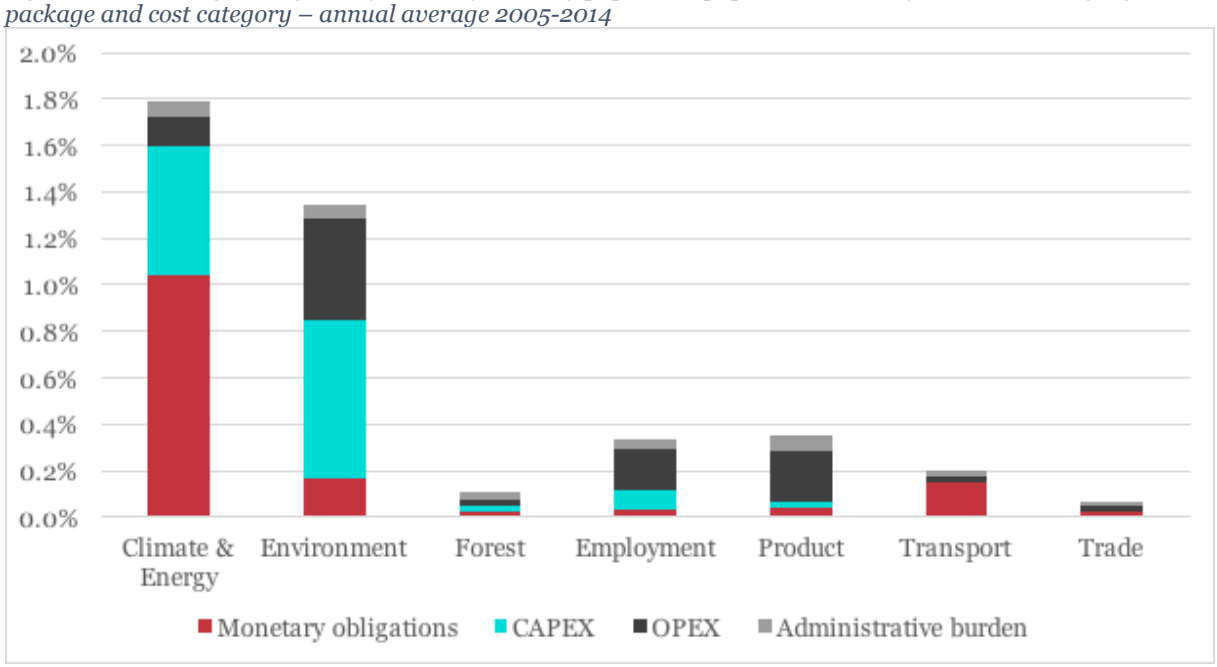
Table 38 Direct regulatory costs for manufacture of paper and paperboard by package and comparison with main financial indicators – annual average for 2005-2014

	% turnover	% AV	% GOS	% EBITDA	% EBIT	EUR/ Tonne
Monetary obligations	0.3%	1.5%	3.9%	2.6%	7.4%	2.33 €
CAPEX	0.3%	1.4%	3.6%	2.4%	6.9%	2.17 €
OPEX	0.2%	1.0%	2.7%	1.8%	5.2%	1.63 €
Administrative burden	0.07%	0.3%	0.9%	0.6%	1.6%	0.52 €
Total	**0.9%**	**4.2%**	**11.1%**	**7.4%**	**21.1%**	**6.6 €**

Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

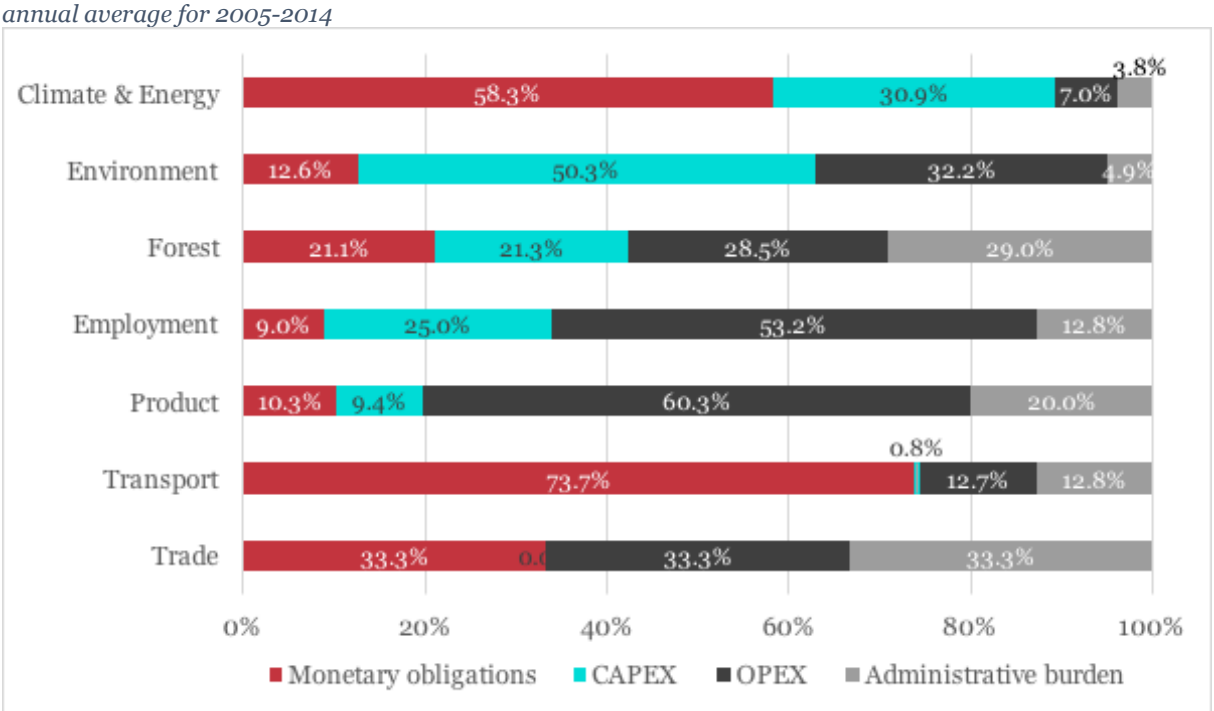
Direct costs from EU regulation can be split by package and by cost categories. The following paragraphs elaborate on the pieces of legislation and related cost categories driving the direct regulatory costs.

Figure 48 Direct regulatory costs for manufacture of paper and paperboard as % of added value, by legislative package and cost category – annual average 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

Figure 49 Share of categories of direct regulatory costs for manufacture of paper and paperboard by package – annual average for 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

The **climate and energy legislative package** is the most important package, representing 42.5% of total direct regulatory costs (1.8% of added value).

The purchase of CO2 allowances under the ETS system represent a significant cost for manufactures of paper and paperboard. The compliance of the industry with the ETS is managed at the plant level, which also means that the administrative burden (e.g. related to greenhouse gas emission permits and/or accounting) is carried by the companies. Overall, the main cost items are monetary obligations (58.2% of the package) and capital expenditures (30.9% of the package). Substantive obligations resulting from the ETS include investments for emission abatement equipment, energy and process efficiency. Utility companies also pass on some of their ETS- related costs to the paper industry, in particular as the manufacture of paper and paperboard is very energy intensive.

Investments to reduce energy consumption (e.g. through improved process efficiency) and greenhouse gas emissions amongst manufactures of paper and paperboard have been made, in some cases this means that mills have their own power supply that generates energy for parts of its factory`s needs (e.g. in integrated pulp, paper and paperboard mills), which in turn improve energy efficiency.

In addition to investments costs (e.g. equipment or new systems of procedures to comply with the provision for a 20% reduction in greenhouse gas emission), the Energy Efficiency Directive foresees independent energy audits for large companies. Energy audits do however also imply fees and regulatory charges, which constitute an administrative burden for manufactures of paper and paperboard. It should also be noted that benefits (cost savings) from increasing energy efficiency, such as heat recovery from refiner steam, as part of reducing overall production costs are not accounted for in this assessment.

The **environmental legislative package** is the second most important package, accounting for 32.1% of total direct regulatory costs (1.4% of added value). Manufactures of paper and paper products were required to reduce industrial emissions under the IPPC Directive for the period under review of this study (IPPC directive has been repealed by the IED starting from 7th January 2014). They are also required to have licences or emission permits and pay fees and charges associated with these. Permit conditions are constantly updated by the EU Member States.

Capital expenditures and operation costs are a key cost item of the package, representing 50.3% of environmental costs. Investment in new installations as well as maintenance costs for equipment and supplies are interlinked with these costs as the sub-sectors operating under IED permit are obliged to invest in Best Available Technologies (BATs). Also referring to investments concerned with air quality (Directive on Ambient Air Quality and Cleaner Air for Europe), air emissions and waste management (e.g. Waste Framework Directive). For instance, costs for permits for waste (as well as waste water) treatment are significant costs that arise for manufactures of paper and paperboard. Several large companies have their own landfills where operating costs for the maintenance of its equipment and supplies are also generated. CAPEX and OPEX-related costs are for this reason the most significant expenditure for this legislative package and allude to the types of investments that have been made to comply with the directives in question.

Administrative burden is associated with the registration, notification or permitting of certain activities or costs sustained for the supply of data or information for monitoring in accordance with the Industrial Emissions Directive. The IPPC directive and its successor IED have impacted on costs is in relation to permits that take into account the whole environmental performance of the plant based on BATs. There are also requirements for waste management documentation, and depending on the product type (including hazardous waste) and waste management method, these would also generate administrative burden for the manufactures of paper and paper products.

National Emission Ceilings for certain pollutants (NEC Directive) sets upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia). Since member states had to limit their annual national emissions of those pollutants by

2010 to an amount not exceeding the emission ceilings, this Directive generates investment and administrative burden for the manufactures of paper and paper products.

The **product legislative package** represents 6.3% of total direct regulatory costs (0.3% of added value). Operating costs are the key cost item from this package (60.3% of the package) and mostly refer to the eco-label, from life-cycle assessment, training of personnel to fulfil eco-design requirements, obligations connected to distribution and labelling, or providing information about product supply chains.

The Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Regulation has been noted as generating significant cost. This includes activities such as testing, investing in laboratory equipment, labelling equipment and databases for chemicals to be used in the varied manufacturing processes associated with different paper and paper products.

Monetary obligations represent 10.3% of the package. As a matter of fact, all substances registered with ECHA are also subject to a fee. These registration fees do however vary depending on the volume of substances and size of companies (e.g. small companies pay less). Furthermore, fees are associated with the applications for authorisation of a new substance to come into contact with food and/or annual licence fees connected with labelling products under the EU Eco-label. These regulations would in turn also produce monetary obligations for manufactures of paper and paper products. In the case of the Eco-label Regulation, these are, on the one hand, entirely voluntary and do not impose any specific obligations on the industry. On the other hand, it has been argued that green public procurement requirements have provided an incentive for products to have an eco-label (i.e. the eco-label is a way of proving compliance with specifications in public tenders). In either case, if a company choose to use the eco-label (and meet the requirements) an annual fee arise.

Information obligations and administrative burden arise in relation to REACH regulation, including costs for administrative personnel, and amount for 20% of the package.

The **employment legislative package** represents 8% of total direct regulatory costs (0.3% of added value). Operation costs and capital expenditures respectively represent 53.2% and 25% of the package as manufacturers of paper and paper products do need to invest in health and safety standards, buy personal safety equipment as well as equipment to limit exposure substances including hazardous ones according to the EU regulation (as well as invest in training). Investment and operating costs also arise from the monitoring procedures and protective equipment for work at night that have to be established because of the EU Working Time Directive.

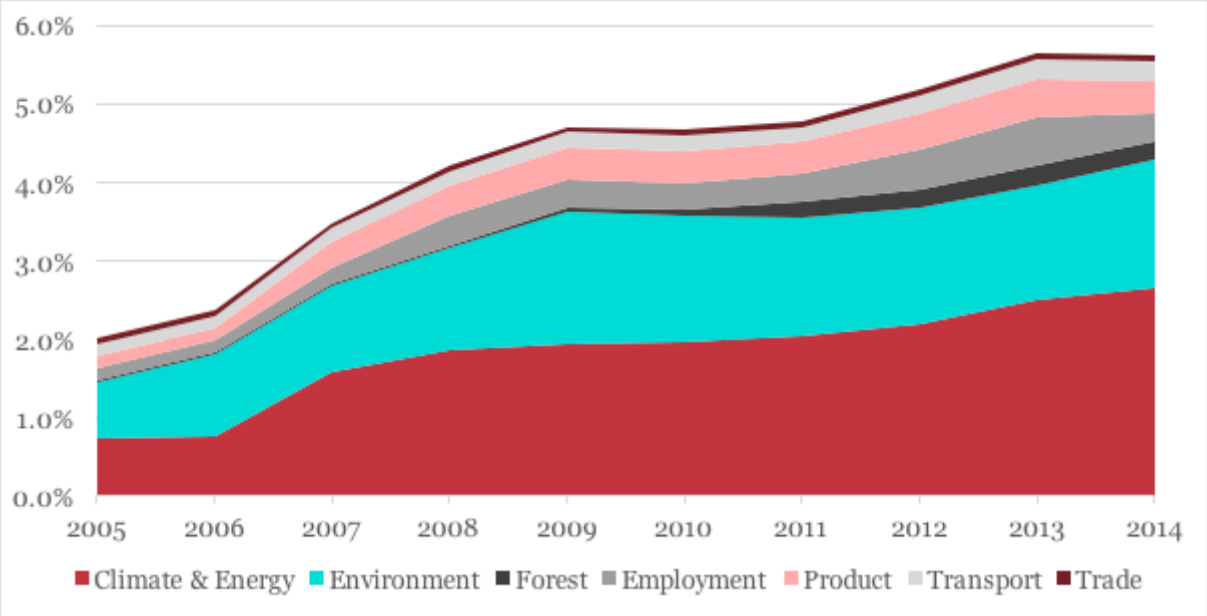
The administrative burden that are associated with this package (12.8% of the package) arise because of the preparation of audits, carrying out health and safety checks or developing new measures for the use and handling of hazardous substances. The Working Time Directive generate additional administrative burden because of the administrative personnel in charge of monitoring working hours of personnel as well as monitoring obligations in relation to night work.

With respect to the **transport legislative package**, this sub-sector uses shipping as well as road transport of raw material to the location where paper and paperboard are manufactured, but also for the delivery of paper and paperboard to its customers. Monetary obligations are a key cost item (73.2% of the package) and are principally associated with taxation of sulphur emissions or other related fees, such as charges for determining notifications under the Waste Shipment Regulation.

Similarly to the pulp sector, the harmonisation of dimensions and maximum weights for national and international lorry journeys affects the manufacturers of paper and paper products in limiting the weight and size of transport, which possibly leads in turn to investments (capital expenditures and operating expenditures) related to the dimension and weight of haulage vehicles or proof of fulfilment by providing the manufacturer's plate with an additional plate showing dimensions or registration documents, along with charges on excess weight.

The Waste Shipment Regulation requires a financial guarantee or insurance and may include investments in infrastructure as all companies have a duty to manage the process in a way that protects the environment and human health.

Figure 50 Evolution of direct regulatory costs for manufacture of paper and paperboard as % of added value for the period 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics and EBIT, EBITDA and production quantities from CEPI, RISI database

The analysis of cost ratios trends (time frame 2005-2014) demonstrate that direct regulatory costs nearly tripled over the time period. Direct costs ratios relating to the climate and energy legislative package have increased significantly between 2006 and 2009, and have then remained stable. Costs for climate and energy increased significantly in 2006 and 2009, and have since then seen a slow but gradual increase, while cost for the environment legislative package increased significantly in 2009, after which it has decreased slightly.

With respect to the **energy and climate package**, these increases in costs for manufactures of paper and paperboard are interlinked with investments to meet forthcoming legal obligations. This was connected to the publishing of the Renewable Energy Directive and the launch of the second phase of the ETS, both happening in 2009. For instance, manufactures of paper have been covered by the ETS since its start in 2005 (some exclusions apply). The Energy Efficiency Directive has been followed by investments to meet legal requirements such as investments in gauges, frequency variators and converters, electrical motors, engine cogeneration, etc.

The **environmental package** is also characterised by high costs. In this case, we see a significant increase of costs in the 2008-2009 period. This is interlinked to a number of directives that came into force during this period. Most notably amongst these would be the Waste Framework Directive as well as the Ambient Air Quality and Cleaner Air for Europe Directive. Together with the IED, these legislative acts have generated the increasing cost figures that can be found for the environmental package, caused by significant investment costs, as well as running operational and maintenance costs, following on from their implementation, e.g. for additional and higher steam input to reduce NOx emissions, adaptation of effluent for treatments of plants, etc.

Costs related to **forest-related policie**s start to become more significant when the EUTR regulation was adopted in 2010 and when it was implemented in 2013. Overall it is however less significant than costs arising from the implementation of other legislation.

Please note: Indirect regulatory costs are described for the whole pulp, paper and paperboard industry under chapter 5.6. and are thus not included in the chapter for the manufacture of paper and paperboard only.

5.9 Expected future costs for the period 2014-2030

Following the assessment of the present effects of current EU legislation on the forest-based industries, this section elaborates on future regulatory costs likely to impact the forest-based industries, either based on current legislation with future cost impacts or future legislation (i.e. drafted or already in the adoption process phase as of the end of 2014). The original objective for this task required the elaboration of cost-related indicators covering 2014-20130 for energy and climate policies and 2014-2020 for other policies. However, some aspects from the regulatory implementation cannot be measured, e.g. its future regulatory cost impact, as important limitations in the availability of data prevent the elaboration of a proper cost assessment for future years. In this regard, the considerations presented in this section are based on desk research and the feed-back from the associations involved in this study, enquired about possible future impacts of legislation, policy strategies and documents linked to the policy packages included in this study.

Overall, in a Communication[44] 2013 related to the new EU Forest Strategy for forests and the forest-based sector, the European Commission re-iterated its position to further support and develop the sector for the coming years, based on the guiding principles of sustainable forest management, the multifunctional role of forests, its resource efficiency, and global forest responsibility. EU legislation and policy is thus considered as primordial – through new developments and the revision of existing acts – in order to ensure forest protection, foster growth and job creation and guarantee the sustainable production and consumption of the various products emanating from these industries. However, as mentioned in an Opinion of the European Economic and Social Committee (EESC) on 'Opportunities and challenges for a more competitive European woodworking and furniture sector', from 2012, "unfortunately there are currently some key inconsistencies between certain parts of some EU policies and initiatives which are having a serious impact on the forest-based industries' competitiveness and profitability[45]"

Future costs for the EU forest-based industries as a whole:

<u>Climate and Energy legislation</u>

While non-legislative policy strategies do not present quantifiable direct or indirect costs for the forest-based industries, they are good indications as to what policy-makers may decide in the future and what policy priorities may be made. The roadmap for moving to a competitive low-carbon economy in 2050, the 2030 climate & energy **framework** and the **energy roadmap 2050**[46] all share the idea of reducing carbon emission and reducing energy consumption by making it more efficient. However, de-carbonising energy generation will require substantial investments and may result in higher per-unit energy prices.

It is also expected that the proposal under the **Clean Air Policy Package**[47] will replace the existing legislation (Directive 2001/81/EC no National Emission Ceilings Directive) to further reduce harmful

[44] Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, on "A new EU Forest Strategy: for forests and the forest-based sector", SWD (2013) 342 final

[45] Opinion of the European Economic and Social Committee on 'Opportunities and challenges for a more competitive European woodworking and furniture sector', 2012/C 24/04

[46] 2050 Low Carbon Economy, http://ec.europa.eu/clima/policies/strategies/2050/index_en.htm

[47] Clean Air Policy Package, http://ec.europa.eu/environment/air/clean_air_policy.htm

emissions from industry, transport, energy plants and agriculture. These may generate additional **compliance costs** also for the forest-based industries to meet new objectives and standards.

Regarding the **third energy package**, energy-intensive industries are of course most indirectly affected by two distinct issues, e.g. liberalisation of energy markets and potential higher prices. The forest-based industries, while potentially benefiting from the liberalisation of energy markets, may also suffer indirectly from higher power prices because of EU deregulation measures. Similarly, the physical expansion of an integrated energy market may be accompanied by decreasing energy prices since barriers between EU Member States will decrease. This would however be considered as a benefit and is not part of the assessment.

A Sustainable Bioenergy Policy[48] for the period after 2020, currently under preparation, is welcomed by the sawmilling sector as an instrument to address climate change, security of energy supply and to reach significant greenhouse gas savings by generating bio-energy from sustainable sources. While the requirements for sustainability schemes can be adopted by larger energy producers of 1 MW thermal or 1 MW electrical capacity or above, they could lead to additional administrative burden on small-scale producers. It is still not determined which, if any such binding criteria will be applicable and, if so, on which actors of the sector.

Environmental legislation:

The Circular Economy Package[49] promotes the resource efficient of raw materials, both primary and secondary ones, including reuse and recycling. In particular, the so-called "cascading use" of renewable resources envisages a virtuous hierarchy of use. The European Commission encourages the multiple use of bio-based materials, such as wood. To develop cascade thinking further, the Commission has recently carried out a study on cascading, primarily focussed on wood. (https://bookshop.europa.eu/en/home/) Recognising that resource and market conditions vary between and within member states, especially as regards facilities for the collection, sorting and re-distribution of secondary raw materials, particularly bulk ones such as wood, the Commission will not be legislating prescriptively on cascading. Guidance for cascading will be done by the EU Expert Group on Forest-based Industries and Sectorally Related Issues (Commission Decision 4321/2014).

Forest-related legislation:

Regarding forest-related legislation, businesses are encouraging further and more consistent coordination of the enforcement of the EU Timber Regulation, in order to avoid additional administrative burden emanating from the different interpretation due to national transposition of the regulation. Such administrative burden is especially affecting companies that have operations across Member States. The EUTR's stronger enforcement could also lead to additional economic and administrative burden on the various operators concerned by adding additional labelling requirements.

One expert expressed concerns about possible impacts on future wood costs for the forest-based industries of the forest management restrictions which the Habitats Directive may place on some forest owners if they are not fully compensated. Whilst some work has been carried out in Germany on this subject, it is too early to assess what the net effects might be.

Employment legislation:

A proposal for better workers' protection against cancer causing chemicals[50] was announced in May 2016 and aims to amend the Carcinogens and Mutagens Directive which limits workers' exposure to chemical substances likely to cause cancer at the workplace by including new or amending existing

[48] Preparation of a sustainable bioenergy policy for the period after 2020, https://ec.europa.eu/energy/en/consultations/preparation-sustainable-bioenergy-policy-period-after-2020

[49] Towards a circular economy, https://ec.europa.eu/priorities/jobs-growth-and-investment/towards-circular-economy_en

[50] Commission proposes better workers' protection against cancer-causing chemicals (Press release, May 2016), http://europa.eu/rapid/press-release_IP-16-1656_en.htm

limit values for 13 substances under a modified version of the Carcinogens and Mutagens Directive. These limit values set a maximum concentration for the presence of a chemical carcinogen that a worker may be exposed to. Accordingly, by broadening the scope of the Directive, the amendment could lead to indirect costs through substitution, in order to replace the considered chemical with less hazardous substances.

Other concerns:

Overall, companies are concerned with the degree of **uncertainty** related to some of the current pieces of legislation and their potential impacts in the future. For example, future cost impacts of the ETS will depend highly on the outcome of its ongoing revision, currently under the co-decision process. In particular, it is not yet decided which if any of the different sectors will receive free allowances for their risk of carbon leakage.

The energy audits that large companies are obliged to perform at least every four years incur personnel costs for the organisation, implementation and documentation of the audit, including any costs for hiring external consultants. The first audits should however only be performed during 2015 and will as such only affect the cost during the future period in this assessment.

Other specific future costs for woodworking sectors

Climate and Energy legislation:

Nonetheless, concern persists amongst some actors in the EU forest-based sector as a whole that the cascading principle will be enshrined in detailed legislation. For example, the sawmill industry association, as well as a number of companies interviewed, expressed concerns about the consequences regarding the promotion of the cascading use of wood, as all their by-products are dedicated to specific secondary wood users, depending on specific market demands. Companies from the sawmilling sector are willing to sell their products and by-products with their respective best values, whether it is for materials or energy, to various customers across several sectors.

Other indirect costs may occur from the revision of the Renewable Energy Directive, leading to increased costs for wood, their main raw material. Other concerns from woodworking industries are due to uncertainty related to the new Renewable Energy Directive[51], which increased renewable energy targets may affect wood availability and costs.

The European Commission recently (July 2016) published a new legislative proposal[52] for the LULUCF legislation that aims to achieve a reduction of at least 40% of emissions from sectors not covered by the EU ETS scheme, a level that is 30% below the level of 2005. This framework will now fall under the Effort Sharing Decision (Decision 406/2009/EC), that sets new binding targets for 2013-2020 and relates mostly to waste, transport, buildings and agriculture. According to the new proposal submitted in 2016, the bulk of the administrative burden should not rely on businesses but rather on Member States in charge of the accounting related to emissions and removals, and of the information on measures in the sector. Effort was put on the proposal to highlight any opportunity of flexibility or synergies to implement the legislation in the most cost-effective way.

Environmental legislation:

Other potential regulations linked with the Circular Economy Package, such as the Eco-design and the Extended Producer Responsibility, could increase the direct production costs, according to sawmillers businesses. On the other hand, revised directives related to waste (Waste Framework Directive

[51] Preparation of a new Renewable Energy Directive for the period after 2020, https://ec.europa.eu/energy/en/consultations/preparation-new-renewable-energy-directive-period-after-2020

[52] Proposal for a Regulation Of The European Parliament And Of The Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change

2008/98/EC, the Landfill Directive 1999/31/EC and the Packaging and Packaging Waste Directive 94/62/EC) may improve wood availability and lead to cost reduction.

Additional direct costs may impact the wood-based panels sub-sector in order to comply with future requirements from the BREFs, to the extent they will require further reducing emission levels and, in turn, implying further investments.

The Harmonised EU VOC-Classes, may bring new cost implication depending on the products that will be covered by the new requirements on VOC emissions under the Declaration of Performance following CE marking. As a matter fact, after validation, construction product under its scope without a statement on VOC emissions levels will be commercialised in countries that have applied a legislation at national level that would regulate the emissions into indoor air. These developments could lead to additional capital expenditures for equipment, for operating expenditures of labelling and administrative burden.

Product-specific legislation:

REACH, as it increases the costs for binder resins to meet REACH requirements, is also likely to add to administrative burden and operating costs of personnel.

Other specific future costs for pulp, paper and paperboard sub-sector

Climate and Energy legislation:

The review of the ETS Directive is an essential element from the overall regulatory framework applying to the pulp, paper and paperboard industry, and European institutions must ensure its long-term predictability. However, the ETS review that may start impacting the production costs from 2015 onwards, as the stock of emission allowances granted has been used in the previous years. Moreover, data collection and verification are likely to bring further administrative burden to businesses from the sector. Businesses are in favour of the implementation of a mandatory and harmonised EU compensation scheme, in order to tackle the issue of rising electricity costs among Member States. As a counter measure, it is important to note that, in order to support EU's competitiveness, the European Commission has built a Carbon Leakage List[53], that includes energy-intensive industries that could be exposed to a substantial risk of carbon leakage. Industries under the List receive a higher share of free allowances; pulp, paper and paperboard industries are included in the second List that covers the third phase of EU ETS, covering 2013-2020. It has been decided under the 2030 climate and energy policy framework that the free allocation of emission allowances would be pursued until 2030.

Environmental legislation:

The main future costs for the pulp, paper and paperboard sector are expected to emerge from the Industrial Emissions Directive, as the agreed BREFs (pulp, paper and paperboard, large combustion plants, waste incineration, waste treatment, etc.) that will require capital expenditures for new machines and equipment along with operating expenses of personnel, training and maintenance of the equipment in the coming years.

Moreover, it can be mentioned that the waste directive and the packaging and packaging waste directive are currently under revision. Businesses are supportive of the European Commission's proposal to harmonise the methods to measure recycling rates and to avoid the use of different methods for computing the national recycling rate. On the other hand, administrative burden could emanate from the different definitions for recyclable products, from the various methods proposed and interpretation. Suggestions to break down some categories of packaging materials brought some

[53] Commission Decision of 27 October 2014 determining, pursuant to Directive 2003/87/EC of the European Parliament and of the Council, a list of sectors and subsectors which are deemed to be exposed to a significant risk of carbon leakage, for the period 2015 to 2019 7809) (2014/746/EU)

concerns, as this would result in complex monitoring, data collection and enforcement[54] (Europen, 2013).

Other environmental legislation may bring additional regulatory costs: the Product Environmental Footprint[55], if operational, is expected to lead to additional operating costs of personnel or external consultants, in order to calculate footprints, while the Environmental Liability Directive may result in costs due to rehabilitation of polluted soil or costs to provide studies on the owner's contribution to the pollution of "brownfield" land.

[54] EUROPEN Contributions to the Commission Consultation on the EU Waste Management Targets Review

[55] Developments on Product Environmental Footprint, http://ec.europa.eu/environment/eussd/smgp/policy_footprint.htm

Summary table:

Area Legislation Topic	Cost category likely to be impacted	Type of cost impact
Climate and Energy legislation		
Roadmap for moving towards a low-carbon economy, **Policy framework for climate and energy** **The energy roadmap 2050**	Capital expenditures (investments) – D Higher energy prices - I	↑
Clear Air Policy Package	Compliance costs including capital expenditures for investments	↑
Third Energy Package	Trade-off between higher power prices from deregulation measures and decreasing energy prices from integrated energy market	⇔
Sustainable Bioenergy Policy	Administrative burden for small-scale producers	↑
Woodworking		
Cascading principle	Indirect costs – loss of market share	↑
Renewable Energy Directive	Indirect costs – increase cost of raw materials	↑
LULUCF	Less administrative burden for businesses – reporting fall under MS	↓
Pulp, paper and paperboard		
ETS	Administrative burden for data collection and verification Capital expenditures for investments Decreasing electricity costs if harmonisation among MS	↑ ↑ ↓
Environmental legislation		
Circular Economy Package	EC to provide guidance for cascading	⇔
Woodworking		
Eco-Design	Increase in production costs	↑
Extended Producer	Increase in production costs	↑

Area Legislation Topic	Cost category likely to be impacted	Type of cost impact
Responsibility		
Landfill Directive	Improvement in wood availability	↓
Packaging and Packaging Waste	Improvement in wood availability	↓
Waste Framework Directive	Improvement in wood availability	↓
BREFs	Capital expenditures for investments	↑
Harmonized EU VOC=Classes	Capital expenditures for equipment Operating expenditures of labelling Administrative burden	↑ ↑ ↑
Pulp, paper and paperboard		
Industrial Emissions Directive and BREFs	Capital expenditures for additional equipment Operating expenses of personnel for training and maintenance	↑ ↑
Packaging and Packaging Waste	Administrative burden from different definitions and computation methods for the national recycling rate. Potential administrative costs due to detailed breakdown of categories of packaging material	↑ ↑
Product Environmental Footprint	Operating costs of personnel to calculate footprints	↑
Environmental Liability Directive	Capital expenditure for investments of rehabilitation of polluted soil Administrative burden for studies	↑ ↑
Forest-related legislation		
EU Timber Regulation	Operating expenditures of labelling Administrative burden from the national transposition	↑ ↑
Employment legislation		
Proposal for better workers' protection against cancer causing chemicals under Carcinogens and Mutagens Directive	Administrative burden to carry out hazard identification and risk assessment Operating costs of training to run new systems and procedures Indirect costs of substitution for less hazardous	↑

Area Legislation Topic	Cost category likely to be impacted	Type of cost impact
	substances	
Product-specific legislation		
	Woodoworking	
REACH	Administrative burden related to requirements for binder resins	↑
Other concerns		
Uncertainty		↑

6 International comparisons for USA, China and Brazil

6.1 Approach to international comparisons

The **main objective** of this section is to compare production cost structures of forest-based industries in EU with those from selected non-EU countries, and to provide initial insight into the regulatory costs they face, based on qualitative comparisons of key legislation, with references to some specific EU and non-EU legislative acts that influence the production costs of non-EU producers.

The **geographical focus** of this international comparison was modified through the project, following discussions with the Mirror Group after the study was narrowed down in an initial phase, and now includes three countries relevant to the reviewed sub-sectors: The United States of America, China and Brazil.

The **sectoral focus** is mainly on the woodworking and pulp, paper and paperboard sub-sectors, while including indication of the potential effects where relevant on downstream value chains, notably printing and furniture.

Next to the description of the methodology in Section 6.1.1, the assessment of the forest-based industries located in the selected non-EU countries includes the following items *for each of the target countries in sections 6.2 to 6.4*:

- A brief **background description** of the forest-based sector in each of the competitor countries,
- An **analysis of the production cost structures** of the woodworking and pulp & paper sub-sectors in the EU and in the competitor countries,
- A brief **description of national** (and, where relevant, EU) **policies** and **legislation** likely to have a cost impact on the production costs,
- A qualitative analysis of the **likely cost impacts** of national and EU legislation.

The analysis at country-level is then followed by a **comparative synthesis** of the competitors' sectors, company and cost structures and of likely cost impacts of the national and EU legislation in Section 6.5.

6.1.1 Methodology

The international comparison of cost structures and the cost impacts of regulation has been done in the following steps. First, secondary data was gathered and analysed (Section 6.1.1.1). Second, these data were further complemented with the results from two questionnaires: 1) a questionnaire for relevant associations, federations and industry experts, followed up with telephone interviews; and 2) a shorter on-line questionnaire for companies in the target countries (Section 6.1.1.2). Finally, the generated data was compiled and synthesised in a systematic manner (Section 6.1.1.3).

In the following, the methodological approach is explained in more detail.

6.1.1.1 Review of sources for the international comparison of cost structures

Scientific and other available literature and datasets on topics in the scope of the international comparison (e.g. sector and cost structure, national and EU legislative policies likely to have a cost impact, etc.) were reviewed, separately from the literature review performed for the first chapters which was focusing on the EU industry.

Table 39 provides an overview of the key data sources used as related to the distinct sections of the international comparisons, including the synthesis section 6.5.

Table 39 Data sources as part of the data collection (first step) used for each section of the international comparison part

Report section	Main Sources	Type of input data
Country descriptions, for each country		
Background description of the forest-based sector	• Pulp, paper and paperboard/Woodworking: CCA forest-based industries inception report • Woodworking: Euromonitor International reports[56] • Pulp, paper and paperboard/Woodworking: FAOSTAT • Pulp, paper and paperboard/Woodworking: National statistical offices	• Sectoral structure: company size-frequency • Sectoral output: quantity and value • Sectoral turnover
Description and analysis of the **production cost structures** of the woodworking and pulp & paper sub-sectors	• Pulp, paper and paperboard sub-sector: RISI database • Woodworking: BR, CN, US: Euromonitor International reports, EFORWOOD database[57], questionnaires and interviews; • Pulp, paper and paperboard/Woodworking: other sources of national statistical offices	Production costs by categories (%-based; related to total output; cost per output unit)
Description of policies and legislation having cost impacts on the woodworking and pulp & paper sectors and their implications	• Pulp, paper and paperboard/Woodworking: Questionnaires and interviews from experts/associations • Pulp, paper and paperboard/Woodworking: Literature review	• Key policy packages • Key domestic /EU legislation /regulation
Synthesis: International comparative analysis of cost impacts from policy		
Comparative synthesis of the countries' sectors, company and cost structures and of the qualitative analysis of the likely cost impacts	• Questionnaires and interviews from experts/associations • Literature review	• Cost structure data for BR, CN, US, EU • Key policy packages and legislation

Source: authors' elaboration

In addition, a systematic review of relevant scientific literature was done using the CAB Abstracts[58] database and Google Scholar[59]. Publications and other information sources from international organisations (UNECE, FAO, ILO, the Conference Board), national statistical bodies (US Census

[56] Euromonitor International is an international market research organisation. EuroMonitor publishes regularly updated reports on the level of Divisions of the ISIC classification system. For more info on EuroMonitor International, visit http://www.euromonitor.com/

[57] EFORWOOD data that was compiled for application in ToSIA (Tool for Sustainability Impact Assessment). ToSIA is a decision support tool for the forestry sector, which analyses environmental, economic, and social impacts of changes in forestry-wood production chains, using a consistent and harmonised framework from the forest to the end-of-life of final products. The 6FP EFORWOOD project compiled process data to describe the forest-based value chains in 28 European. For more info, visit http://tosia.efi.int

[58] See: www.cabi.org – "CAB Abstracts gives researchers access to over 8.3 million from 1973-present. Its coverage of the applied life sciences includes forestry and forest products as well as agriculture, environment, veterinary sciences, applied economics, food science and nutrition."

[59] http://scholar.google.com

Bureau, US Bureau of Labor Statistics; Brazilian Institute of Geography and Statistics; China National Bureau of Statistics), national associations and organisations representing the woodworking and pulp, paper and paperboard sub-sectors, were also examined (see Appendix A for more details on key data sources per country).

It must be noted that the international comparison refers to different industry classifications according to different sources: NACE[60], ISIC[61] and national classifications such as the North American Industry Classification System (NAICS) and the Brazilian classification of economic activity (CNAE; Classificação Nacional deAtividades Econômicas). The Euromonitor International reports use the ISIC Rev. 3.1 classification. A correspondence table between NACE Rev. 2 Division 16 (Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials) and Division 17 (Manufacture of paper and paper products) and ISIC Rev. 3.1 Divisions 20 and 21 is presented in Appendix F.

[60] NACE stands for "Nomenclature statistique des Activités économiques dans la Communauté Européenne" (in English "Statistical Classification of Economic Activities in the European Community") from Eurostat. For instance, C1621 refers to the manufacture of veneer sheets and wood-based panels

[61] ISIC stands for "International Standard Industrial Classification of All Economic Activities", a classification of sectors and industries from the United Nations Statistics Division. For instance, the ISIC code 20 refers to wood and wood products.

Information on the **cost structure of the woodworking sub-sector**, in Brazil, China and USA respectively, is based on specific reports by Euromonitor International[62]. The reports contained market analysis data for the wood and wood products sector (ISIC 20)[63] – more specifically, covering: sawmilling, planing and treatment of wood, veneer sheets and plywood, builders' carpentry and joinery, wooden containers, and other products of wood).

For the data on the European cost structure, the dataset originally developed in the FP7 project EFORWOOD for application in the Tool for Sustainability Impact Assessment (ToSIA) was used. ToSIA is a free proprietary decision-support-tool for the forest-based sector and originally developed for "researchers" looking into issues concerning the sustainability of forest wood chains in order to provide them with a set of value-chain process indicators. By using ToSIA, the forest-based industry, national and international policy makers, and researchers can analyse the sustainability effects of changes due to deliberate actions (e.g. policies or business activities) or due to external forces (e.g. climate change, and the global markets). As stated on the website[64], "ToSIA analyses environmental, economic, and social impacts by using a consistent and harmonised framework from forestry to the end-of-life of final products". The dataset includes cost data for the sawmilling sector and the pulp, paper and paperboard sector for 23 European countries plus Norway and Switzerland[65]. The cost information is available for the following categories, by average cost per unit of production (metric tonnes or cubic metres) and total production cost per country:

- Raw materials from the forest-wood chain (FWC),
- Raw materials from outside the FWC,
- Labour costs,
- Energy costs,
- Other production costs,
- Non-production costs: taxes, interest rates, other non-productive costs.

In general, it should be noted that the EFORWOOD dataset considers mostly large companies, and the related cost structures may hence not be representative for SMEs.

For the international comparison of the **costs structures for the pulp, paper and paperboard sector**, the following product groups are considered: 17.11 Manufacture of pulp; and 17.12 Manufacture of paper and paperboard, e.g. graphic paper, packaging paper and paperboard, household and sanitary paper).

The costs structure analysis for the pulp, paper and paperboard sector is mainly based on RISI data for 2014[66]. **Europe** is defined as EU25 plus Norway and Switzerland, and the non-EU countries selected for the international comparison are: China, Brazil and the United States[67]. Costs taken into account

[63] ISIC is the International Standard Industrial Classification of All Economic Activities, as maintained by the United Nations. "Wood and Wood Products" are part of ISIC Revision 3.1 Division 20 which spans "Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials". For mor info on the ISIC classification visit: http://unstats.un.org/unsd/cr/registry/regct.asp. The ISIC Revision 3.1 Division 20 is congruent with the European Union NACE Revision 1.1 Division 20. For more info on correspondence between NACE and ISIC, see:

http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=26&Lg=1&Co=&T=0&p=4

[64] More information on EFORWOOD and ToSIA is available from http://tosia.efi.int/.

[65] Countries from the EFORWOOD dataset include: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK)

[66] RISI – an information provider for the global forest product industry, Business Impact Assessment, pulp and paper, 2014. Please note that some reference to previous RISI data (2005-2014) could also be made in this section.

[67] Additional non-EU countries in the RISI database are Canada, Indonesia, Japan and Russia.

are **direct manufacturing costs** for the pulp, paper and paperboard sector, based on a number of consumables used in the production process. In line with RISI definitions, costs are categorised as follows in this report:

- Raw materials: Wood, recovered paper, market pulp, chemicals;
- Energy: Electricity and fuels;
- Labour;
- Other costs: Maintenance and capital costs.[68]

As for **energy costs**, the cost of producing one tonne of product depends on the pulp type and on the paper grade produced. For example, the cheapest energy input is attained by market pulp, followed by containerboard (packaging paper). The highest price for energy inputs are paid for the production of tissues, coated mechanical and uncoated mechanical paper.[69]

As for **electricity**, it must be noted that the price components of the final bought-in electricity price vary substantially both within the EU, and between the non-EU countries. The extent to which the electricity price is reflected in the final product price depends also on other factors, such as the materials used, the cost of capital, labour costs and pass-through capacity.

Transport costs are not direct manufacturing costs, as such, and are not included as consumables by RISI; it is hence not possible to display these costs in this cost structures for pulp, paper and paperboard. However, when transport costs were mentioned in the literature or in interviews regarding the impact of regulation, they were included in the report as additional insights.

Table 40 shows the comparison of the main cost categories of the EFORWOOD, RISI and EuroMonitor datasets. For further detail, see also section 6.1.1.3 Method for cost structure data compilation and synthesis.

[68] **Wood** is considered solid pulpwood excluding bark; **recovered paper** means recovered paper as raw material for pulping, **market pulp** includes chemical, mechanical, semi-chemical, deinked and other pulps, which are sold in open competition with that of other producers, **fuels** are either purchased bark/waste, biofuels, coal, natural gas or oil. **Labour** includes the work related costs of operators, maintenance, exempt and non-exempt personnel; **maintenance** includes maintenance materials, operating supplies, contract maintenance and waste disposal. For more details, please refer to Chapter 2, section 1.3.1 or see RISI Methodology Business Impact Assessment Tool (2015).

[69] Own calculation based on RISI data, and Ecofys & Fraunhofer ISI (2015) Electricity costs in energy intensive industries.

Table 40 Main cost categories, of the EFORWOOD, RISI and Euromonitor datasets; their geographical and sectoral application in this study.

	EFORWOOD	RISI	Euromonitor
Geographic application:	European countries	European countries, BR, CN, US	BR, CN, US
Sectoral application:	Woodworking, pulp, paper and paperboard	Pulp, paper and paperboard	Woodworking
Raw materials costs:	Raw materials [from the forest-wood chain (FWC) + from outside FWC]	Raw materials: Wood, recovered paper, market pulp, chemicals	Raw materials (and process materials) [raw materials + intermediate materials + non-durable goods]
Energy costs:	Energy costs,	Energy: Electricity and fuels	Energy
Labour costs:	Labour	Labour	Labour
Other costs	[Other production costs] + [Non-production costs: taxes, interest rates, other non-productive costs]	Other costs: Maintenance and capital costs	[Capital costs] + [Other costs (including services and taxes less subsidies)]
Transportation costs	Available in original dataset: Transportation costs	Not available in dataset	Transport and logistics

Source: Authors' elaboration

6.1.1.2 Questionnaires and interview approach

To supplement the findings from the literature review, two on-line questionnaires were used. Firstly, a questionnaire was designed for sourcing further **information from relevant federations, associations and sectoral experts** in the non-EU countries. The questionnaire was put on line and contacts were further followed up by e-mail and telephone interviews. Upon the preference of Chinese respondents, the questionnaire was also translated into Mandarin Chinese (see **Appendix G** for more details on the list of contacted organisations (individual contact details are omitted) and **Appendix H** for the survey form).

Secondly, a shorter questionnaire was designed to collect **information from individual companies in Brazil, China and the United States**. It was set-up and disseminated through a web-based survey platform. Company contacts were sourced from the ORBIS database[70]. Based on the availability of contact details, the selected pool of respondents was drawn from those companies listed in the ORBIS database under the NACE Rev. 2 main section C "Manufacturing", for the sector "manufacture of wood and products of wood, cork, and straw and plaiting materials" (NACE 16) and "manufacture of paper and paper products" (NACE 17)[71] in the target countries. Contacted associations

[70] Orbis database: proprietary database of worldwide company information. http://www.bvdinfo.com

[71] Following Orbis - Bureau van Dijk's classification into major sectors.

and federations were also encouraged to share the questionnaires with their members. In total, the questionnaire was disseminated directly to 99 companies in Brazil, 413 companies in China and 99 companies in the United States. The response rate was low. Five responses were received from each of the countries (Table 41).

For Brazil, in addition to the companies listed in ORBIS, members of the ABPMEX (Association of Brazilian Wood Exporters) were also called. Brazilian and Chinese companies willing to participate preferred to do so by giving a written contribution (through the web-based questionnaire and/or through the questionnaire as a Word document). Chinese companies were sent a Mandarin Chinese version of the questionnaire. Interviews were arranged and conducted through email and telephone with representatives of two US companies. Table 41 provides summary details of the numbers of associations, federations, industry experts, and companies contacted.

Table 41 Summary of contacted associations, federations and industry experts, and companies.

	Invited participants		**Telephone calls**		**Initial indication of willingness to respond**		**Actual responses**	
	Associations/ Federations/ Experts	Companies	Associations/ Federations/ Experts	Companies	Associations/ Federations/ Experts	Companies	Associations/ Federations/ Experts	Companies
Brazil	23	99	3	44	5	17	2	3
China	20	413	4	227	4	25	5	0
United States	14	99	3	95	3	3	3	2

Sources: authors' elaboration

Despite substantial efforts, the participation in the surveys was very low; among the reasons mentioned for not participating, there were a general policy not to participate in surveys, and the unwillingness to provide information related to cost structures and competitiveness, specifically if used for a European research project. One Chinese expert expressed a strong concern over the risk of being seen as performing industrial espionage and related reputational risks. The low number of responses does not allow to point out any significant difference in response rate –or the reason therefore- between the three countries.

6.1.1.3 Method for cost structure data compilation and synthesis

The Euromonitor cost categories were restructured by aggregating some of the very detailed categories in order to be harmonised with the ones used in this study; an overview is shown in Table 42.

Table 42 Structure of cost items into cost sub-categories and categories, as applied in the presentation of country data and in the international comparison

New grouping for the CCA study	Cost sub-category from the Euromonitor report	Cost items from the Euromonitor report
Raw materials (and process materials)	Primary materials (broadly those materials produced within the primary sector: sections A, B and C of ISIC Rev. 3.1)	Forestry (wood mainly – materials produced within Division 2 ISIC Rev. 3.1: Forestry, logging and related service activities, including production of bamboo and rattans)
		Agriculture (materials produced within Division 1 ISIC Rev. 3.1: Agriculture, hunting and related service activities)
		Other primary materials
	Intermediate materials (broadly those materials produced within the manufacturing sector: section D ISIC Rev. 3.1)	Wood and wood products
		Basic chemicals
		Other chemicals [1]
		Plastics in primary forms and synthetic rubber
		Plastic products
		Other intermediate materials
	Non-durable goods[2]	Non-durable goods
Capital costs		Machinery for rubber, plastics and paper industries and other special purpose machinery
		Other durable goods
Labour		
Transport and logistics		Road, passenger and freight transport
		Communications (and other transport)
Energy		Energy: Refined petroleum products (BR, US) and Electricity (CN)
		Recycling (and other "Energy utilities")
Other costs	Services	Business and management consultancies
		Monetary intermediation[3]
		Other services
	Taxes less subsidies	Taxes less subsidies

Source: Authors' elaboration 1 Other chemical: In relation to the forest-based industries these may include: gelatine and its derivatives, glues and prepared adhesives, activated carbon, catalysts and other chemical products for industrial use. 2 Non-durable goods: In relation to enterprises these may relate to e.g. employee catering facilities. 3 Monetary intermediation: the sum of ISIC 3.1 Division 65 (Financial intermediation, except insurance and pension funding) and Division 67 (Activities auxiliary to financial intermediation).

Cost data from the Euromonitor reports were provided in local currency, then converted to Euro by applying the ECB reference exchange rate for the indicated reference year. Percentages were recalculated for the cost sub-categories. On this basis comparisons were drawn between target countries and the EU.

6.2 Country overview: Brazil

6.2.1 General description of the forest-based sector

6.2.1.1 Forest resources profile

Brazil has total forest area of 493.5 million ha (59% of the total land area in 2015). This has decreased from 546.7 million ha in 1990 (FAO, 2015). Most of the Brazilian forest is in the Amazon, and this is where the majority of deforestation takes place. Since 2004 when the deforestation rate in the Amazon was 2.8 million ha per year, the deforestation rate has decreased annually to 0.6 million ha per year in 2015 (although there were increases in 2008 and 2013) (INPE, 2015). There are 7.7 million ha of plantations (1.6% of total forest area), mainly in the south and east of the country. A policy is in place to increase the area of plantation forest to 11 million ha by 2020. Most of the plantation forests are eucalypts and pines and serve almost the full needs of the pulp, paper and paperboard industries, while part of plantation production supplies the woodworking industries (e.g. teak). In 2011, the total quantity of roundwood produced was 273.1 million m^3, of which 62.5 million m^3 originated from native forests and 210.6 million m^3 from forest plantations. From those amounts, the industry uptake was respectively 23 % and 60 %, amounting to 140.0 million m^3 in total, with the rest of the wood destined for energy production (Brazilian Forest Service, 2013).

6.2.1.2 Sectoral structure

The tables below presents the structure of the wood products manufacturing and pulp, paper and paperboard manufacturing sectors according to the number of employees. Table 43, extracted from the Instituto Brasilerio de Geografia e Estatestica (IBGE) data[72], presents the number of companies for woodworking and pulp, paper and paperboard , while Table 44, taken from Euromonitor International only displays the woodworking sector.

IBGE information on wood products manufacturing is subdivided into two sub-sectors: sawmilling; and manufacture of wood, cork and plaited products. Information with regard to pulp, paper and paperboard manufacturing is available in four sub-sectors: 1) production of pulp and other materials for paper production; 2) manufacture of paper and paperboard; 3) packaging; and 4) manufacture of other paper and paperboard products.

While IBGE data suggest fewer than 21 000 companies in the Brazilian wood working sector (Table 43), data from Euromonitor International (2014) suggest this number to be closer to 30 000 (Table 44); the difference possibly emanate from the fact that Euromonitor International data are synthesised from various information sources.

[72] The data are from the SIDRA database of the Brazilian Institute of Geography and Statistics (IBGE) which uses the Brazilian classification of economic activities (Classificação Nacional de Atividades Econômicas - CNAE 2.0). CNAE 2.0 is based on the ISIC Rev. 4 with the first and second levels being identical. For division 16 (Wood products manufacturing) the subdivisions are also identical to the ISIC subdivisions. For division 17 (Pulp and paper manufacturing) the CNAE classification separates manufacture of pulp and manufacture of paper and paperboard at the third level. In the ISIC classification this is done at the fourth level.

Table 43 Number and size of Brazilian businesses in wood products and paper manufacturing sectors for the year 2012

	Size of business (number of employees)								
	1-4	5-9	10-19	20-49	50-99	100-249	250-499	≥500	Total
Sawmilling and planing	5067	1894	1599	833	179	61	15	4	9652
Manufacture of wood, cork, straw and plaiting materials	6268	2227	1507	840	209	99	29	21	11200
Total: Wood products manufacturing	**11335**	**4121**	**3106**	**1673**	**388**	**160**	**44**	**25**	**20852**

	1-4	5-9	10-19	20-49	50-99		250-499	≥500	Total
Manufacture of pulp and other materials for paper manufacture	37	8	8	7	6	-	2	6	74
Manufacture of paper and paperboard	107	22	23	34	42	29	16	14	287
Total: Pulp, paper and paperboard manufacturing	144	30	31	41	48	29	18	20	**361**

Source: IBGE 2013 (*http://www.sidra.ibge.gov.br/bda/tabela/listabl.asp?z=p&o=5&i=P&c=1936)*

Table 44 Number of Brazilian companies for ISIC20 – Wood and Wood Products - by Employment Size 2007–2012

Company category	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Micro (1-9 employees)	24595	24340	24401	24594	25242	25245
Extra small(10-19	3036	3023	3000	3030	3122	3161
Small (20-49 employees)	1833	1734	1662	1756	1792	1789
Medium (50-249 employees)	686	596	555	597	615	605
Large (250+ employees)	108	93	75	75	76	71
Total	**30258**	**29786**	**29693**	**30052**	**30847**	**30871**

Source: Euromonitor International 2014

Table 45 Employment in the wood products manufacturing and paper and paper products manufacturing sector in Brazil (2007-2013)

Classificação Nacional de Atividades Econômicas (CNAE 2.0)	Employment (thousands FTE)						
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
16 Wood products manufacture	273,8	252,7	238,3	247,9	244,3	239,7	235,9
17 Paper and paper products manufacture	193,8	195,8	199,4	200,6	196,8	200,3	209,1

Source: IBGE 2013

Employment in the wood products manufacturing sector declined from 2007 to 2009 and then again from 2010 to 2013. Employment in the paper and paper products manufacturing has shown a steady increase from 2007 to 2013.

6.2.1.3 Production, trade and consumption

In 2014, Brazil was the world's fourth largest consumer of industrial roundwood (8% of global consumption; 149.4 million m^3), the sixth largest consumer of sawnwood (3%; 13.8 million m^3) and wood-based panels (3%; 9.8 million m^3), and the seventh largest consumer of pulp for paper(4%; 6.3 million tonnes)[73]. Brazil was the fourth largest producer of pulp for paper (9%; 16.4 million tonnes), the fifth largest producer of industrial roundwood (8%; 149.5 million m^3), the sixth largest producer of wood-based panels (3%; 11.8 million m^3), the seventh largest producer of sawnwood (3%; 15.2 million m^3), and the ninth largest producer of paper and paperboard (3%; 10.4 million tonnes). It was the largest exporter of pulp for paper (19%; 10.6 million tonnes; US $4.9 billion) (FAOSTAT, 2015).

The forest-based sector (including forestry and logging as well as wood products manufacturing and the paper and paper products manufacturing sectors) accounted for 5.3% of the Agricultural and Manufacturing GDP in 2011 (down from 7.5% in 1995). Although the sector has grown in the period, it has not grown as fast as other sectors in the Brazilian economy.

n 2010, at least 75% of Brazil's commercial log production volume of 128.4 million m^3 was produced in plantations (Oliver, 2013). In 2013, plantations accounted for more than 95% of Brazilian exports of wood-based products by export value and roundwood equivalent volume (RWE). The majority of those exports were pulp, paper and paperboard (approximately 70% and 10%, respectively in terms of RWE volume (Wellesley, 2014). Brazilian legislation to counter deforestation required wood companies to increase their purchase of wood from legal sources. This has led to a scarcity of legal wood and to an increase in the availability and price of wood from natural forests of more than 350%. (Tomaselli et al., 2012) In turn, this decreased competitiveness of wood industries and it has caused the closure of many sawmills (Tomaselli et al., 2012).

[73] Apparent consumption is the production (or removals) plus imports minus exports.

Table 46. Overview of Brazil's FB-I production and trade in 2014.

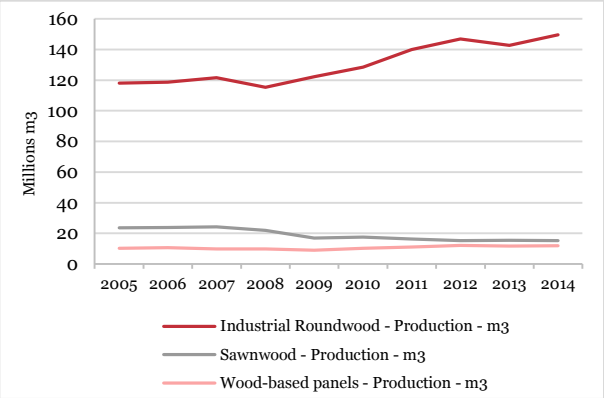
- In 2014, Brazil produced 15.2 million tonnes of sawnwood. Imports of sawnwood were worth $US 26.3 million (33 484 m^3) and exports $US 425 million (425 333 m^3).
- Wood-based panels: In 2014, Brazil produced 11.8 million m^3 of wood-based panels, and exported $US 0.7 billion worth of panels (2.2 million m^3).
- Furniture: In 2014, Brazil imports of furniture were worth $US 1.2 billion and exports were worth $US 0.9 billion.
- The pulp, paper and paperboard sector is dominated by large companies. The Brazilian Pulp and Paper Association (BRACELPA) represents 44 associated companies, which jointly account for 100% of the pulp produced domestically and 80% of the paper produced domestically.
- Wood pulp: Brazil produced about 16.8 million tonnes of wood pulp in 2014. It exported $US 5.3 million (11 million tonnes). Imports were worth $US 327 842 (429 074 tonnes).
- Paper and paperboard: Brazil produced about 10.4 million tonnes of paper and paperboard in 2014; its imports were worth $US 1.1 billion (1.1 million tonnes) and exports were worth $US 1.7 billion (1.7 million tonnes).
- Printing: Imports were worth $US 248.6 million and exports were worth $41.8 million.

Source: production and trade for wood and pulp, paper and paperboard products – FAOSTAT 2015; trade for furniture and printing – ITC 2015.

While Table 46 shows the latest available data for Brazilian production and trade, the evolution of production quantity and trade (value and quantity) are shown in Figure 51 to Figure 58.

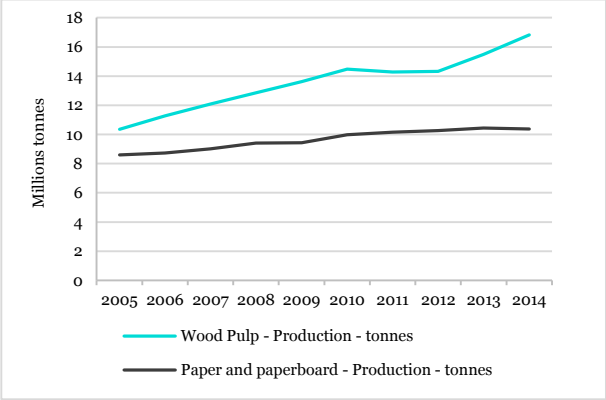
The impact of fluctuating currency exchange rates can be highly significant and thus the impact of monetary policy. It was recently reported in the Economist that the "recession and political upheaval have brought Brazil's currency, the Real, down by three-fifths against the dollar since 2011." This has been a major benefit for Brazil's exporters, including pulp producers who export nearly all their output (The Economist, 2016).

Figure 51 Production of wood products – Brazil



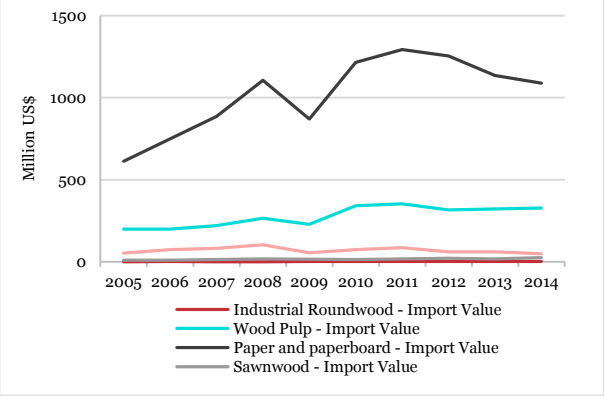
Source: FAOSTAT, 2015

Figure 52 Production of pulp, paper and paperboard products – Brazil



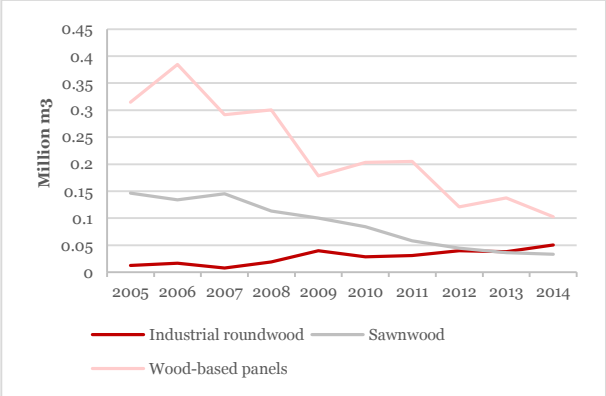
Source: FAOSTAT, 2015

Figure 53 Import value of wood and paper products – Brazil [currency in US$ as international reporting standard]



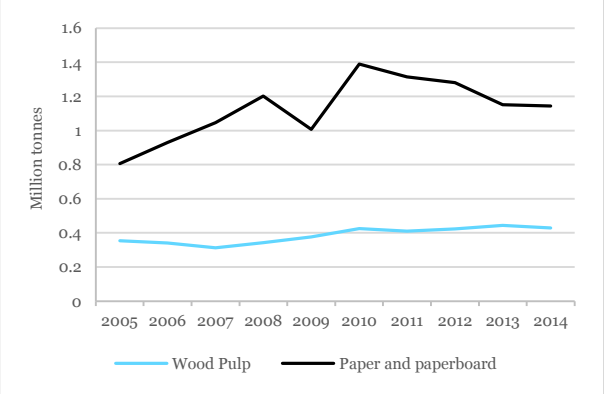
Source: FAOSTAT, 2015

Figure 54 Import quantity of wood products – Brazil



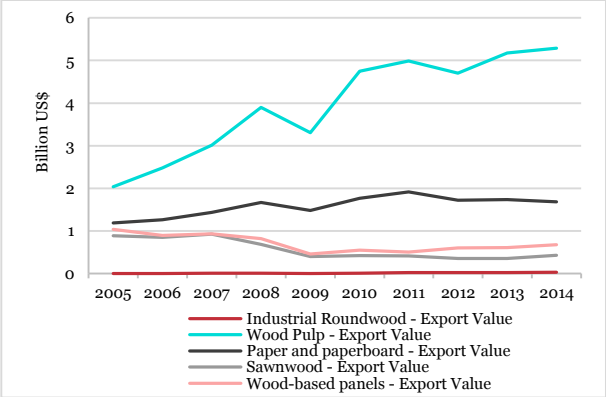
Source: FAOSTAT, 2015

Figure 55 Import quantity of paper products – Brazil



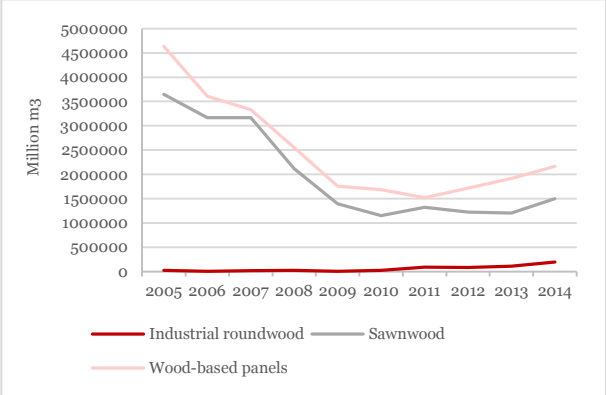
Source: FAOSTAT, 2015

Figure 56 Export values of wood and paper products – Brazil [currency in US$



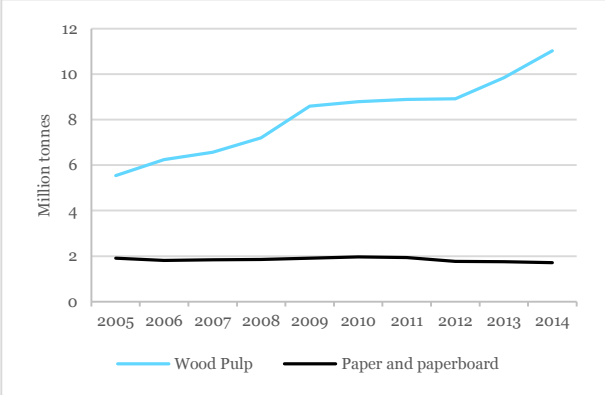
Source: FAOSTAT, 2015

Figure 57 Export quantity of wood products – Brazil



Source: FAOSTAT, 2015

Figure 58 Export quantity of paper products – Brazil



Source: FAOSTAT, 2015

6.2.2 Production cost structures in the selected F-BI sub-sectors

6.2.2.1 Production cost structure in the woodworking sub-sector

In 2012, raw materials (14.4%) plus intermediate wood and wood products (31.7%) accounts for 46.1% of the total costs. Domestic demand for wood and wood products is a key driver for higher log costs (Euromonitor International, 2014). Although Brazil is a forest-rich country, costs of raw materials have increased as pressure to decrease deforestation [mostly driven by agriculture, but resulting in wood harvest as a 'by-product'] and ensure raw materials are sourced responsibly and sustainably has increased (see e.g. Tomaselli et al., 2012). However, in the same time, more advanced technologies allowed Brazilian wood manufacturers to produce a similar volume of finished products from a reduced volume of raw materials, leading in turn to higher operating margins (Euromonitor International, 2014). Integrated companies in the woodworking industries (as well as in the pulp, paper and paperboard sector) own significant areas of forest plantations and this contributes to some degree of control of costs of raw materials.

Labour costs account for 27.3% of the total costs. Average hourly compensation costs in the wood and wood products manufacturing sector (not including furniture) increased from 8.2 R$ ($US 4.49 according an exchange rate for 2008) per hour in 2008 to 12.7 R$ ($US 5.91 according an exchange rate for 2013) per hour in 2013 (The Conference Board, 2014). Besides salary increases, also the number of employees has increased in the industry (Euromonitor International, 2014).

Transport costs, energy costs, and other costs (including financial services, taxes) account for 4.6%, 5.9% and 6.0% of total costs, respectively.

Table 47 presents the cost structure for the woodworking sub-sector in Brazil. Data is from the Euromonitor International report on Wood and Wood Products in Brazil: ISIC 20 (Euromonitor International, 2014).

Table 47 Cost structure for the woodworking sub-sector in Brazil, 2014

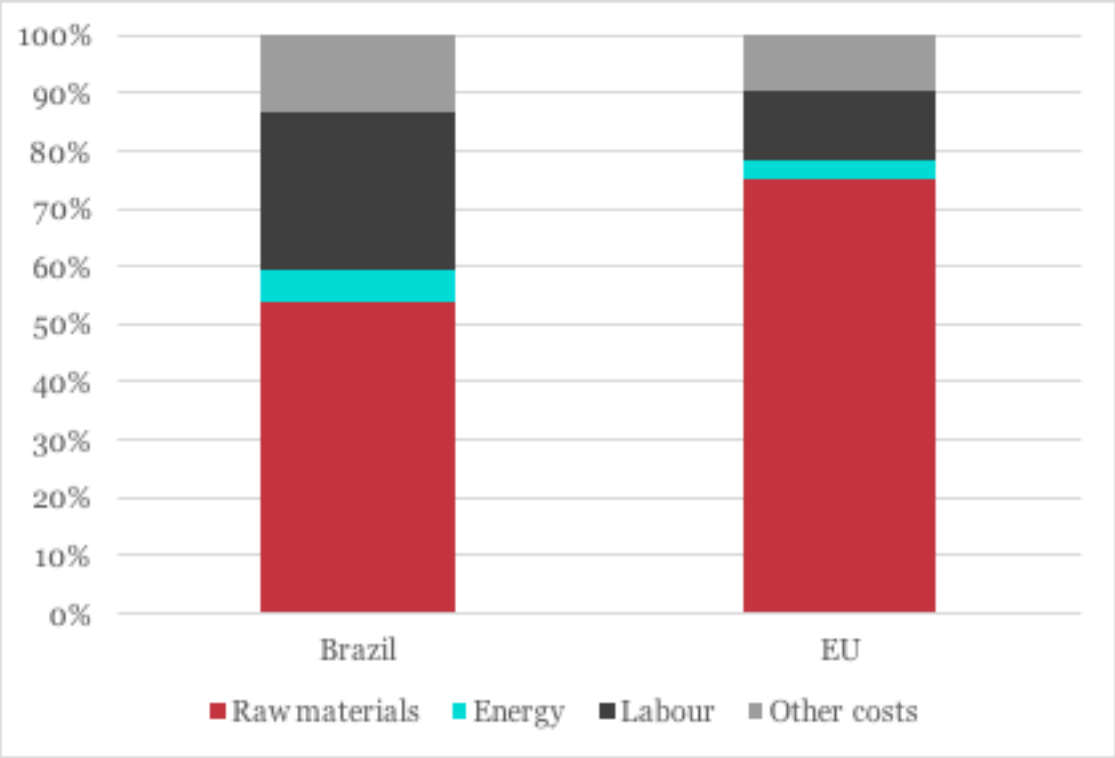
Main cost category	Cost sub-category	Cost items	R$ million	€ million[74]	% of cost structure
Raw materials (and processed materials)	Primary materials	Forestry (wood mainly)	3050.00	1216	14.4%
		Agriculture	2.50	1.0	
		Other	1.40	0.6	
	Intermediate materials	Wood and wood products	6728.00	2682	39.7%
		Plastics in primary forms and synthetic rubber	350.00	140	
		Plastic products1	213.00	85	
		Other	1131.00	451	
	Other	Grain mill products[2]	20.10	8	0.1%
		Other	9.00	4	
Capital costs		Machinery for rubber, plastics and paper industries and other special purpose machinery	274.00	109	2.0%
		Other	145.00	58	
Labour			5802.00	2313	27.3%
Transport and logistics		Road, passenger and freight transport	572.00	228	4.6%
		Other	594.00	237	
Energy		Refined petroleum products	716.00	285	5.9%
		Other (including utilities and recycling)	542.00	216	
Other costs	Services (part of OPEX)	Monetary intermediation	431.00	172	4.8%
		Other	594.00	237	
	Taxes less subsidies (monetary costs)		247.00	98	1.2%

Source: Euromonitor International, 2014 - 1 e.g. packaging for products, 2 e.g. non-durable food items used in employee catering facilities.

[74] R$ to € currency conversion based on the European Central Bank reference exchange rate for 2012.

The following figure allows to compare cost structures from Brazil and EU, in relative terms:

Figure 59 Cost structures for Brazil and EU in relative terms, as % of production costs, 2005



Source: Euromonitor International 2014 for Brazil and ToSIA data, 2005 for EU

6.2.2.2 Comparison of the EU and Brazil's production cost structure in the pulp, paper and paperboard sub-sector

Direct manufacturing costs, including all cost categories referred in the table below[75] for pulp production in 2014 are substantially higher in Europe than in Brazil (417 EUR/tonne in Europe vs. 321 EUR/tonne in Brazil). The main differences are raw material wood costs (122 EUR/tonne vs 215 EUR/tonne). Focusing on Brazil, further than raw materials costs, another important category is capital costs.

Overall, energy is not a major component in the cost structure for either of the geographic areas. Moreover, Brazil displays negative electricity costs (-7 EUR/tonne). The explanation can be traced back to the structural change of the energy matrix for the production of pulp, paper and paperboard in Brazil during the last 40 years. Brazil progressively diminished the use of fuel oil and firewood, to the benefit of black liquor (considered a major bioenergy source)[76]. In the late nineties, Brazilian mills also introduced natural gas. In fact, generation sources of supplied electricity in Brazil have historically rested on hydroelectric power[77]. However, in the late nineties, factors such as lack of investments and environmental restrictions have undermined electricity generation concentrated in hydropower. This, together with the existence of new pulp mills located in areas without electricity supply, called for increasing self-generation capacity. The main substitution has happened between electricity (hydroelectric) and natural gas, with the installation of gas turbines able to generate steam and

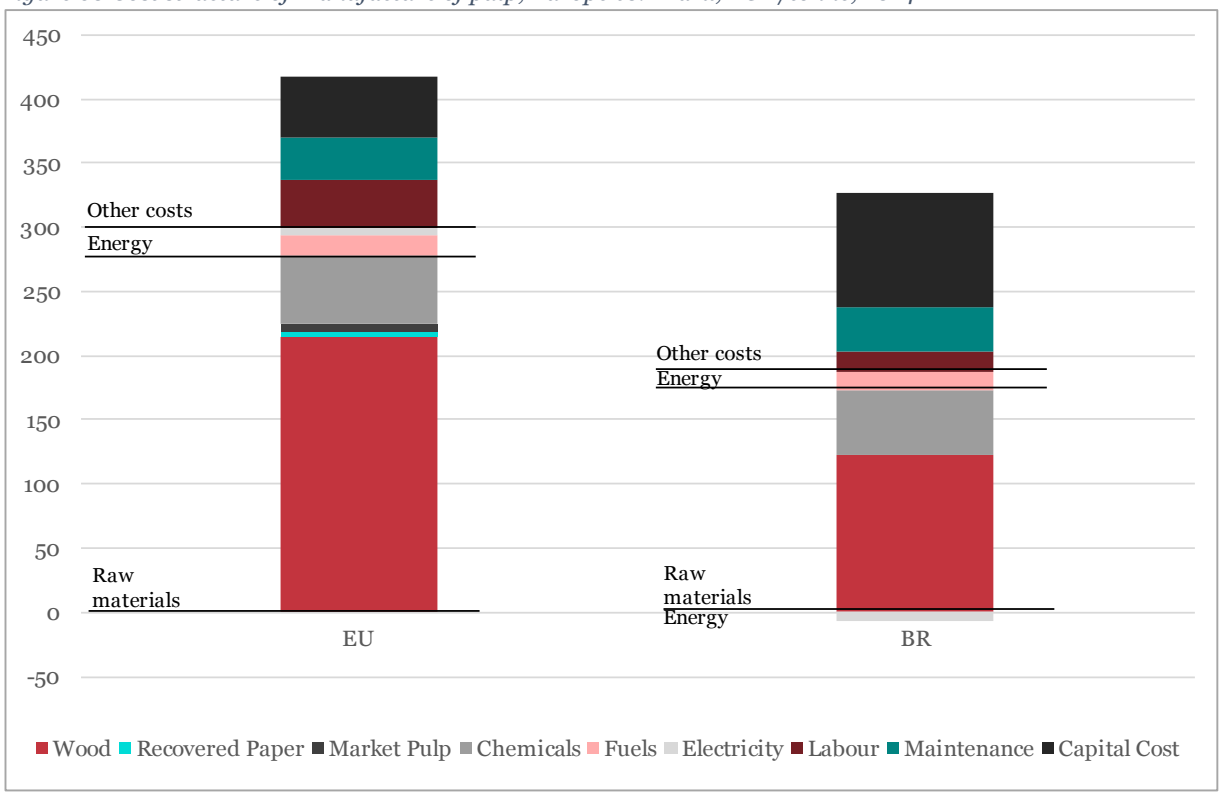
[75] Direct manufacturing costs include: Capital costs, maintenance, labor, electricity, fuels, chemicals, market pulp, recovered paper, and wood.

[76] BRACELPA (2014) The Brazilian pulp and paper industry

[77] Moldan. L. (2006) How Brazilian pulp and paper industry faces energy challenges, BRACELPA, Sao Paulo, Brazil

electricity. This, in turn, has substantially increased the ability to sell electricity to the grid; to give an idea, electricity sold to the grid increased by34% only between 2006 and 2007.[78]

Figure 60 Cost structure of Manufacture of pulp, Europe vs. Brazil, EUR/tonne, 2014



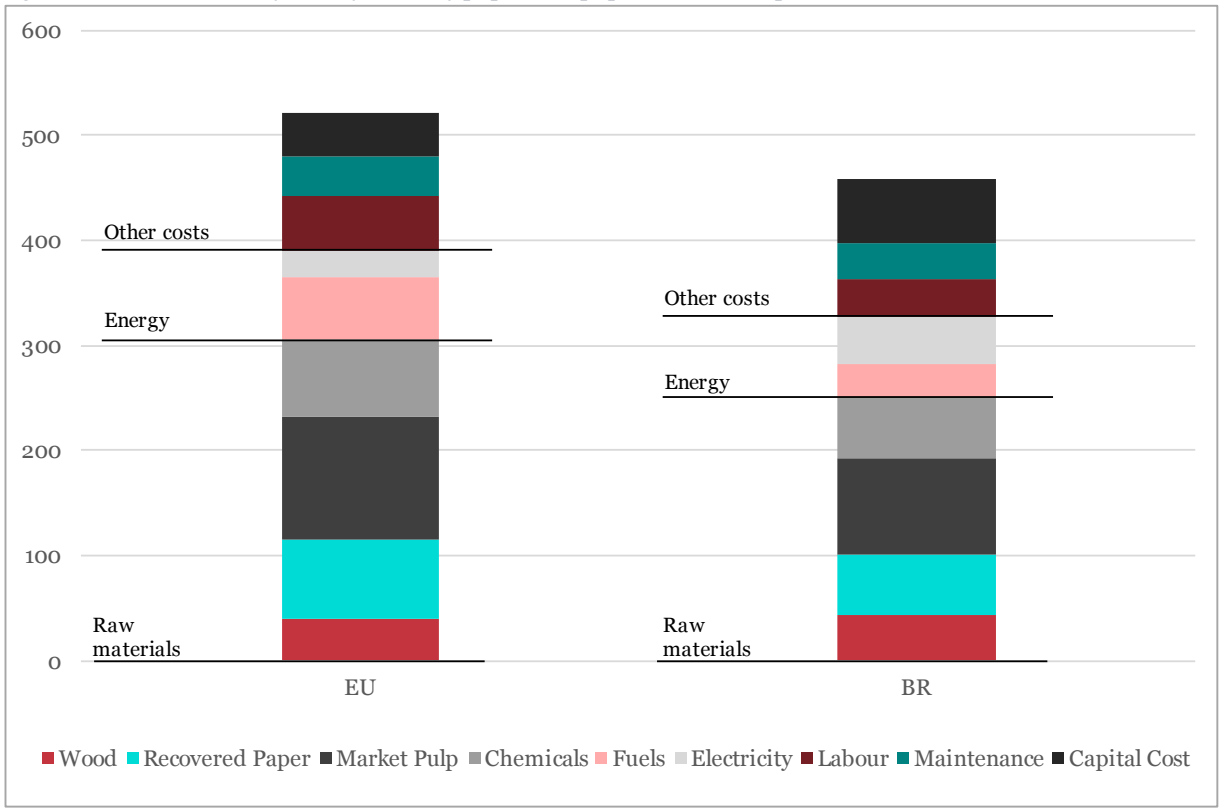
Source: Authors' elaboration based on RISI data

Differently from the Chinese case, where costs for production of paper and paperboard reported to be higher than in Europe, manufacturing costs for this product group are lower in Brazil than in Europe. Despite the cost of wood is similar in the two geographic areas[79], costs for other raw materials than wood, together with energy and labour costs, explain the relative competitiveness of manufacturing paper production in Brazil. Nonetheless, as mentioned for the case of Brazilian pulp, capital costs are higher in Brazil than in Europe.

[78] Colodette at all. (2009) The Brazilian Pulp Industry: Performance And Potential For Bioenergy Generation, Federal University of Viçosa, Viçosa, MG Brazil

[79] The mix of raw materials used in the production of paper in Europe is different: Europe uses a lot of recovered paper at relatively low cost.

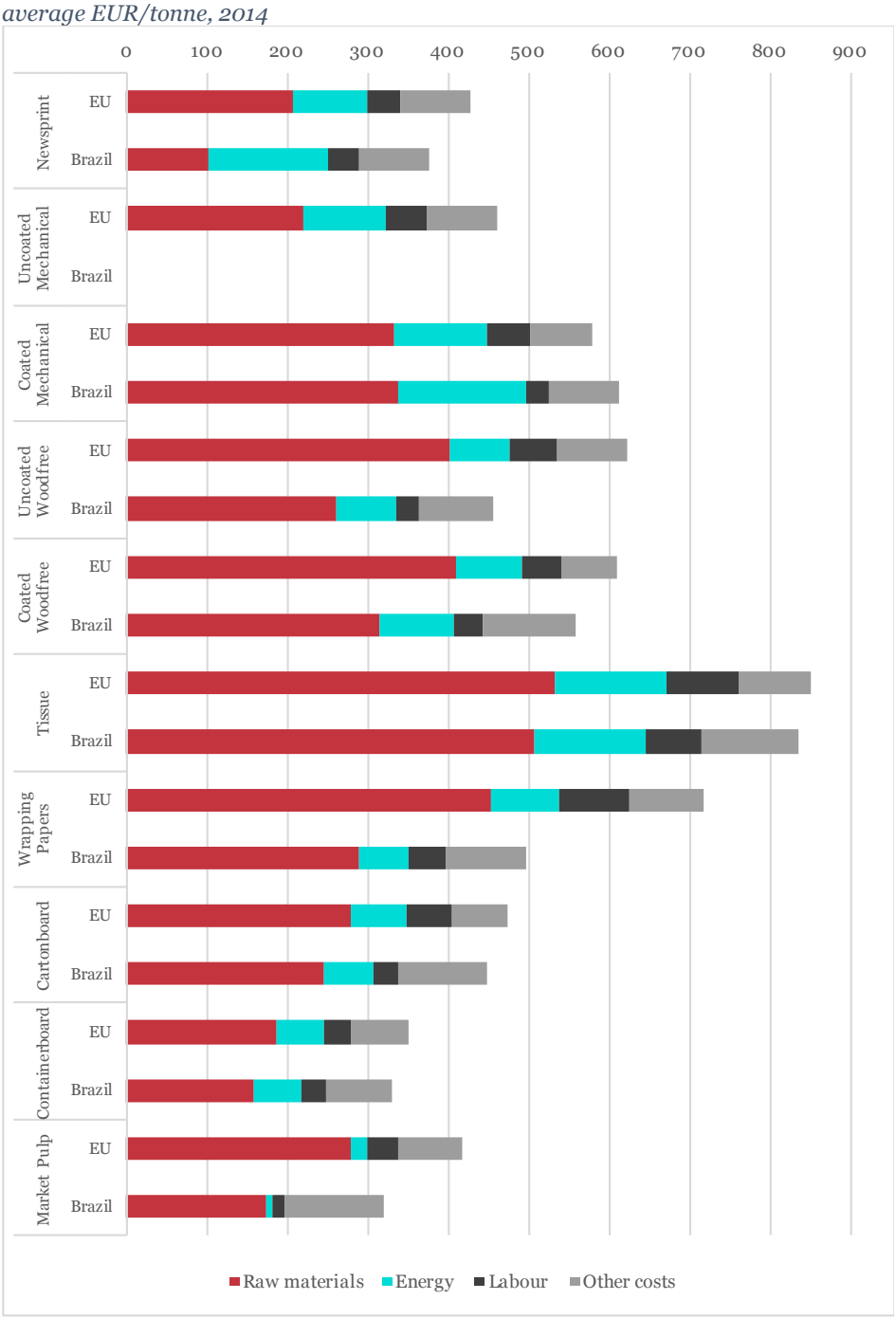
Figure 61 Cost structure of Manufacture of paper and paperboard, Europe vs. Brazil, EUR/tonne, 2014



Source: Authors' elaboration based on RISI data

The view by product group suggests that the highest differences between Brazilian raw materials and European raw materials are registered for uncoated wood-free (139 EUR/tonne cheaper in Brazil) and wrapping papers (166 EUR/tonne cheaper in Brazil). Analogously to the comparison with China, Europe also stands out for higher costs in labour (all products) and in almost all of the products for energy, except for newsprint (55 EUR/Tonne cheaper) and coated wood-free (44 EUR/tonne cheaper). The making of uncoated mechanical paper, uncoated wood-free and wrapping papers is consistently cheaper in Brazil than in Europe (except for slightly lower capital costs in Europe).

Figure 62 Cost structures of inputs to the pulp, paper and paperboard sub-sector, Europe versus Brazil, in average EUR/tonne, 2014



Source: Authors' elaboration based on RISI data

6.2.3 *Policy framework*

6.2.3.1 Forest-related and Environmental policies

Brazilian national forest and forest-related environmental policy is regulated by a series of complementary laws. Forest legislation includes the Forest Code of 1965 (amended in 2012), Protection of Fauna (Law n. 5.197/1967), National Environmental Policy (Law No. 6938/1981), Water Resources Policy (Law n 9.433/1997), Environmental Crimes Law (Law 9. 605/1998), Decree 3179 on penalties for forest crimes (1999) and Decree 3420 (2000) creating the National Forest Programme.

Brazil is a federal republic and each state has its own institutions and legislation determining environmental and forest policy which adds notable complexity to any description of Brazil's forest and environmental policies. A more complex regulatory environment is expected to add to the compliance costs for businesses to some (unidentified) extent.

Deforestation and forest degradation in the Amazon is notably the most well-known forest policy issue in Brazil and beyond, having global effects. It is important to note that most deforestation occurs to clear land for agricultural production. Brazil has made huge efforts to enforce legislation and decrease deforestation. Wood companies have had to comply with new requirements to source wood from sources and prevent illegal logging. Based on a resolution issued in 2006 by Brazil's 'National Environmental Council' (CONAMA), electronic volume-based supply chain control systems were introduced by Brazilian States (EFI EU FLEGT Facility, 2012).[80]

In preparation for the CoP21 in Paris, Brazil announced that it will cut carbon emissions by 37% from 2005 levels by 2025 (Federative Republic of Brazil, 2015). It aims to achieve this by reducing deforestation and increasing the share of renewable sources of energy. Brazil stated it will strengthen and enforce implementation of the Forest Code at all government levels; and aim to achieve zero deforestation by 2030; restore and reforest 12 million ha of forest by 2030; and enhance sustainable management of natural forests. Brazil also aims to increase the share of renewables (including biomass, solar and wind) to at least 23% by 2030. The likely effect, to avoid negative impact on the woodworking sector's wood supply is that it should become increasingly reliant on plantation-grown stock.

The Plano Agricola e Pecuário (The Agriculture and Livestock plan) is an annual plan from the Ministry of Agriculture. The plan aims to "increase agriculture production (including the area of forest plantations) and encouraging environmentally sustainable practices. It outlines strategic actions dealing both with cross-cutting issues (such as access to finance, product marketing, rural risk management, infrastructures) and with sub-sector specific issues" (ITC, 2014). The plan for 2016-2017 earmarks R$202.88 billion (US $58.4 billion) credit for rural production enterprises (including forestry). Priority is given to small- and medium-sized enterprises.[81] Within the plan is a programme for the development of the forest plantation area in Brazil. The aims of the programme include to increase the area of forest plantations from 7.6 million ha to 10.6 million ha over the period 2015-2025, and to reach exports of US $20 billion by 2025 (Ministry of Agriculture, 2015). The aim of the investment in increasing forest plantation area is to provide the forest-based industries in Brazil with a reliable (with regard to supply and price) and sustainable source of raw materials. Besides increasing plantation area, net annual increment in plantations is expected to increase as a result of tree breeding.

In the long-term the efforts to increase the plantation area and the increment in plantations will increase Brazil's domestic capacity to produce wood and should stabilise wood prices.

Table 48 presents a summary of forest-related and environmental policies for Brazil, with their likely cost impact.

[80] DOF (Document of forest origin) was introduced in 2006; DOFex (DOF Export), an extension of the DOF system initiated in early 2011; and SISFLORA (System for the Commerce and Transport of Forest Products), developed in 2006 and used instead of DOF in the states Pará and Mato Grosso.

[81] See: http://www.agricultura.gov.br/pap

Table 48 - Summary table of forest-related and environmental policies for Brazil

Policy area	Policy name	Date		Cost area	Cost impact
Environment	National Environmental Policy	1981	Areas covered by the NEP include: definition of standards, licensing, environmental impact assessments, establishing special areas for preservation, incentives for cleaner production, and environmental zoning	Cost/Availability of raw materials	↗
	Water Resources Policy	1997	Protection of Brazil's river basins and the natural vegetation	Cost/Availability of raw materials	↗
	Environmental Crimes Law	1998	Establishment of criminal penalties for those found guilty of committing environmental crimes.	Cost/Availability of raw materials	↗
Forest-related	Forest Code of 1965 (amended in 2012)	1965 (latest amendment 2012)	The 2012 law regulates and restricts activities in specifically environmentally protected areas. The 1965 law established that 50% of rural land should be maintained as forest (legal reserves) and prohibited the clearing of natural vegetation in sensitive areas.	Cost/Availability of raw materials	↗
	Decree 3179 on penalties for forest crimes	1999	Regulating the application of penalties for forest crimes	Cost/Availability of raw materials	↗
	Decree 3420	2000	Creation of the national forest programme. The aims of the NFP aims are to: (1) promote and implement sustainable forest development; (2) protect biodiversity of forest ecosystems; (3) harmonize sustainable forest development with sectoral policies and other sectors; (4) institutional development, with the Federal Government playing a key role in the coordination and modulation of activities. Specific objectives include: ensuring the production of raw materials to meet the needs of the domestic and external markets; and boosting the supply of forest products and by-products, restoring degraded areas, reducing waste, introducing technologies and new markets and promoting employment and income.	Cost/Availability of raw materials	↗
	Agriculture and Livestock Plan 2011-2012	2011	The Agriculture and Livestock plan aims to increase agriculture production (including the area of forest plantations) and encouraging environmentally sustainable practices.	Cost/Availability of raw materials	

6.2.3.2 Trade policy

Brazil is a member of Mercosul (Mercado Comum do Sul in Portuguese), a South American trading bloc with five members, and six associate members and two observer countries.

The Global Enabling Trade Report assesses countries with regard to the Enabling Trade Index (ETI). ETI captures various dimensions of enabling trade, e.g. market access, border administration, infrastructure and operating environment. With regard to market access, Brazil was ranked 108th out of 138 countries in terms of the barriers to its domestic market (an assessment of the level and complexity of a country's tariff protection as a result of its trade policy), and 77th out of 138 countries with regard to foreign market access (an assessment of the barriers its exporters faced) (WEF, 2014a).

The International Trade Centre (ITC) provides an overview of trade strategy and policy for Brazil (ITC, 2014). Although no cost implications could be directly concluded, the following initiatives are of relevance for the forest-based industries:

- **Brasil Maior**. "The plan Brasil Maior aims to foster innovation and competitiveness in the Brazilian economy. It focuses on strengthening production processes, developing technological and entrepreneurial skills, improving energy supply, diversifying exports and increasing internationalisation, and developing competences for sustainable development. The plan targets specific productive sectors [including the pulp, paper and paperboard sector], and it deals with cross-cutting issues such as international trade, investment, innovation, technical and vocational training, sustainable production, small and medium enterprises' competitiveness, special initiatives for regional development, customers' well-being, labour conditions and relations" (ITC, 2014).[82]
- The **Brazilian Export Strategy**. "The document provides a diagnostic analysis of the current export performance of the Brazilian economy and it outlines a strategy aiming to increase exports and meeting the targets of the national productive development policy. The strategy envisages five main objectives: 1) increase competitiveness of Brazilian exporters; 2) increase exports' added value; 3) increase the number of exporters and in particular strengthening the position of small- and medium-sized enterprises; 4) increase access to foreign markets; 5) increase exports of services" (ITC, 2014).[83] ApexBrazil is a government agency dedicated to promoting Brazilian products and services overseas, and promoting foreign investment in Brazil. The development of the pulp, paper and paperboard sector, backed by an ambitious investment plan in the private sector[84], is an area that is specifically targeted by the national export strategy.[85]

The average duty imposed on imports from countries with most-favoured-nation (MFN) status was 7.9% (range 2-14%) on woodworking products (HS44[86]), 3.6% (range 2-4%) on pulp (HS47), and 13.2% (range 0-16%) on paper (HS48) (WTO, 2016). The average tariff based on all imports of wood and paper products etc. (relating to HS Chapters 44, 45, 47, 48, 49, 9401-04 (except 940490), 961900) was 28.4% on average (WTO, 2016). These levels of import duties are quite high, especially compared to the EU which applies 0% import duties on imports of pulp (HS 47), paper (HS 48) and many other forestry products. CEPI reported that imports of some particular paper grades are charged tariffs of up to 25% for countries with non-MFN status. Wood, pulp, paper and paperboard products accounted for 1.3% of imports to Brazil.

Table 49 presents a summary of forest-related and environmental policies for Brazil, with their likely cost impact.

[82] See: http://www.bndes.gov.br/SiteBNDES/bndes/bndes_en/Hotsites/Annual_Report_2011/Capitulos/institutional_operations/the_bndes_and_public_policies/brasil_maior_plan.html

[83] http://www.desenvolvimento.gov.br/arquivos/dwnl_1220468182.pdf

[84] http://bracelpa.org.br/bra2/?q=en/node/332

[85] www.apexbrasil.com.br

[86] Harmonized Commodity Description and Coding System (HS) as maintained by the World Customs Organization (WCO), HS44 refers to chapter 44 that groups commodities "Wood and articles of wood; wood charcoal".

Table 49 Summary table of trade policies for Brazil

Policy area	Policy name	Date		Cost area	Cost impact
Trade	Brasil Maior	2011	The plan Brasil Maior aims to foster innovation and competitiveness in the Brazilian economy. It focuses on strengthening production processes, developing technological and entrepreneurial skills, improving energy supply, diversifying exports and increasing internationalization, and developing competences for sustainable development. The plan targets specific productive sectors [including the pulp, paper and paperboard sector], and it deals with cross-cutting issues such as international trade, investment, innovation, technical and vocational training, sustainable production, small and medium enterprises' competitiveness, special initiatives for regional development, customers' well-being, labour conditions and relations.	Cost/Availability of capital	↘
	Brazilian Export Strategy	2008	The document provides a diagnostic analysis of the current export performance of Brazilian economy and it outlines a strategy aiming to increase exports and meet the targets contained in the national productive development policy. The strategy envisages five main objectives: 1) increase competitiveness of Brazilian exporters; 2) increase exports added-value; 3) increase the number of exporters; 4) increase access to foreign markets; 5) increase exports of services.	Cost/Availability of capital	↘

6.2.3.3 Third party certification in aid of compliance with legality requirements

The national report of the 10th session of the United Nations Forum on Forests refers to a policy to increase the area of certified forests from 6.3 million ha to 7.2 million ha over the period 2008-2011 (UNFF-Brazil, 2012). Cerflor (endorsed by the Programme for the Endorsement of Forest Certification - PEFC) and the Forest Stewardship Council (FSC) provide third-party certification in Brazil. The latest figures from FSC stated that there are 1089 Chain of Custody certificates and the certified forest area is 6.0 million ha (106 certificates, both for plantation and natural forests), slightly over 1% of the total forest areas (FSC International, 2016). The latest figures from PEFC stated that there are 75 Chain of Custody certificates; the PEFC certified forest area is 2.7 million ha (PEFC, 2015). The Brazilian Forest Certification Programme (Cerflor) was developed within the national framework of SINMETRO - National System of Metrology, Standardisation and Industrial Quality guided by the rules of the National Council of Metrology, Standardisation and Industrial Quality (Conmetro), and by

its executive body the National Institute of Metrology, Standardisation and Industrial Quality (Inmetro).

6.2.3.4 Analysis of the likely cost impacts of national and EU legislation

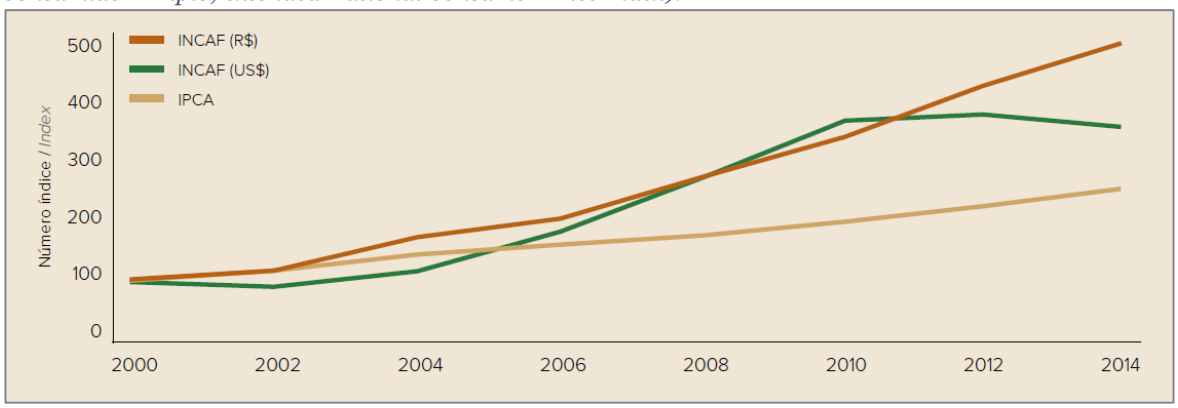
According to the Indústria Brasileira de Árvores (Brazilian Tree Industry - Ibá), the organisation representing the Brazilian Tree Industry from forest plantations to the wood products and pulp, paper and paperboard industries, the forest-based sector has had to deal with a number of challenges and structural issues which have reduced competitiveness (Ibá, 2015, 2014). These challenges and issues mentioned by Ibá include:

- Increasing cost of labour without a corresponding increase in productivity [the main source of laws related to employment is "Consolidação das Leis do Trabalho" referred to as the "Labour Code" – enacted in 1943 and subject to many changes.];
- Labour taxes and other deductions represented 58% of gross salaries, while the global average was 23%;
- Complex federal and state environmental legislation (see also section 6.2.3.1);
- National credit policies which are not favourable for long-term investment in forest production;
- Restrictions on land acquisition by foreign capital companies and Brazilian companies with a majority share of foreign capital;
- Lack of bilateral and multilateral trade agreements involving Brazil. [As such, the Brazilian F-BI sector is subject to trading tariffs, particularly of significance for exports abroad – see section 6.2.3.2; note there is no free trade agreement yet between EU and Mercosur. Intense negotiations took place between 1999 and 2004, and were relaunched at the EU-Mercosur summit in Madrid in 2010. However, here has not been much recent progress.];
- Subsidies for extraction and consumption of fossil fuels at the expense of renewable energy and forest biomass; [Since the 1990s, Brazil has emerged as a major-oil producing country with the oil and gas sector dominated by the state-owned company Petrobras. There is a wide variety of tax exemptions, suspensions and reductions that benefit the fossil fuels sector directly, at the expense of other sectors (Nuaimy-Barker, 2015).]
- Lack of funding for research in strategic areas such as industry innovation; biotechnology and genetic improvement.

One of the Brazilian respondents (pulp, paper and paperboard) mentioned in an interview that "they hoped that mergers and acquisitions would occur over the coming years to increase the average company size and the competitiveness of the sector". However, the EU merger experience shows that mills rather than companies end up competing with each other.

Although there have been increases in labour productivity in Brazil, Ibá has expressed a general concern that the cost of producing wood has become relatively higher in relation to other leading producers over the last 15 years. With respect to the increase in the costs of producing wood, in 2000 the cost was 40% less than in the US. By 2014, although still less expensive than the United States, the difference was less than 10% (Ibá, 2015). An evolution of the trend in cost of wood production is shown in Figure 63

Figure 63. Increase in the cost of wood production (INCAF – Indice Nacional de Custos da Atividade Florestal; National Index of Forestry Activity Costs) versus Brazilian Inflation (IPCA – Indice Nacional de Precos ao Consumidor Amplo; extended National Consumer Price Index).



Source: Pöyry Indice Nacional de Custos da Atividade Florestal in Ibá 2015.

Of particular importance to the Brazilian forest industries was pressure coming from domestic requirements to use legally sourced wood (Forest Code, National Environmental Policy, Decree 3179 on penalties for forest crimes (1999) and Decree 3420 (2000) creating the National Forest Programme; see section 6.2.3.1). At the beginning of the previous decade, the legality requirements dramatically increased raw material costs for Brazilian industries, pushing many of particularly the smallest companies out of business: when the Brazilian authorities began to enforce these measures more strictly, legally sourced wood from natural forests became scarce and overall wood prices soared – by up to 356%. This affected the industry and many sawmills closed in the period following 2001 (Tomaselli et al., 2012). The early adoption and enforcement of domestic measures to tackle illegal logging by Brazil should, in principle, reduce the impacts of the EU Timber Regulation on costs of local businesses exporting to the EU. Li et al. (2008) modelled what effect eliminating illegal logging would have on forest industries, trade and forest resources. For Brazil, the limits set by Li et al. for the intial share of illegally logged industrial roundwood were extremely broad and ranged from a high estimate of 0.8 to a low estimate of 0.05. Elimination of illegal logging was predicted to increase revenues in wood-producing countries, except where industries' inputs depended on high levels of illegal logging in Brazil and Malaysia.

Taxes, interest rates, labour and strict environmental legislation were mentioned (but not specified) by respondents as the most significant costs affected by legislation. In relation to trade with EU countries, high cost of export taxes and high transport costs were mentioned. High interest rates for all types of investments and the economic crisis were mentioned as key current and future barriers for investment and innovation. The current key interest rates in Brazil (at 14.25% in July 2016) are at their highest rate for 10 years. One company correspondent stated that ensuring compliance with the EUTR or with the Lacey Act was a "hassle" in the beginning, yet it had to be mandatorily implemented in order to sell into EU and US markets. However, more recently it was considered as a standard procedure for those suppliers, trading companies and clients that are involved in exporting to the EU and the United States. Another responding company (an exporter of timber) considered that the EU Timber Regulation did indeed not deter or prevent them from doing business with Europe as they already fullfil all criteria required by the EU Timber Regulation. The correspondent continued that there is no price differentiation for their exports because of administrative requirements for the suppliers, as for the same product, they are independent from the sales' destinations (United States, Europe, Caribbean, Far East or South Africa). Market premiums for e.g. FSC certified products are not so much an issue for governmental clients when they are required to purchase certified wood-based products. However, European importers selling to other customers are only interested when price levels of certified products are the same as for non-certified products.

One respondent pointed out the significant effects of monetary policy and forex rate fluctuations on the shaping of markets. The Brazilian Real is weak compared to the US dollar and Chinese renminbi

making Brazilian exports relatively competitive (UNECE/FAO, 2015). Current (July 2016) interest rates in Brazil are high 14.25% compared with the United States (0.5%), China (4.35%) and the Euro area (0%). This reflects confidence in the Brazilian economy.

6.3 Country overview: China

6.3.1 General description of the forest-based sector

6.3.1.1 Forest resources profile

The Chinese forest area has increased between 2005 and 2015 from 193 million hectares to 208 million hectares, an increase of 1.5 million hectares per year on average; 77% of which attributable to planted forests (all new reforestation and afforestation activities for restoration of ecosystems and wood production). With regard to ownership of wood forests in China, 28.3% are state-owned, 34.3% are collectively owned, and 37.4% are privately owned (reported in the 7th National Forest Inventory of China 2004-2008). The proportion of privately owned wood production forest has increased from 18.5% since the 6th NFI (1999-2003) (see Table 50) (State Forestry Administration, 2014). The growing stock that has increased in the same period from 13.6 billion m^3 o.b. to 16 billion m^3 o.b.. However, the forest of designation "wood-production forest", is still much below the 84.0 million hectares that it was in 1990, and despite having increased to 64.7 million hectares in 2015, from 63.8 million hectares in 2005.

Table 50 Changes in ownership of wood forests in China. (source: 7th and 6th China national forest inventory)

Ownership type	**6th NFI 1999-2003**		**7th NFI 2004-2008**	
	Area (in million ha)	% of wood-production forest	Area (in million ha)	% of wood-production forest
State owned	3.54	42.4%	1.81	28.3%
Collective	3.27	39.1%	2.20	34.3%
Individual	1.54	18.5%	2.40	37.4%
Totals	8.35	100%	6.42	100.00%

Source: 7th and 6th China national forest inventory

6.3.1.2 Sectoral structure

The contribution of the forest-based industries to GDP in China has increased by 11 times since 2000 to 3.9 trillion RMB (at current foreign exchange rates, equivalent to €538 bn) in 2012 (FAO-FRA2015, 2015). The primary wood-processing sector in China (in this case primary processing is mainly sawmills and excludes plywood mills) is highly fragmented with many small-sized logging companies and sawmills located in over 20 provinces (IBISWorld, 2011).[87] In comparison, the secondary wood-processing sector (i.e. wooden building materials, wood-based panels, wooden pallets and packaging) is relatively concentrated within three economic development zones: the Pearl River Delta, the Yangtze River Delta and the Bohai Bay Area (Figure 64). These economic development zones are located in close vicinity to the Guangzhou, Shanghai and Beijing metropolitan areas, respectively (Cao et al, 2013).

[87] IBISWorld, 2011. World Furniture Manufacturing in China. Santa Monica, CA: IBISWorld Inc.

Figure 64. Map of China indicating the Bohai Bay, Yangtze River Delta and Pearl River Delta Regions

Base map: Google maps

It is estimated that small- and medium-sized wood-processing enterprises account for 87% of the total production (Sun and Chen, 2003). There are no precise statistics on the number of wood-processing mills. However, Euromonitor International has compiled statistics for the overall woodworking sector as presented in the following table (Euromonitor International, 2013).

Table 51 Number of Chinese companies for ISIC20 – Wood and Wood Products, by Employment Size 2007–2012

Number of companies	2007	2008	2009	2010	2011	2012
Micro (0-7 employees)	8285	9347	10140	10425	10934	11407
Extra small(8-19	19472	22817	23663	23206	23702	23590
Small (20-49 employees)	17518	21006	23348	24626	26289	28031
Medium (50-299 employees)	9510	11030	12315	13042	13953	14931
Large (300+ employees)	669	742	771	755	771	768
Total	55454	64942	70237	72054	75649	78727

Source: Euromonitor International, 2013

6.3.1.3 Production, trade and consumption

China is a big player in the global markets, competing directly with EU-based F-BI on the input side on the wood raw material markets, and on the output side with wood-based products destined for the EU and other markets. China also exports many innovative wood-substituting products (e.g. based on bamboo and rattan). China is the world leading producer and exporter of manufactured wood products, including wood-based panels, wooden furniture, plywood, wooden flooring, musical instruments and a variety of other wooden building products and handicrafts (Cao et al., 2013).

In 2014, China imported forest products[88] for a total value of $US 46.8 bn, while it exported for a total value of about $US 16.2 bn (FAOSTAT, 2015). In order to satisfy the huge demand for wood raw material, China needs to import considerably. Over the past years, the main suppliers in terms of metric volume of e.g. roundwood are the Russian Federation, New Zealand and USA; for sawnwood, these are Canada, Russian Federation and the USA. Roundwood imports were about 53.7 million m^3 in 2014, when exports in that category were only negligible at 57 800 m^3 (FAOSTAT, 2015). In 2014, China was the leading consumer of sawnwood (22% of global consumption (ogc); 95.4 million m^3), wood-based panels (47% ogc; 179.3 million m^3, of which slightly less than half is plywood), and paper and paperboard (27% ogc; 106.0 tonnes). China was the second leading consumer of industrial roundwood (12% ogc; 216.1 million m^3) and pulp for paper (19% ogc; 33.9 million tonnes).[89] It was the leading producer of wood-based panels (49%; 191.2 million m^3), recovered paper (24%; 53.7 million tonnes), and paper and paperboard (27%; 108.8 million tonnes); and the second leading producer of pulp for paper (10%; 17.5 million tonnes), and sawnwood (16%; 68.4 million m^3) (FAOSTAT 2015).

Cao et al. (2013) amended using FAOSTAT, gives a good overview of the production capacity development for sawmilling, wood-based panels, flooring and furniture sectors, as follows.

Table 52 Overview of China's FB-I production and trade

- Sawmilling: It is estimated that there are about 2800 logging companies and over 200 000 sawmills in China (IBISWorld, 2011). 90% of these mills are small and most are running with out-dated production technology. In 2014 China produced 68 million cubic metres of sawnwood. Imports of sawnwood were worth $US 8.6 billion (27 million cubic metres) and exports $US 408 million (423 000 cubic metres) (FAOSTAT, 2015).
- Wood-based panels: In 2014 China produced 191 million m^3 of wood-based panels, and exported 15 million m^3 or in value $US 7.9 billion worth of panels (FAOSTAT, 2015). China is the world's largest manufacturer of wood-based panels in terms of total production volume, mainly plywood (in 2014: 104.1 million m^3), fibreboard (in 2014: 56.8 million m^3) and particleboard (in 2014: 20.6 million m^3) (FAOSTAT, 2015). Flooring: Wooden flooring production has greatly increased between 2000 and 2010, from 108 to 479 million m^2.
- Furniture: China is the largest manufacturer and exporter of wooden furniture in the world, with exports in 2011 exceeding $US 10 billion, accounting for 30% of the world's total wooden furniture exports
- Wood pulp: The country produced about 10.4 million tonnes of wood pulp in 2014, of which it exported only 48 000 tonnes ($US 29.2 million). China imported 18.7 million tonnes of wood pulp, worth $US 12.6 billion (FAOSTAT, 2015).
- Paper: China produced about 109 million tonnes of paper and paperboard in 2014, imported 4.6 million tonnes (at a value of $US 4.9 billion) and it exported 7.3 million tonnes ($US 7.5 billion) (FAOSTAT, 2015), making it the world's largest producer.
- Printing: In 2014, China imports of printed materials were worth $US 1.9 billion and exports were worth $US 3.8 billion.

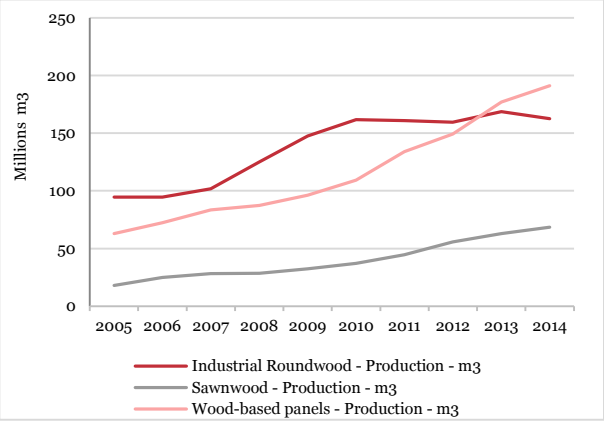
Source: production and trade for furniture, wood products, and pulp, paper and paperboard products – Cao et al. 2013 and FAOSTAT 2015; trade printing – ITC 2015.

[88] Forest products: i.e. All forest products listed in the FAOSTAT database: chips and particles, wood fuel, wood residues, wood charcoal, wood pellets, sawnwood, industrial roundwood, wood-based panels, pulp, recovered paper, paper, paperboard. Bamboo and rattans are included in the forest product definitions (e.g. within 'wood in the rough' and 'pulp other than wood'.

[89] Apparent consumption is the production (or removals) plus imports minus exports.

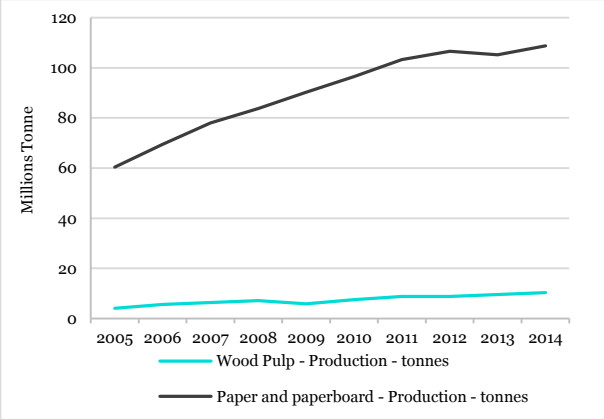
Figure 65 to Figure 72 present the evolution of production quantity, and trade (value and quantity) for the period 2005-2014. The value of trade is presented in $US as the international reporting standard.

Figure 65 Production of wood products – China



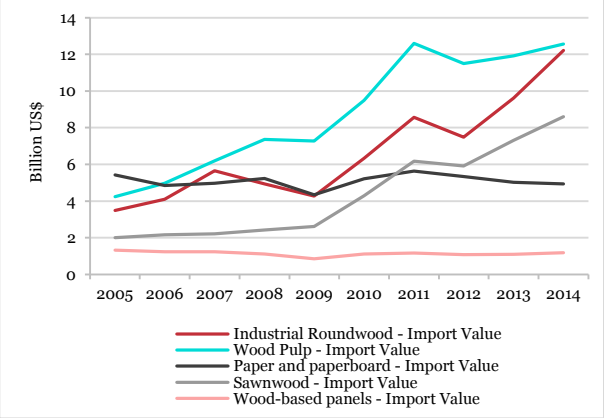
Source: FAOSTAT, 2015

Figure 66 Production of pulp, paper and paperboard products – China



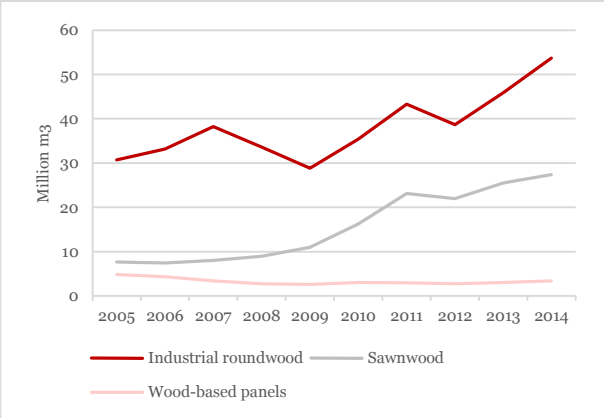
Source: FAOSTAT, 2015

Figure 67 Imports of wood and paper products – China [currency in US$ as international reporting standard]



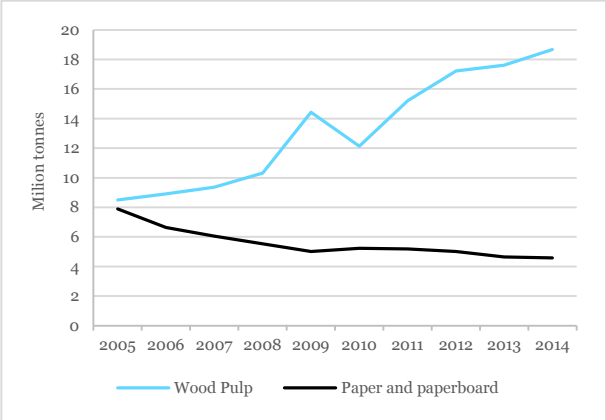
Source: FAOSTAT, 2015

Figure 68 Import quantity of wood products – China



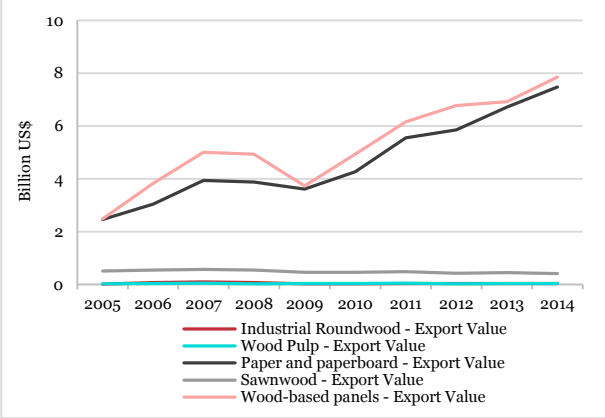
Source: FAOSTAT, 2015

Figure 69 Import quantity of paper products – China



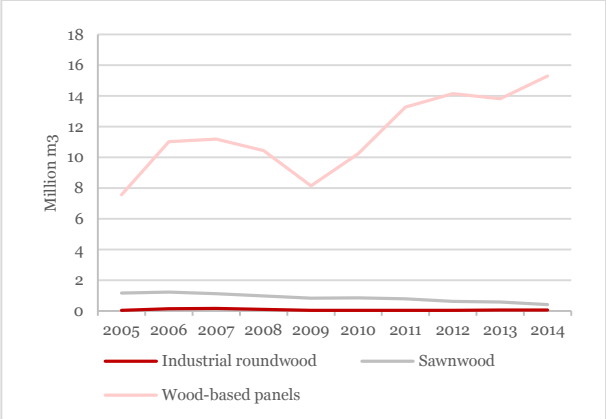
Source: FAOSTAT, 2015

Figure 70 Exports of wood and paper products – China [currency in US$ as international reporting standard]



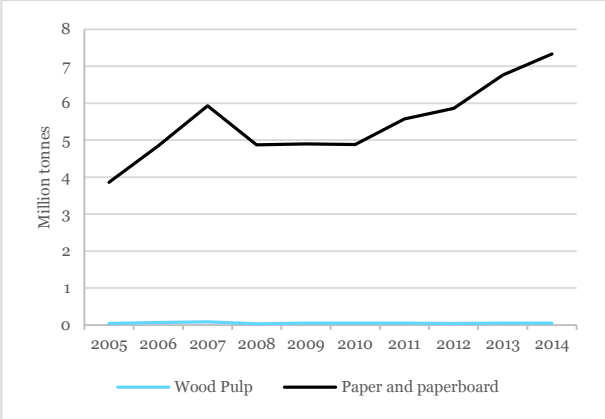
Source: FAOSTAT, 2015

Figure 71 Export quantity of wood products – China



Source: FAOSTAT, 2015

Figure 72 Export quantity of paper products – China



Source: FAOSTAT, 2015

6.3.2 Production cost structures in the selected F-BI sub-sectors

6.3.2.1 Production cost structure in the woodworking sub-sector

In 2012, raw materials (20.8%) plus intermediate wood and wood products (materials produced within the manufacturing sector and not within the primary forestry sector) (35.9%) accounted for 56.7% of total costs (Table 53). Agricultural raw materials accounted for 6.7% of the total costs. China has invested a lot in the development of its manufacturing industries and, although it has the fifth largest forest area in the world (FAO, 2015), supply from Chinese forests cannot keep up with demand from the forest-based industries. In any case, there are very strictly enforced restrictions on cutting Chinese forests. Consequently, China imports a lot of raw materials to supply its industries, and raw material costs are dependent on price and currency fluctuations in the global markets. China is also investing in the development of the forest plantation area, but the plantations are still relatively immature and the benefits of this policy have not been realised yet (Haley and Haley, 2013). Zeng et al. (2012) report that the price of raw materials including raw wood and sawn timber increased by 10% - 30% compared with 2008. Requirements to comply with the EU Timber Regulation are expected to

add extra pressure to the operating environment for SMEs in the wood product industry (Zeng et al., 2012), notably raw material and administrative costs.

Labour costs accounted for 10.2% of total costs. This was the lowest of the three countries selected for the international comparison. However, labour costs are also increasing faster than in competitor countries. Heavy machinery usage is also mentioned as a factor that keeps the share of labour low as proportion of total costs (Euromonitor International, 2013). In comparison to labour costs in the United States, the average hourly remuneration costs for the whole manufacturing sector have increased from slightly more than 2% of the labour costs in the US in 2002, to more than 8% of the labour costs in the United States in 2012 (The Conference Board, 2014). Several provinces introduced mandatory wage increases in 2010 (EIU, 2010). While China is still considered as one of the countries with the cheapest labour in the world, many industries are concerned with the rapidly rising labour costs (Euromonitor International, 2013) and some companies may relocate their production lines partly or fully to lower-wage countries. Lower labour costs in some of China's neighbouring countries, such as Vietnam, have been a boon for industries located there.

Transport costs, energy costs, and other costs (taxes, financial services) accounted for 2.7%, 5.2%, and 4.8% of total costs, respectively (Table 53).Overall manufacturers' costs increased 236% between 2008 and 2012, while profitability stayed at 10%, explained by rising prices and wages (Euromonitor International, 2013).

The increased raw materials costs, increased payments for production-line workers, and impact on export costs from the cumulative appreciation value of Chinese currency (RMB) (up to 6.6%)resulted in a rise of the mean export cost of a unit product by around 20 – 40% (Zeng et al., 2012).

Table 53 Cost structure for the woodworking sub-sector in China for the year 2012 (see Table 42 for an explanation of the categories)

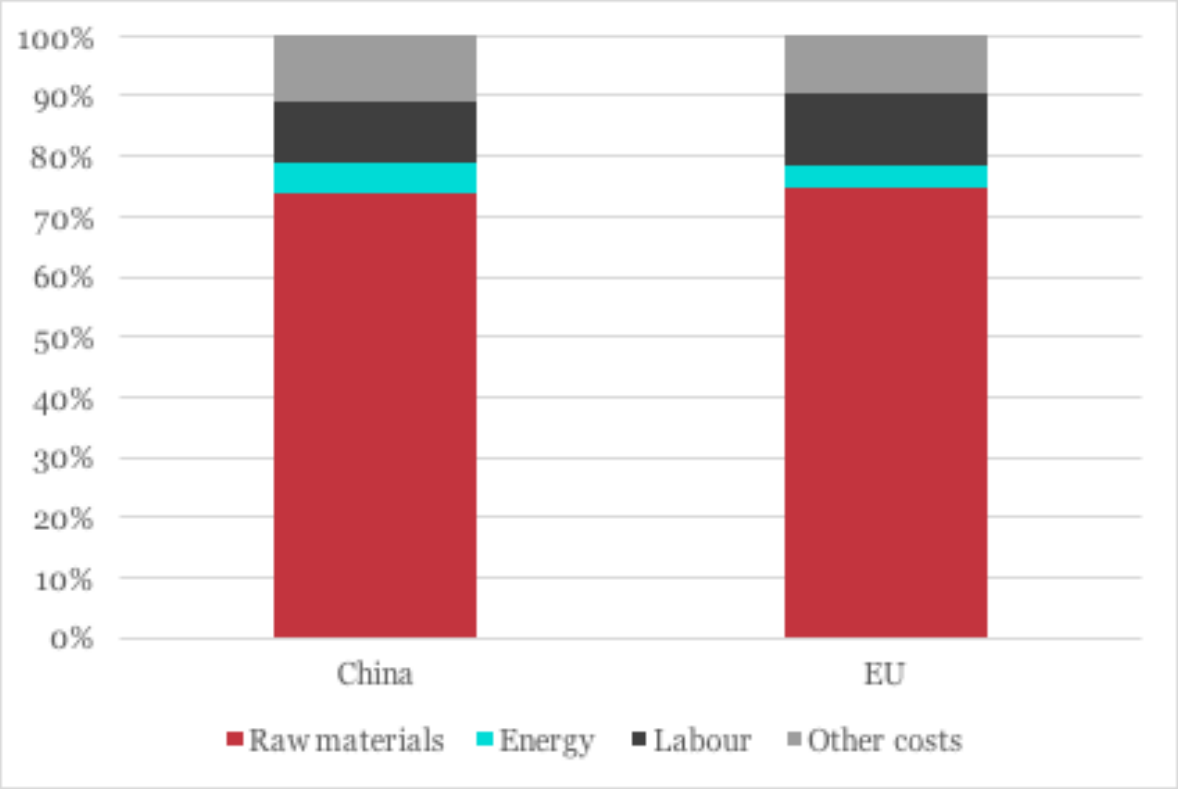
Main cost category	Cost sub-category	Cost items	RMB million	€ million[90]	%
Raw materials and processed Materials	Primary material	Forestry (wood mainly –including production of bamboo and rattans)	212242	26186	20.8%
		Agriculture	101650	12541	
		Other	13.2	2	
	Intermediate materials	Wood and wood products	542845	66975	51.6%
		Basic chemicals	60099	7415	
		Other chemicals	59012	7281	
		Other	119208	14708	
	Other	Pharmaceuticals	5884	726	1.3%
		Other	14016	1729	
Capital costs	Durable goods	Machinery for rubber, plastics and paper industries and other special purpose machinery	11157	1377	3.3%
		Other	38752	4781	
Labour			153751	18969	10.2%
Transport and logistics		Cargo handling, warehousing and travel agencies	17341	2139	2.7%
		Other	23993	2960	
Energy		Production, collection and distribution of electricity	36539	4508	5.2%
		Other (including recycling)	42484	5242	
Other costs	Services (part of OPEX)	Monetary intermediation	16573	2045	3.0%
		Other	29247	3608	
		Taxes less subsidies	27663	3413	1.8%

Source: Euromonitor International, 2013

[90] RMB to € currency conversion based on the European Central Bank reference exchange rate for 2012.

The following figure allows to compare cost structures from China and EU, in relative terms:

Figure 73 Cost structures for China and EU in relative terms, as % of production costs, 2005



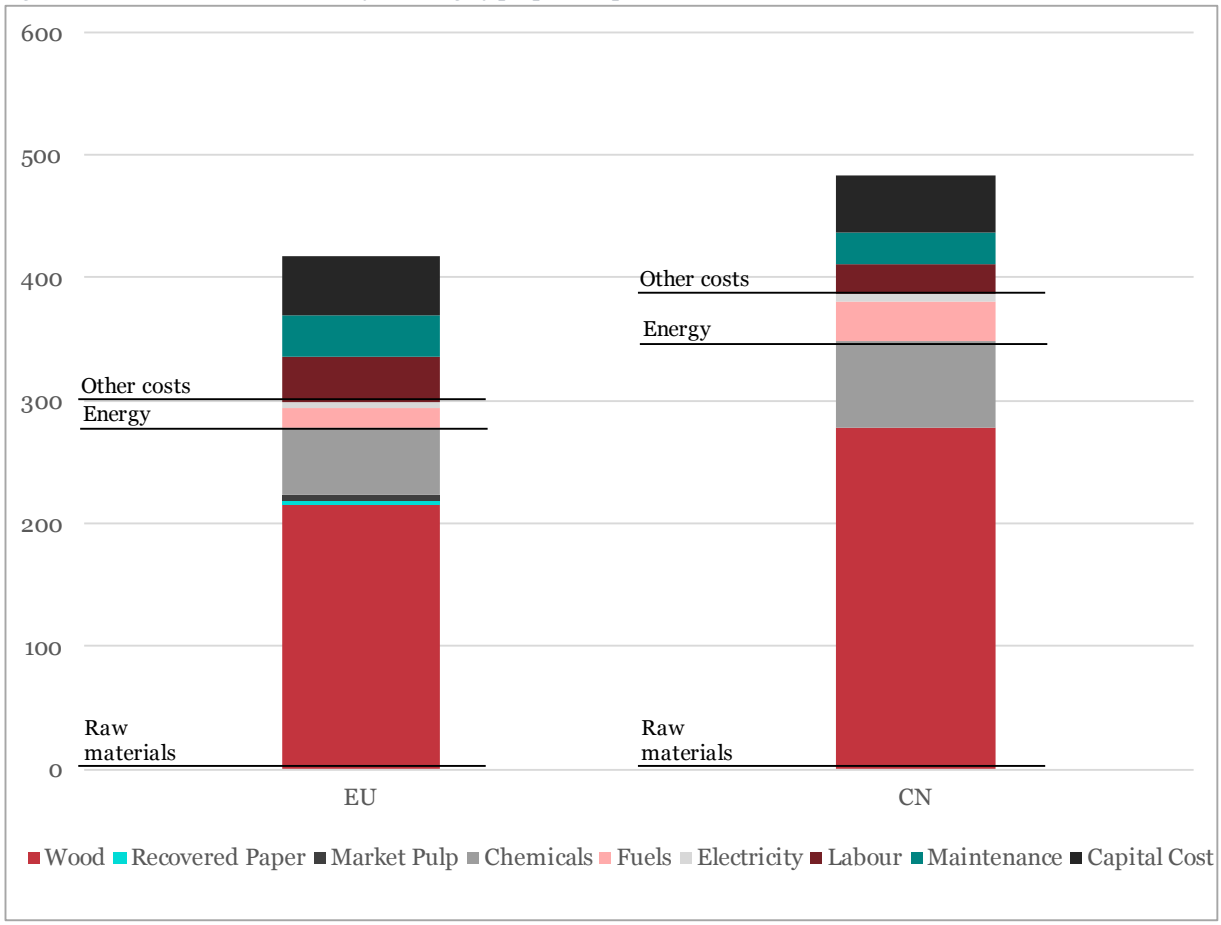
Source: Euromonitor International 2013 for China and ToSIA data 2005 for EU

6.3.2.2 Cost structure in the pulp, paper and paperboard sub-sector

Reference to Figure 74 indicates that in 2014, direct manufacturing costs for the production of pulp are overall higher in China than in Europe (a difference of 67 EUR/tonne). Raw material wood costs account for more than a half of the Chinese manufacturing costs (278 EUR/tonne), and approximately for half of the European costs (215 EUR/tonne). Looking at previous years, raw material costs for wood in China are set higher than the European ones, starting from 2010, with the highest price difference was registered in 2014. Chemicals are other significant raw materials costs (54 EUR/tonne in EU28, 70 EUR/tonne in China). Energy costs are dominated by fuels in both Europe and China, nonetheless, fuel is reported to be more expensive in China than in Europe (33 EUR/tonne vs. 16 EUR/tonne). Conversely, labour and maintenance are more expensive in Europe than in China (71 EUR/tonne vs. 50 EUR/tonne). However, it should be recalled that the pulp, paper and paperboard sector is far from being a labour-intensive one.

To summarise, direct manufacturing costs for the production of pulp are higher in China, where they are dominated by wood raw material costs, chemicals, and capital costs. In Europe, higher costs are observed for labour and maintenance.

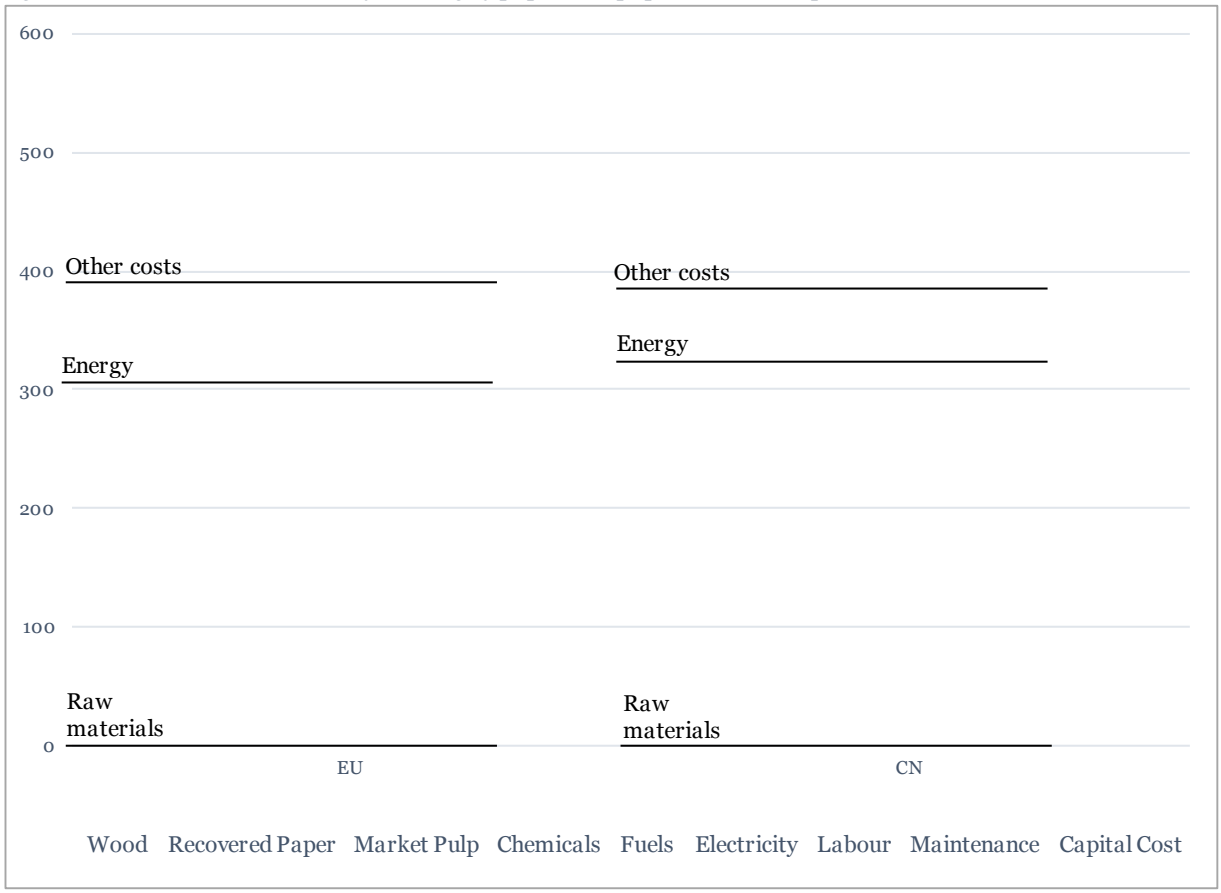
Figure 74 Cost structures in manufacturing of pulp, Europe vs China, EUR/tonne, 2014



Source: Authors' elaboration, based on RISI data

As can be seen in Figure 75, the total costs in Euro per tonne for the paper and paperboard produced in 2014 show an inverted picture, with higher total costs in Europe than in China; a difference of 45 EUR/tonne. The costs structure for the production of paper and paperboard is more fragmented between the various cost categories, reflecting a greater intensity of processing than for pulp. Other raw materials than wood (i.e. recovered paper, market pulp and chemicals) account for the highest share of the costs. What marks the gap between the higher production costs in Europe than in China are mainly labour costs (19 EUR/tonne in China and 53 EUR/tonne in Europe), wood costs (23 EUR/tonne in China, 40 EUR/tonne in Europe), and energy costs (60 EUR/tonne in china, 84 EUR/tonne in Europe). Figure 17, the total costs in Euro per tonne for the paper and paperboard produced in 2014 show an inverted picture, with higher total costs in Europe than in China; a difference of 45 EUR/tonne. The costs structure for the production of paper and paperboard is more fragmented between the various cost categories, reflecting a greater intensity of processing than for pulp. Other raw materials than wood (i.e. recovered paper, market pulp and chemicals) account for the highest share of the costs. What marks the gap between the higher production costs in Europe than in China are mainly labour costs (19 EUR/tonne in China and 53 EUR/tonne in Europe), wood costs (23 EUR/tonne in China, 40 EUR/tonne in Europe), and energy costs (60 EUR/tonne in china, 84 EUR/tonne in Europe).

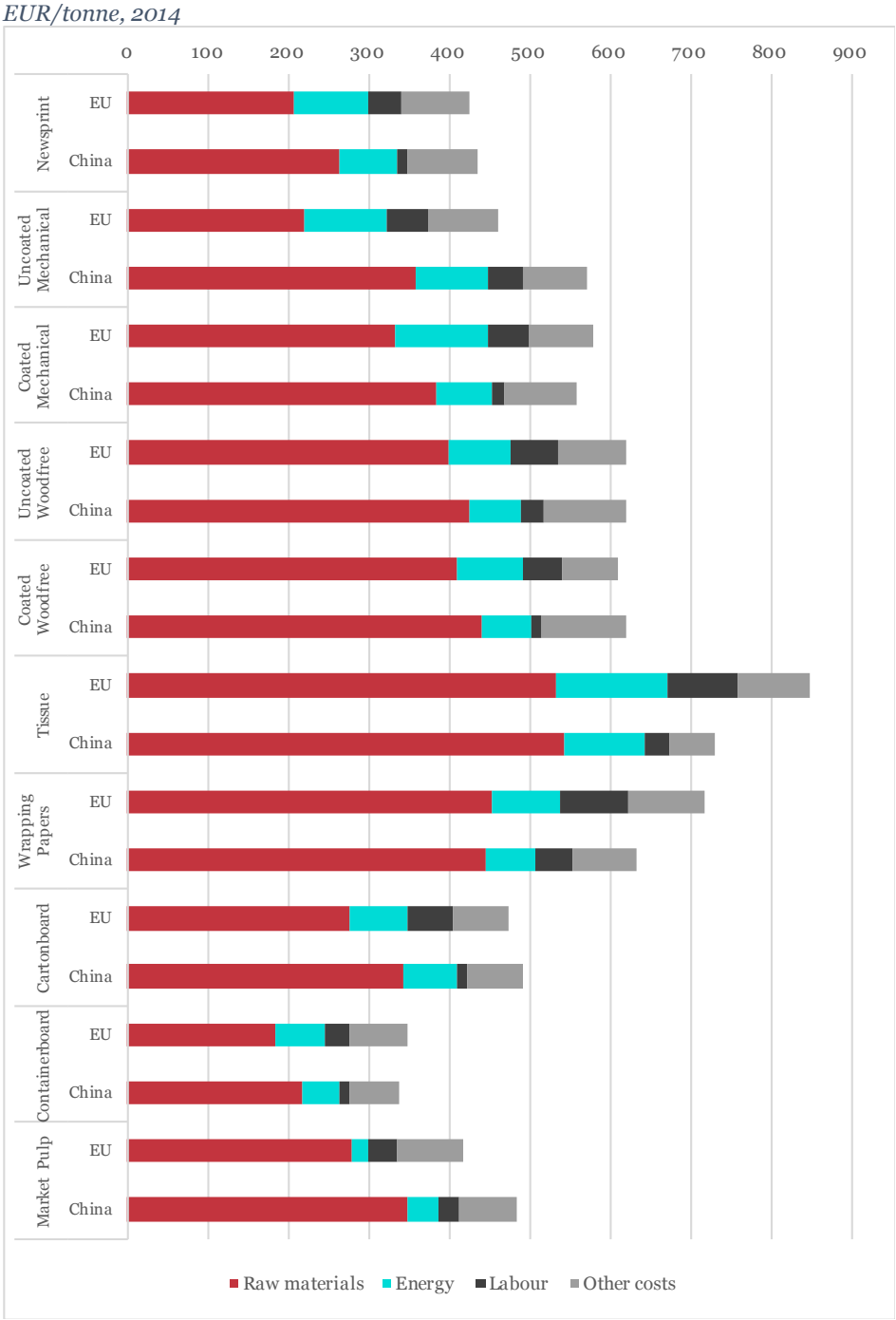
Figure 75 Cost structures in manufacturing of paper and paperboard, Europe vs. China, EUR/Tonne, 2014



Source: Authors' elaboration, based on RISI data

From the breakdown by product (Figure 76), it can be observed that raw materials (taken together and separately for wood) are cheaper in Europe than in China, for all pulp, paper and paperboard products (the highest difference is for uncoated mechanicals, where Europe is cheaper of 106 EUR/tonne than China). Nonetheless, the picture for energy, labour, capital and maintenance is overall more favourable to China; Europe is considerably more expensive for the almost all products (with differences averaging 18EUR/tonne for energy and 31EUR/tonne for labour). Only capital costs for three paper grades are lower in Europe than in China (coated mechanical, uncoated wood-free and coated wood-free).

Figure 76 Cost structure of inputs to the pulp, paper and paperboard sub-sector, Europe versus China, average EUR/tonne, 2014



Source: Authors' elaboration based on RISI data

6.3.3 *Policy framework*

6.3.3.1 Forest-related and Environmental Policy

The Forest Law was adopted in 1984 and came into force in 1985. Article 1 of the law mentions protection, nurture and rational utilization of forest resources and acceleration of the greening of China. Article 3 states that "The forest resources shall belong to the state, unless the law stipulates they belong to the collective. For the forests, trees and woodlands owned by the state and the collective and the trees and woodlands owned by private individuals, the people's government above the county level shall register and record them, issue certificates and confirm the ownership and the right to use". In

response to environmental disasters in the 1990s, the law was amended in 1998 with a view on shifting emphasis from wood production towards a more comprehensive sustainable management approach (Standing Committee of the National People's Congress, 1998). The new law focusses on increased public financing, enhanced authority of forest agencies, harmonised restoration, development, protection and use of forests and wildlife with the ultimate aim of achieving sustainable forestry development. Objectives of Chinese forest policy after 1998 included: 1) improving biodiversity conservation and securing national ecological safety; 2) restoration of key ecosystems; 3) promotion of sustainable forest management; 4) clarification of forest land tenure and securing farmers' rights in relation to forests, plantations and forest land management (as individual households can hold forest ownership titles) ; 5) promotion of a balanced forest industry development; 6) strengthening of international cooperation (Chen, 2010 in Yasmi et al., 2010). Domestic harvesting restrictions and a logging quota system have led to increasing roundwood imports, especially in softwood species (Indufor, 2013), mainly from Russia, New Zealand and the United States (Chinese Customs Statistics, 2015) which in theory should have an upward effect on wood prices.

The government has implemented six key forestry programmes to develop sustainable forest management in China: 1) The Natural Forest Protection Programme; 2) Conversion of Agricultural Land to Forests and Grasslands (Grain for Green); 3) Desertification Control; 4) Key Shelterbelts Programme); 5) Wildlife Conservation and Nature Reserve Development Programme; 6) Fast Growing and High Yield Forest Plantation Programme. Along with the development of the plantation area, there is an increased policy emphasis on the sustainability of forest management and on the other functions of forests apart from production of raw materials (FAO 2010).

As regards the forest-based industries, compared to the woodworking industry, the Chinese government has invested heavily in the development of the pulp, paper and paperboard industry. China is trying to expand its forest resources and reduce its reliance on imports of raw materials, and has reduced taxes on plantations and tariffs on imports of processing machinery. The central government and local governments have provided subsidies to establish new plantations. However, the growth of the paper and woodworking manufacturing industries has outstripped the growth of the forest area. This situation is unlikely to change in the near future (Haley and Haley, 2013).

In 2009 a plan on "revitalization of the Chinese forest industry" was published by five government agencies: the State Forest Administration (SFA), the National Development and Reform Commission (NDRC), the Ministry of Finance, the Ministry of Commerce and the State Tax Administration. The plan outlines support to 100 leading enterprises and 10 wood-industry clusters. The plan aims to raise the sector's output value from 1.4 trillion RMB (US$209.9 billion) in 2008 to 2.3 trillion RMB (US$329.4 billion) in 2012, and to maintain annual sector growth of around 12%. The agencies expect annual trade in wood products to exceed $US 90 billion and exports to exceed $US 50 billion (Haley and Haley, 2013).

China's Five-Year Plans are initiatives for social and economic development, triggering reforms and implementing targets in different fields, such as agriculture, climate, environment, innovation, etc. These plans are re-iterated every five years, updating priorities, measures and goals. Overall, targets for resource conservation and environmental protection are increasing drastically. Targets specific to forestry and forest-based industries relate to forest increase with indicators of forest coverage rate (rising from 20.36% in 2010, to 21.66% in 2015, and to 23% in 2020) and of increasing forest stock (from 137 m^3 in 2010 to 143 m^3 in 2015). Other important targets concern the decrease in water consumption per unit of value added from industrial output, the increase of non-fossil fuel usage in primary energy consumption, the decrease in energy consumption in general per unit of GDP, etc.

In this perspective, the 12th Five-Year Plan to Promote Paper-making Industry (the so-called "Circular") was issued and highlighted "tight output control, accelerated development of forestry-paper integration programme, upgrading of raw material structure, optimisation of product structure,

determination of controlling parameters for energy saving and emission reduction, improving of industrial cluster and the like[91]". This Plan anticipates the following tasks[92]:

- **Improve raw material structure, increase domestic supply** by heightening the proportion of wood fibre, advocating the recovery and reutilization of waste paper and realizing the scientific and rational utilisation of non-wood fibre;
- **Heighten innovation ability, enhance technical level** by: researching and developing the low consumption, less pollution, high quality, high efficiency pulp, paper and paperboard production technology, researching and developing the advanced suitable equipment with independent intellectual property, heightening the ability to make technical innovation, energetically push forward the integration of informatisation and industrialisation and optimising the human resource structure, build the high quality personnel team.
- **Optimise industrial layout, realize rational resource allocation;**
- **Push forward clean production, protect ecological environment** by: actively pushing forward energy saving and reduce consumption, realizing the high efficiency of resource utilisation, by disseminating the clean production technology, strengthening pollution control, by enhancing the consciousness of environmental protection, tightening supervision and control, by accelerating to eliminate outdated capacity, reducing production and decreasing drain and by attaching importance to the emission reduction of dioxin-persistent organic pollutants and ammonium nitrate.
- **Optimise corporate structure, promote merger and reorganisation** by fostering the backbone enterprises, by guiding small and medium-sized paper enterprises to develop in the direction of being professional, exquisite, special and new, and by regulating the business scale and structure;
- **Regulate product structure, improve product quality** by developing the light-weight, functional paper and paper board new products, by accelerate the upgrading and updating of low grade products, and by making great efforts in the development of environmentally friendly paper products.
- **Set up saving mode, advocate rational consumption**.

Table 54 presents a summary of forest-related and environmental policies for China, with their likely cost impact.

[91] Shandong Zhangqiu Daxing Paper-making Machinery Co (2013) http://en.sd-daxing.com/news_detail/newsId=1.html

[92] National Development and Reform Commission, Ministry of Industry and Information Technology, State Forestry Administration (2011), Twelfth Five-Year Development Plan of Paper Industry

Table 54 - Summary table of forest-related and environmental policies for China

Policy area	Policy name	Date	Notes	Cost area	Cost impact
Environment	Wildlife Conservation and Nature Reserve Development Programme		The WCNRDP targeted conservation of species and habitats. Between 2001 and 2006, 831 natural reserves were created and 19.5 million ha of forest and other sites were protected. By 2010, the number of reserves was predicted to reach 1800 (16% of the total land area) with 220 national nature reserves.	Cost/Availability of raw materials	↗
Forest-related	Forestry Law	1984	Enacted with a view to protecting, cultivating and rationally exploiting forest resources, accelerating territorial afforestation and making use of forests in water storage and soil conservation, climate regulation, environmental improvement and supply of forest products to meet the requirements of socialist construction and people's livelihood.	Cost/Availability of raw materials	↘
	The Natural Forest Protection Programme	1998	Affecting logging restrictions, protected areas, replanting, and a range of other policies aimed at protecting China's forests and reducing the risk of erosion and flooding	Cost/Availability of raw materials	**?**
	Conversion of Agricultural Land to Forests and Grasslands (Grain for Green)	1999	Initiated in 1999 in order to combat deforestation, ecological degradation and soil erosion resulting from over-cultivation. At the 16th Party Congress in 2002, the GFG programme was expanded to a nation-wide programme. Some 151.36 billion yuan was committed to the programme. The grain-for-green policy aimed to move 15 million ha of low-yield farmland to forest and to afforest another 17 million ha of barren land. The programme was suspended in 2007. By 2008, 8.2 million ha of cropland had been converted to forest through the programme.	Cost/Availability of raw materials	↘
	China National Action Programme To Combat Desertification	1994-	China signed UN Convention to Combat Desertification in 1994 and ratified the convention in 1997. The first national action programme was published in 1996. An update was issued in 2005. The long-term objective (-2050) is to establish 34 million ha of forest and grassland, 1.8 million ha of forest shelterbelts, enclose a further 19 million ha of desert to enable regeneration of forest and grassland.	Cost/Availability of raw materials	↘
	Key Shelterbelts Programme	1978	The program was planned initially for the period (1978-2050) in 8 phases. The total planned investment was 7.68 billion yuan and 35.08 million ha of afforestation was planned. By the end of 2008, a total 24.47 million ha afforestation had been conserved by the program	Cost/Availability of raw materials	↘

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

6.3.3.2 Trade policy

Forest product related trade policy in China is significantly influenced by the issue of legality verification for the wood raw materials, as required in key export markets such as the USA and the EU. It is estimated that about 17% of the volume of China's wood-based imports are at high-risk of illegality (Wellesley, 2014). However, this proportion has decreased significantly since 2000 as China has made progress in its efforts to tackle the illegal trade in wood products. These efforts have included development of a draft national wood legality verification system and active engagement with producer and consumer countries.

In order to meet the new requirements set by the Lacey Act Amendment and the EU Timber Regulation, China is in the process of implementing the China Timber Legality Verification Scheme (CTLVS) (Jonson et al., 2015). The CTLVS is based on China's domestic wood management and control system, which includes a forest harvesting permit, a wood shipment permit, and a wood processing permit. Under CTLVS, Chinese-authorised organisations issue wood legality certificates.

However, there are still many challenges to be overcome in the progress of implementing the scheme (Jonson et al., 2015). The wood enterprises in China have two functionally different options to ensure the legal sources of their raw materials: 1) they can use FM (Forest Management) certified wood, otherwise; and 2) they can use the verified legal wood. The wood enterprises have two functionally different options to ensure the traceability along their supply chain: 1) they can apply the Chain-of-Custody (CoC) certification for forest enterprises; or 2) they can provide an all-conditioned traceability system along their production and marketing processes (Zeng et al., 2012). Zeng et al. (2012) cite Rametsteiner and Simula (2003) in arguing that FM certification is a more rigorous process than legality verification.

The average duty imposed on imports of wood and paper products from countries with most-favoured-nation (MFN) status was 4.3% (range up to 20%) (WTO, 2016).

The EU is the biggest trading partner for China, and China is the second biggest trading partner for the EU (after the United States). Negotiations concerning an EU-China investment agreement were launched in January 2014 with the aim of ensuring that markets are open to investment in both directions. In January 2016 the EU and China agreed that the "future deal should improve market access opportunities for their investors by establishing a genuine right to invest and by guaranteeing that they will not discriminate against their respective companies."

Table 55 presents a summary of trade-related for China, with their likely cost impact.

Table 55 - Summary table of trade-related policies for China

Policy area	Policy name	Date	Notes	Cost area	Cost impact
Trade	China Timber Legality Verification Scheme (CTLVS)	n.a.	In order to meet the new requirements set by the Lacey Act Amendment and the EU Timber Regulation, China is in the process of implementing the China Timber Legality Verification Scheme (CTLVS)	Cost/Availability of raw materials	↗
Trade	EU-China bilateral talks on investment	January 2016	Negotiations on-going to improve and create level bilateral market access opportunities for investors	Access to capital and goods	↘

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

6.3.3.3 Third party certification

In the private sector of forest ownership (see above)[93], a rapid growth in third-party certification occurred in the last decades. The Chinese Forest Certification Scheme was launched in 2010 and is endorsed by PEFC. The latest figures from PEFC state there are 255 Chain of Custody certificates and a

[93] 7th NFI (2004-2008) states that 32.1% of all forests and 37.4% of timber forests are owned by individuals. (State Forestry Administration, 2014). This has increased since the 6th NFI (1999-2003).

certified forest area of 5.6 million ha (PEFC, 2015). The latest figures from FSC state that there are 4157 Chain of Custody certificates and a certified forest area of 1.2 million ha (66 certificates) (FSC International, 2016).

6.3.3.4 Analysis of the likely cost impacts of national and EU legislation

China's huge investments in pulp, paper and paperboard production has created market disturbances at the global level for pulp, paper and paperboard, and also wood and recovered paper (CEPI, 2016).

One expert mentioned that in general for the forest-based sector, the most significant pieces of domestic legislation affecting costs were generally those concerning chemical emissions and the environment. Another consultant, representing the woodworking sector, commented that costs had increased to compliance with domestic environmental legislation and domestic labour legislation. The consultant remarked that the EU sets higher environmental and chemical requirements compared with selling to domestic markets, and therefore the costs of placing products onto European markets are higher. Another expert, answering from the point of view of the 'builders' carpentry and joinery sub-sector', stated that EU legislation was "definitely harder [to comply with than domestic legislation] due to 1) complexity of many furniture and flooring products; 2) the growth of markets within Asia for furniture and flooring, which have no similar legislation; 3) many SMEs operating in the sector with limited resources for comprehensively [addressing] the EU regulations." This implies higher costs for producers wanting to export to the EU market, but this does not mean that products placed on the domestic market are of a higher quality. However, of course one could consider that theoretically the producers have the option to diversify their product range for the domestic market with lower and higher grade products.

Legality verification and laws against illegal logging and trade are largely depicted as the foreign legislation with the highest impact on the production costs of Chinese companies. This holds particularly true for the stringent forest legality requirements by instruments such as the EU Timber Regulation and the US Lacey Act (2008) Amendment. These were expected to have a big impact on particularly export-oriented Chinese enterprises (Zeng et al., 2012), which has recently been confirmed by Xu et al. (2014) who surveyed Chinese wood-processing businesses via a questionnaire handed out to 210 companies and interviews and visits to 10 wood-processing businesses. Over two-thirds of questionnaire respondents (74 businesses responded) indicated that the impact of international demand for legal forest products had a great impact on Chinese trade in forest products, and 31% indicated a great impact on their own business. One expert commented that the EUTR was the most significant piece of EU legislation resulting in increased costs of production, but that the EUTR was not more administratively burdensome than US Lacey requirements.

For the two options to tackle legality issues (CoC certification versus all-conditioned traceability system), cost estimates are as follows: 1) when an enterprise only employs the forest certification measures, i.e. the FM certified wood plus the CoC certification, implementation of this higher standard will bring about a rise by 3 – 24% in the product costs; 2) when it applies the verified legal wood and an all-conditioned self-run traceability system, the cost increase can be controlled below 6%. However, the increased product costs are inevitable, whatever measures the enterprises adopt.

The experts commented that domestic and foreign legislation (relating to wood legality and environment) has meant that companies have to invest in more modern and cleaner operations in order to reduce (e.g. air and water) pollution. In the short-term, this may decrease the competitiveness of Chinese companies, but in the long-term the requirements will result in more modern and more sustainable business.

The combination of the saturation of domestic markets together with an overall expansion of the pulp, paper and paperboard industries in China have resulted in overcapacity in the sector, hence increasing exports of paper products from China. Moreover, being a country with very few forestry resources despite being the fastest-growing paper industry, China imports a significant part of its raw materials at world prices. In order to reduce the dependency on imported raw materials, the Chinese government provides subsidies and loans to support the industry's expansion. In this perspective, a

paper from the Economic Policy Institute from 2010 estimates that the subsidies between 2002 and 2009 in the paper industry has reached $33.1b, that can be broken down as follows[94]:

- Subsidies for electricity: $778m from 2002 to 2009;
- Subsidies for coal: $3b from 2002 to 2009;
- Subsidies for pulp: $25b from 2004 to 2009;
- Subsidies for recycled paper: $1.7b from 2004 to 2008[95];
- Subsidy income: $442m from 2002 to 2009;
- Loan-interest subsidies: $2b from 2002 to 2009.

Such subsidies have been provided by both central and local governments and aim to "*develop fast-growing, high-yield plantations; reduce taxes and fees on plantations to stimulate investment; reduce tariff s on imports of processing machinery; promote exports of wood and paper products through value-added tax (VAT) rebates; provide loans and loan-interest subsidies for technology renovation; promote foreign investment in state-owned enterprises (SOEs); and protect debt-ridden SOEs and small local companies with excess-production capacity through local governments' soft loans, subsidies, and loan*[96]".

Subsidies are one of the reasons for which, under the Chinese WTO Accession Protocol, China can be considered as a non-market economy in anti-dumping procedures. Its overcapacity in various industries has hence led to dumping and flood of imports on foreign markets. Provided that China is involved in the highest number of anti-dumping investigations, the obtaining the Market Economy Status has been an essential objective for China. Some countries have already granted the Market Economy Status to China; however, only two countries having major anti-dumping proceedings are among those, namely Australia and South Africa. On the other hand, the EU, the US, Canada, Japan, Mexico and India have not recognised China as a Market Economy. China's status of Non-Market Economy expires after 11 December 2016, date after which there will be a legal obligation to grant the Market Economy Status to China.

6.4 Country overview: USA

6.4.1 General description of the forest-based sector

6.4.1.1 Forest resources profile

The United States of America has about 310.1 million ha forest land (33.8% of the land area in 2015). The forest area is relatively stable, increasing from 302.4 million ha in 1990 (FAO, 2015). 37% of the forest land is owned publicly[97] and the remaining 63% of the forest land is owned privately[98](Butler, Hewes et al., 2014). The ownership pattern in the western United States differs significantly from other regions. In the western United States, 66% of the forests are publicly[99] owned, 22% are owned by industrial producers, and 11% by private non-industrial owners, whereas in the southern United States, 70% of land is owned by private non-industrial owners, 20% by industrial/institutional owners and 10% is publicly owned (Sun and Ning, 2014).

[94] The Briefing Paper considers these numbers are conservative estimates as only subsicides that were traced, recorded and confirmed were included in the calculations.

[95] Missing data for 2002, 2003 and 2009.

[96] Economic Policy Institute (2010), NO PAPER TIGER: Subsidies to China's Paper Industry from 2002-09, EPI Briefing Paper #264

[97] 28% of total forest is in federal ownership, 7% in state ownership and 2% in local ownership (county or municipal)

[98] Families, trusts and estates own 43% of the total US forest area, 16% is in corporate ownership and 4% is in other forms of private ownership

[99] In the US this is land administered by federal, state, county or municipal entities (FAO, FRA2010)

The total growing stock (o.b.) on forest in 2015 is 40.7 billion m^3 and has increased by 423.4 million m^3/yr over the period 2010-2015, and by 299 million m^3/yr over the period 1990-2015 (FAO FRA, 2015). The National Report on Sustainable Forests 2010 (published in 2011) reported that the growing stock on "timber lands" i.e. land available for and capable of wood supply is 932 billion cubic feet (~26.4 billion m^3) and has increased by more than 50% since the 1950s. This increase has occurred in all regions with the exceptions of the Pacific Coast and Alaska in the 1970s and 1980s, when harvesting of large wood as well as the transfer of high-volume wood land to reserves resulted in declines (USDA Forest Service, 2011).

6.4.1.2 Sectoral structure

The US forest-based sector shows many similarities to the European forest sector. For example, both regions have experienced a similar decline in the demand and production of wood pulp (as well as certain categories of paper) during the last decade, which is as in Europe primarily linked to a similar decline in demand for newsprint, printing and writing paper, etc. (UNECE/FAO, 2012). However, overall wood demand in Europe has been bolstered by sustained demand for wood-based panels and, above all, bio-energy.

Employment in the forest-related segment of the US economy (forestry and logging, wood and paper manufacturing, furniture manufacturing and wood-related construction) comprise over 2.5 million jobs, of which only 50 000 are in the forestry and logging segment. The broader "forest-related" category comprises 4-6% of US GDP (FAO, 2015).

In terms of employment, the North American forest-based sector has, as in Europe, seen static or falling employment levels in both sawnwood and wood products, as well as in paper and paper-based products. Labour productivity in the wood products and paper manufacturing industries in the United States is amongst the highest in the world (FAO, 2014). In the US and Europe, labour productivity has been generated mainly by closing small and not efficient mills[100], or through employment cuts. Continued improvements in labour productivity, with modest output growth or no output growth in the country imply that, employment would only grow slightly or continue to decline (UNECE/FAO, 2012).

Table 57 presents the number and size of businesses (by number of employees) in 2012 for: 1) the wood products manufacturing industry (NAICS[101] 321); and 2) the paper manufacturing industry (NAICS 322) (US Census Bureau, 2016). The data from the US Census Bureau differ significantly, both in absolute and relative terms, from the data published by Euromonitor International for the ISIC Division 20 (manufacture of wood and of products of wood and cork; ISIC Rev. 3) for the United States for the period 2007-2012 (Euromonitor International, 2012). Most of the four-digit NAICS codes for the NAICS 321 subsector are contained within ISIC Division 20 of the International Standard Industrial Classification of all Economic Activities (ISIC, Revision 3) of the United Nations (NTIS, 1995). The definitional differences in the ISIC and NAICS classifications are relatively small and cannot explain the substantial differences in the data.

[100] Indufor, 2013, Op. CIt.

[101] NAICS: North American Industry Classification System. For more info, visit: http://www.census.gov/eos/www/naics/

Table 56 Average monthly employment for the wood products manufacturing and paper manufacturing sectors in the US (2006-2015)

	Average monthly employment (thousands FTE)									
	2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Wood products manufacturing	560,7	517,0	457,8	360,4	341,9	336,8	339,2	353,4	371,8	379,6
Paper manufacturing	470,5	458,1	444,9	407,0	394,5	387,2	379,9	378,1	373,5	372,6

Source: US BLS 2015b

Table 57 Number and size of US businesses in wood products and paper manufacturing sub-sectors in 2012

	Size of business (number of employees)									
Sector	1-4	5-9	10-19	20-49	50-99	100-249	250-499	500-999	≥1000	Total
Sawmills and wood preservation	1172	642	561	540	258	159	15	0	0	3347
Veneer, plywood, and engineered wood product manufacturing	289	239	266	328	151	135	30	5	0	1443
Other wood product manufacturing	3295	1669	1558	1437	573	336	53	8	4	8933
Total wood products manufacturing (NAICS321)	4756	2550	2385	2305	982	630	98	13	4	13723
Pulp, paper, and paperboard mills	38	18	22	49	69	101	85	54	12	448
Converted paper product manufacturing (1)	601	388	546	937	703	715	100	24	3	4017
Total Paper manufacturing (NAICS322)	639	406	568	986	772	816	185	78	15	4465

(1): This category is not included in the comparison with the EU. Source: US Census Bureau, 2016

Between 2005 and 2009, 218 677 jobs were lost in wood products manufacturing (NAICS 321) and 89 507 jobs were lost in paper manufacturing (NAICS 322) according to Woodall et al. (2011). Employment in the wood manufacturing sector (NAICS321) peaked in January-March 2006 at about 574 000 and declined to 332 000 in July 2011, after which there has been a slight recovering to about 385 000 at the end of 2015 (US BLS, 2015a).

Employment in the paper manufacturing sector (NAICS322) has been in decline since 2005 when the sector employed more than 490 000 people. There was a sharp decline in employment in the sector in 2008-2009 after which the decline has continued but at a slower rate. At the end of 2015 employment in the sector was about 373 000 (Table 56) (US BLS, 2015b).

Table 58 Woodworking sector – Number of companies by employment size 2007-2012

Number of companies	2007	2008	2009	2010	2011	2012
micro (1-9 employees)	12,153	12,060	11,681	11,395	11,108	10,814
extra small (10-19 employees)	3,234	3,217	2,946	2,893	2,783	2,795
small (20-99 employees)	3,587	3,491	2,873	2,823	2,700	2,692
medium (100-499 employees)	882	834	687	677	652	647
large (500+ employees)	409	398	329	325	314	314
Total	20,265	20,000	18,516	18,113	17,557	17,262

Source: Euromonitor International 2012

6.4.1.3 Production, trade and consumption

In 2014, the United States was the world's largest consumer of industrial roundwood, accounting for 19% (343.8 million m3) of the global consumption, and 25% (45.4 million tonnes) of pulp for paper consumption. It was also the second largest consumer of sawnwood (21%; 90.1 million m3),), wood-based panels (11%; 41.4 million m3), recovered paper (13%; 28.1 million tonnes), and paper and paperboard (18%; 71.1 million). [102] In addition to this, the United States is also the world's largest producer of industrial roundwood (19%; 356.8 million m3), sawnwood (17%; 74.8 million m3) and pulp for paper (26%; 45.4 million tonnes) and the second largest producer of wood-based panels (9%; 34.0 million m3), recovered paper (21%; 46.4 million tonnes) and paper and paperboard (18%; 73.1 million tonnes).

In 1961 the total production of industrial roundwood in the United States was 248 million m3. There was a long-term increase to 1989, after which production was relatively stable (at above 400 million m3) until 2005. There was a sharp decline in production from 2005 to 2009 (to slightly more than 300 million m3). This pattern since 1989 has followed the trends in the US housing market (UNECE/FAO, 2012). Since 2009 there has been an increase, and in 2011 total production of industrial roundwood was 335 million m3. There has been also been a long-term, structural reduction in paper consumption. To some extent, wood consumption may be increased in the near future – though still below historical peaks, due to wood pellet exports and possibly in the long term by their domestic consumption for bio-energy. In addition to being a major player on the global arena, the United States also has one of the world's largest bilateral trade flows (with Canada) in forest products. Also, in terms of competitiveness, the recent FAO outlook study (using revealed comparative advantage (RCA)[103] ratios) suggests that the United States will increasingly become a net importer (UNECE/FAO, 2012).

Table 59, based on FAOSTAT data, gives an overview of the production and trade for sawmilling, wood-based panels, furniture sectors as well as for wood pulp, paper and paperboard.

[102] Apparent consumption is the production (or removals) plus imports minus exports.

[103] RCA index is the ratio of a country's (region's) value of net exports to the value of a country's (region's) total domestic production at local prices (UNECE NAFSOS, 2011)

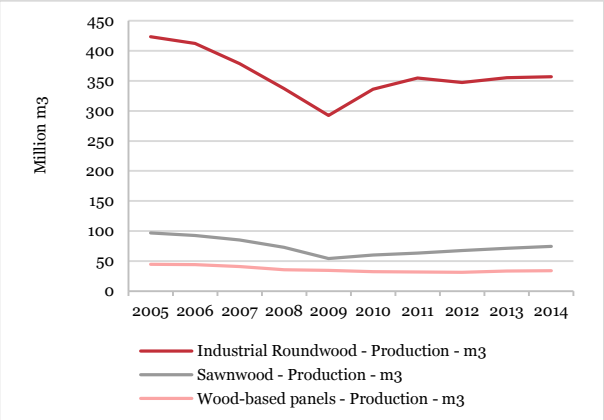
Table 59 Overview of the USA F-BI production and trade in 2014

- Sawnwood: In 2014, the United States produced 74.8 million $m^3$of sawnwood. Imports of sawnwood were worth $US 5.7 billion (22.2 million m^3) and exports $US 3.5 billion (6.9 million m^3) (FAOSTAT, 2015).
- Wood-based panels: In 2014, the United States produced 34 million m^3 of wood-based panels; imports were worth $US 5.2 billion (9.6 million m^3) and exports were worth $US 1.2 billion (2.3 million m^3) (FAOSTAT, 2015).
- Furniture: US imports of furniture were worth $55.8 billion and exports were worth $US11.8 billion, in 2014.
- Wood pulp: the United States produced about 47.8 million tonnes of wood pulp in 2014; imports were worth $US 3.6 billion (5.8 million tonnes), and exports were worth $US 5.8 billion (7.9 million tonnes) (FAOSTAT, 2015).
- Paper: the United States produced about 73.1 million tonnes of paper in 2014; its imports were worth $US 9.7 billion (10 million tonnes) and exports were worth $US 10.1 billion (12.1 million tonnes) (FAOSTAT, 2015).Printing: In 2014, US imports of printed materials were worth $US 4.4 billion and exports were worth $5.2 billion.

Source: production and trade for wood and pulp, paper and paperboard products – FAOSTAT 2015; trade for furniture and printing – ITC 2015.

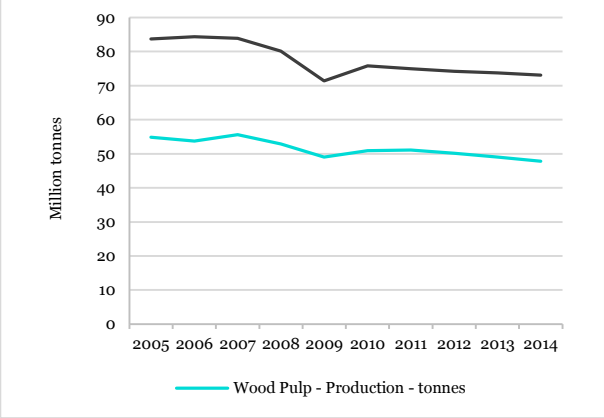
Figure 77 to Figure 84 present the evolution of the production quantity, and trade (value and quantity) of wood and pulp, paper and paperboard products for the United States for the period 2005-2014

Figure 77 Production of wood products – United States



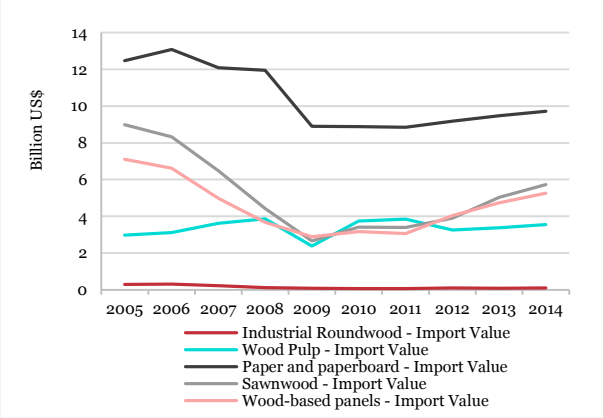
Source: FAOSTAT, 2015

Figure 78 Production of pulp, paper and paperboard products – United States



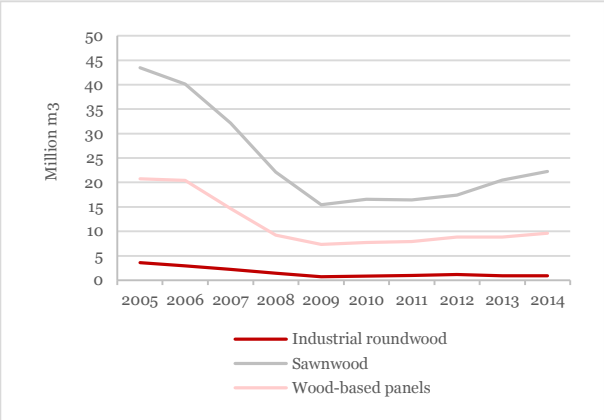
Source: FAOSTAT, 2015

Figure 79 Imports of wood and paper products – United States [currency in US$ as international reporting standard]



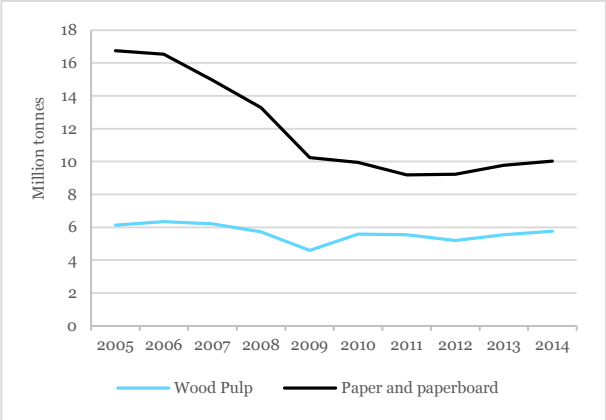
Source: FAOSTAT, 2015

Figure 80 Import quantity of wood products – United States



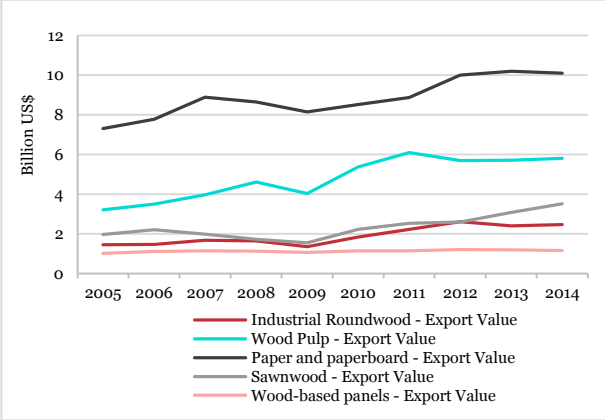
Source: FAOSTAT, 2015

Figure 81 Import quantity of paper products – United States



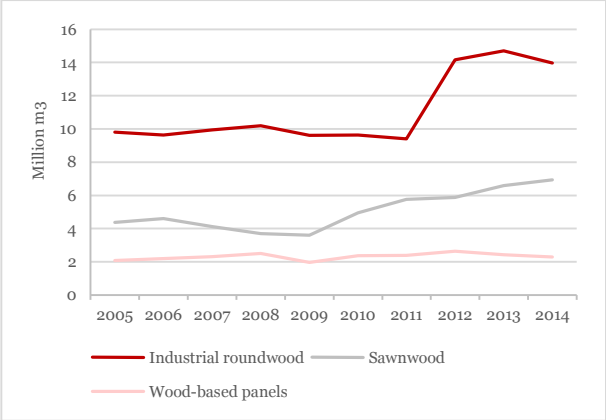
Source: FAOSTAT, 2015

Figure 82 Exports of wood and paper products – United States [currency in US$ as international reporting standard]



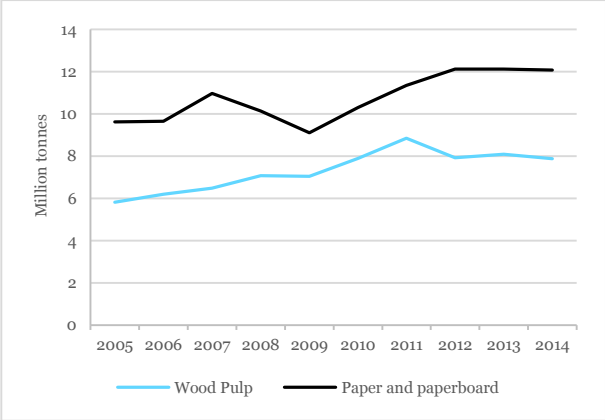
Source: FAOSTAT, 2015

Figure 83 Export quantity of wood products – United States



Source: FAOSTAT, 2015

Figure 84 Export quantity of paper products – United States



Source: FAOSTAT, 2015

When presented with this larger picture, it is clear that the United States, as both producer and consumer of forest-based products, is a main competitor to Europe. However, principally, the interest in this case is that the country competes to some extent in the EU market and also for the same third-country markets as do EU exporters (e.g., increased demand for lumber in China), not necessarily as competitors on their own respective markets.

The US forest sector has experienced a major downturn in the last decade with production and consumption of roundwood, sawnwood, wood-based panels, wood pulp, paper and paperboard and paperboard all experiencing a decline in the period 2005-2014. This was due to long-term trends compounded by the impact of the sub-prime mortgage crisis from 2008, which drastically reduced sawnwood and panels consumption in the short term. The ensuing financial and economic crises keep housebuilding low and caused a temporary low point in the long-term decline of paper consumption. The sector had lagged behind growth in other sectors before the crises. Globalisation of manufacturing and increasing use of electronic media have contributed to the decline in the US pulp, paper and paperboard production, and the collapse of the construction industry after 2007 and off-shoring of furniture production have contributed to the decline in US wood-products production (Woodall et al.,

2011). Increased use of on-line shopping has however boosted consumption of some paper packaging grades. The housing and construction industry has shown a recovery since 2011 and there are signs of partial recovery and stabilisation for the forest products sector, albeit at lower levels than before the crises. (Howard and McKeever, 2015).

The North American Forest Sector Outlook Study (UNECE/FAO, 2012) projected that sawnwood production will continue its recent upward growth trend in the United States, for example in innovative construction products, such as glued-laminated (glu-lam) beams and cross-laminated timber (CLT). In wood-based panels, rates of production were projected to continue gently rising, reflecting continuing demand for products (for example, structural wood panels in other engineered wood products (EWP) such as I-beams) that can partially substitute for solid lumber in some building applications like flooring and ceilings, especially in the United States.

The pulp, paper and paperboard sector faces rapid changes: new production capacity outside the United States and Canada, rapidly rising consumption in Asia, declining uses of newsprint and printing and writing paper in communications, and continued growth in the use of recycled fibre in manufacture (UNECE/FAO, 2012). The net effect of these changes is to keep the US wood pulp production from recovering much from the recently low levels (UNECE/FAO, 2012).

6.4.2 Production cost structures of the selected F-BI sub-sectors

6.4.2.1 Production cost structure in the woodworking sub-sector

In 2012, raw materials (7%) plus intermediate wood and wood products (28.3%) accounted for 35.3% of total costs (the least of the three countries selected for the international comparison) (Table 60). Labour costs accounted for 22% of total costs, which was the highest of the three countries selected for the international comparison. Labour costs have remained relatively stable increasing from $US 23.95 per hour in 2008 to $US 25.1 per hour in 2013 (The Conference Board, 2014), despite the number of people employed falling by about 34% in this period (Euromonitor International, 2012). Transport costs, energy costs, and other costs (taxes, financial services, consultancy) accounted for 4.1%, 10.2% and 11.8% of total costs, respectively.

During the period 2008-2012, manufacturers have cut expenses significantly in all cost categories except for refined petroleum products (Euromonitor International, 2012).

Table 60 Cost structure for the woodworking sub-sector in the United States in 2012 (see Table 42 for an explanation of the categories)

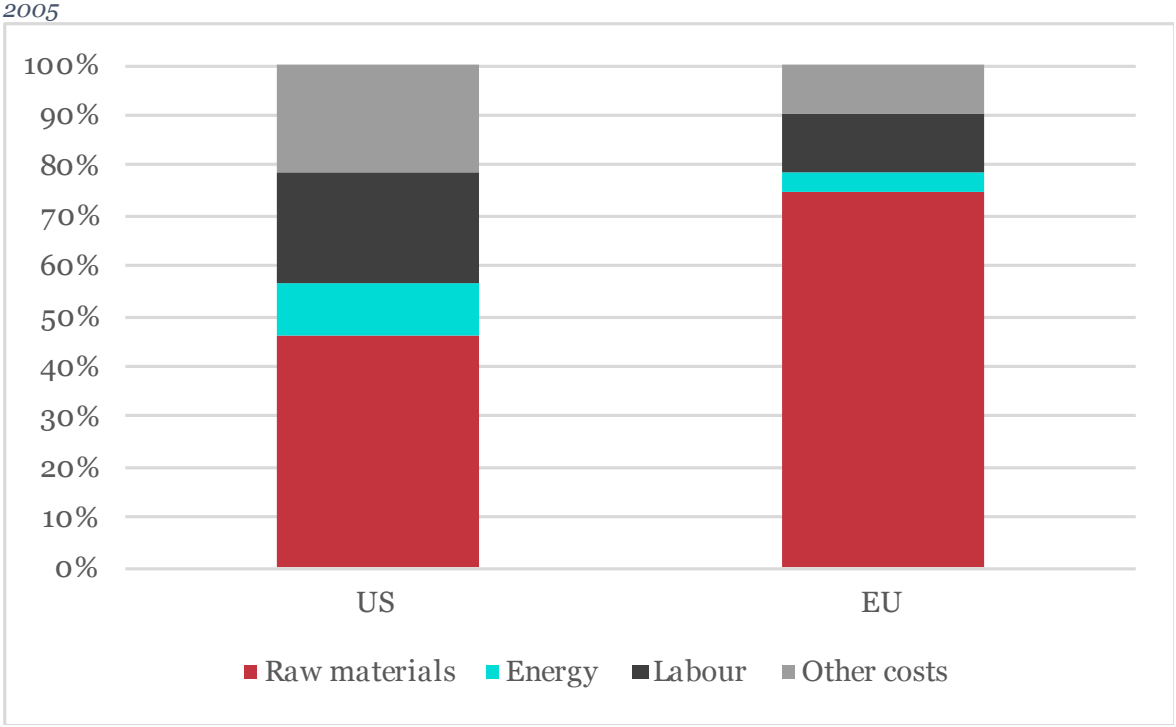
Main cost category	Cost sub-category	Cost items	$US million	€ million[104]	%
Raw materials and processed materials	Raw material	Forestry (wood mainly)	5441	4235	7.0%
		Other	355	276	
	Intermediate materials	Wood and wood products	23502	18292	39.2%
		Plastics	1248	971	
		Plastic in primary forms and synthetic rubber	816	635	
		Other intermediate	7001	5449	
Capital costs		Tools and general hardware	551	429	4.6%
		Other durable goods	3247	2527	
		Clothing	248	193	0.8%
		Other non-durable goods	428	333	
Labour			18279	14227	22.0%
Transport and logistics		Road, passenger and freight transport	2123	1652	4.4%
		Other transport and communication	1551	1207	
Energy		Refined petroleum products	5523	4299	10.2%
		Other (including utilities and recycling)	2913	2267	
Other costs	Services (part of OPEX)	Business and management consultancies	1599	1245	11.6%
		Monetary intermediation	1136	884	
		Other	6897	5368	
	Taxes less subsidies	Taxes less subsidies	188	146	0.2%

Source: Euromonitor International (Reference and publication year: 2012)

The following figure allows to compare cost structures from US and EU, in relative terms:

[104] $US to € currency conversion based on the European Central Bank reference exchange rate for 2012.

Figure 85 Cost structures for the woodworking sub-sector US and EU in relative terms, as % of production costs, 2005



Source: Eurmonitor International 2012 for US and ToSIA data, 2005 for EU.

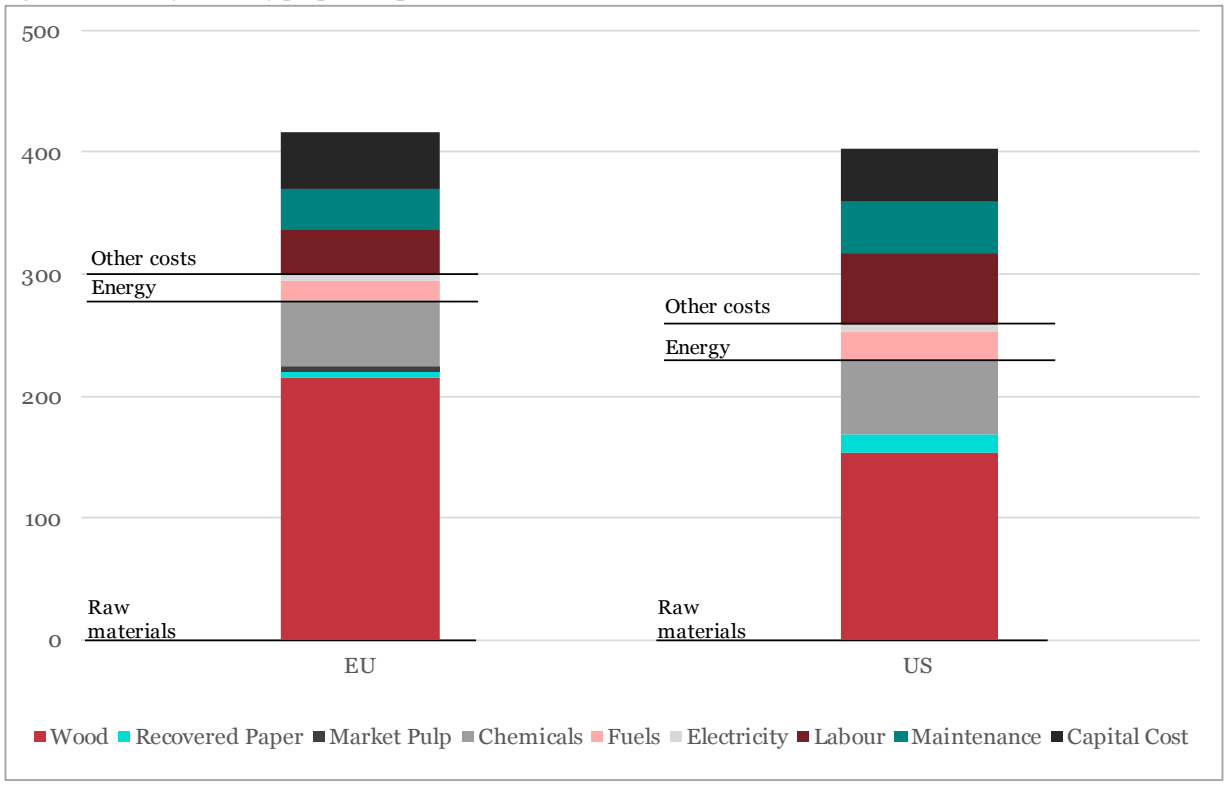
6.4.2.2 Comparison of the EU and US production cost structures in the pulp, paper and paperboard sub-sector

As can be seen from Figure 86 and Figure 87 below, the manufacturing costs for the production of pulp are similar, but slightly higher in Europe than in the US, the production costs for the making of paper and paperboard are notably higher in Europe than in the US (a positive difference of 85 EUR/Tonne).

A more detailed look at Figure 86, displaying the cost structure for the manufacture of pulp, suggests that the most marked difference between Europe and the US are higher raw material costs for wood. This statistic is only partially counterbalanced by lower European costs for another raw material, recovered paper, and labour.

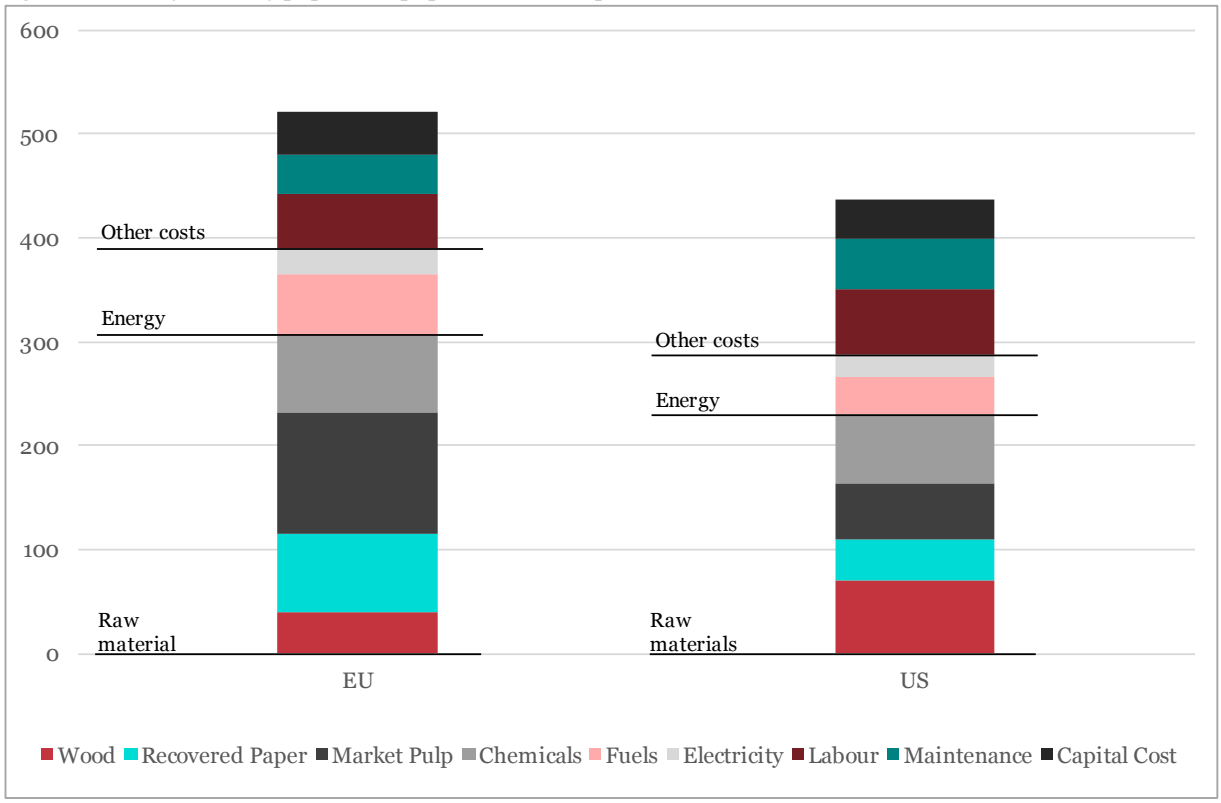
Conversely to the picture for pulp-making, wood costs for paper and paperboard making are higher in the US than in Europe, however, higher costs for recovered paper, market pulp and chemicals makes up for higher total costs for papermaking in Europe than in the US. Focusing on the production of paper, also energy components (electricity and fuels) are cheaper in the US than in Europe: electricity costs in Europe were always higher than in the US in the period 2005-2013. However, since 2009, the prices started to progressively converge, to invert the trend between 2013 and 2014, and set higher in the US for the last available year (2014), Europe at 276 EUR/Tonne, and the US at 316 EUR/Tonne. In the period 2008-2014, on the other hand, prices for fuels were steadily higher in Europe than in the US.

Figure 86 Manufacture of pulp, Europe vs. US, EUR/tonne, 2014



Source: Authors' elaboration based on RISI data

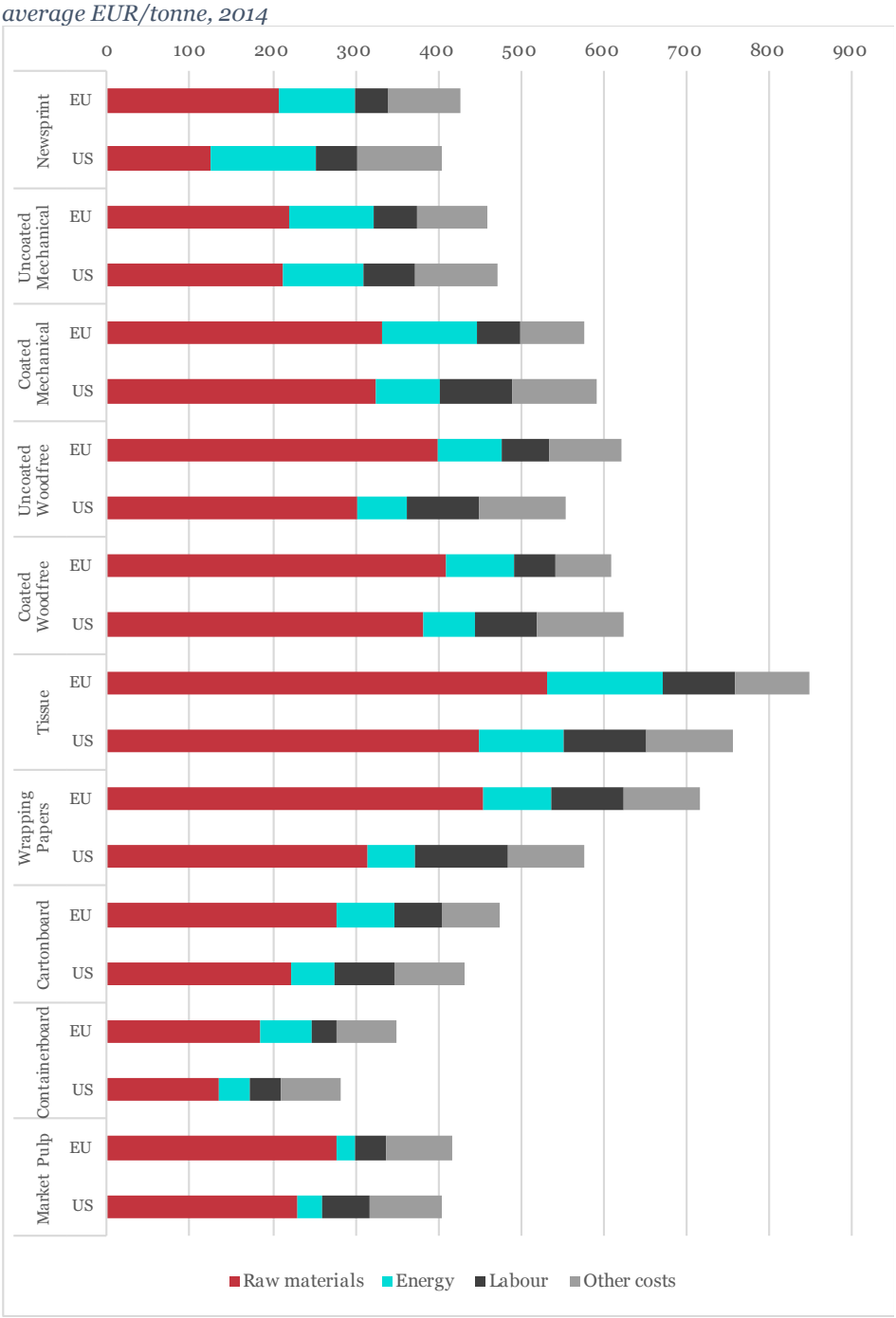
Figure 87 Manufacture of paper and paperboard, Europe vs. US, EUR/tonne, 2014



Source: Authors' elaboration based on RISI data

The view of the cost structure by cost category and products indicates that Europe bears a consistently higher cost for energy (differences in the ranges of 5 to 38 EUR/tonne), for all products except newsprint paper (34 EUR/tonne cheaper in Europe) and market pulp (8 EUR/tonne cheaper). In terms of labour, capital and maintenance costs, manufacturing costs in Europe are always lower than in the US (differences in the order of 1 to 37 EUR/tonne).

Figure 88 Cost structure of inputs to pulp, paper and paperboard sector by product, Europe versus the US, average EUR/tonne, 2014



Source: Authors' elaboration based on RISI data

6.4.3 *Policy framework*

6.4.3.1 Forest-related and environmental policy

Much US forest policy is regulated by a series of forest and environmental laws that, to a significant degree, originate from the era of rising environmentalism (and a related intend to either institutionalise or control this new movement) in the 1970s. The Endangered Species Act (1973)

requires protection of endangered species and habitats. The National Forest Management Act (1976) also requires that National Forests (protected and managed federal forest land) are managed in a way that gives due consideration to forest ecosystem services other than wood production. It is important to note that besides federal laws, also states issue their own legislation, which may have more significance for forest management and forest industries.

An important series of environmental acts and amendments for the United States is the Clean Air Act. The CAA of 1970 initiated four important regulatory programmes: the National Ambient Air Quality Standards (NAAQS); State Implementation Plans (SIPS; state plans to comply with the CAA); New Source Performance Standards (NSPS); and National Emission Standards for Hazardous Air Pollutants (NESHAPs). The NAAQS establish standards designed to protect human health for major air pollutants. NESHAPS are emissions standards for air pollutants not covered by NAAQS. In 1990, the CAA was extended to cover a much wider range of pollutants. Pollution and disposal of waste is also regulated by other legislation: the Clean Water Act (1972) covers pollution control in streams, rivers, lakes and oceans; and the Safe Drinking Water Act (1974), the Resource Conservation and Recovery Act (1976) and the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund - 1980) cover contamination of groundwater. Broadly these acts match with requirements from EU legislation that EU-based forest industries have to comply with (see section 4.4 in this report: "Package 3: Environment legislation"), with stringent requirements on air, water, soil and groundwater pollution, waste management, resource use, resource protection and management restrictions. Costs implied by these legislations could not be comprehensively quantified, however compliance costs are highly significant.

Table 61 presents a summary of forest-related and environmental policies for the United States, with their likely cost impact.

Table 61 - Summary table of forest-related and environmental policies for the United States

Policy area	Policy name	Date	Notes	Cost area	Cost implication
Environment	Endangered Species Act	1973	protection of endangered species and habitats	Cost/Availability of raw material	↗
	Clean Air Act	1970 -	The CAA of 1970 initiated four important regulatory programmes: the National Ambient Air Quality Standards (NAAQS); State Implementation Plans (SIPS); New Source Performance Standards (NSPS); and National Emission Standards for Hazardous Air Pollutants (NESHAPs)	Capital and Operational costs	↗
	Clean Water Act	1972	Affecting disposal of waste products	Capital and Operational costs	↗
	Safe Drinking Water Act	1974	Affecting disposal of waste products	Capital and Operational costs	↗
	Resource Conservation and Recovery Act	1976	Affecting disposal of waste products	Capital and Operational costs	↗
	Comprehensive Environmental Response, Compensation, and Liability Act	1980	Affecting disposal of waste products	Capital and Operational costs	↗
Forest-related	National Forest Management Act	1976	NFMA requires that publicly owned (federal and state) forests are managed in a way that gives due consideration to forest ecosystem services other than wood production	Cost/Availability of raw material	↗

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

6.4.3.2 Third party certification

Third-party certification of sustainable forest management is conducted by FSC, the American Tree Farm System (ATFS) and the Sustainable Forestry initiative (SFI). ATFS (aimed at small woodland owners) and SFI are schemes endorsed by PEFC. The latest figures from FSC state that there are 2906 Chain of Custody certificates and a certified forest area of 13.8 million ha (116 certificates) (FSC International, 2016). The latest figures from PEFC state that there are 260 Chain of Custody certificates and a certified forest area of 33.1 million ha (8.5 million ha through ATFS, and 24.6 million ha through SFI) (PEFC, 2015). FSC and PEFC have globally updated their standards to address due diligence requirements of legislation such as EUTR, Lacey Act. In a study by Moore et al. (2012) forest managers indicated that they believed that the benefits of forest certification were greater than the disadvantages. Third party certification while not directly required by legislation as such, it can de facto be a requirement in public procurement policy, even though equivalent means are acceptable.

6.4.3.3 Climate policy

The implications of climate policy on the US forest-based sector (and the sectors role in mitigating climate change) remain subject to controversial debates. The Forest Policy Forum, an industry initiative comprising US-based forest industry and trade groups, developed (with the counsel of conservation organisations) a set of principles for ensuring that the forest sector – from landowners to manufacturers – can contribute meaningfully to mitigating climate change (and is perceived and incentivised in this way). The principles focus on the positive carbon contributions of managed forests to GHG saving; the steps the sector can take to maintain and grow productive and managed forests in the United States to sustain forest carbon; understanding public policy and market mechanisms and their effects on forests; and supporting innovation in the forest products sector that provides long-term benefits in addressing the carbon challenge (Forest Policy Forum, 2015 in UNECE/FAO, 2015). Yet, environmental science and groups rather emphasise the climate change mitigation contribution of unmanaged forest lands with high carbon stocks (Winkel, 2014).

The Clean Power Plan (CPP) is a policy aiming to reduce carbon pollution from power plants in the United States. It was first proposed by the Environmental Protection Agency (EPA) in 2014. The CPP requires states to meet certain standards concerning carbon emissions; states are free to plan to achieve these standards by various means.

Table 62 presents a summary of climate and energy policies for the United States, with their likely cost impact.

Table 62 - Summary table of climate and energy policies for the United States

Policy area	Policy name	Date	Notes	Cost area	Cost implication
Climate and Energy	Clean Power Plan	2015	Cut harmful pollution from the power sector by 32% below 2005 levels and smog-and soot-forming emissions that threaten public health by 20%. States are free to reduce emissions by various means and must present their plans to do so to the Environmental Protection Agency by September 2016 (with possible extension to September 2018). If they do not do so, the EPA will impose a plan for the state.	Energy costs	Energy costs ↗ Potential for F-BI industries to make money from production of renewable energy ?

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

6.4.3.4 Energy policy

There have been and continue to be a number of subsidies, both at federal and state levels, that target the development of alternative fuels. US pulp, paper and paperboard companies had benefited from

payments through the Alternative Fuel Mixtures Tax Credit (AFMTC), to the tune of around $US 8 billion by the end of 2009. US companies were eligible for the Cellulosic Biofuel Producer Credit until the end of 2012. This credit was extended for one year and effectively companies can carry forward unused credits from previous years through to 2016. The value of such unclaimed credits has been estimated by the Congressional Budget Office to be in the range of $US1.5-2.3 billion (CEPI, 2016).

6.4.3.5 Trade policy and business environment

The Lacey Act (1900) is a US law that bans the import into the United States of illegally traded wildlife. It was amended in 2008 through the Legal Timber Protection Act. This was a milestone in global forest (and forest product trade policy), aiming to close-off the US market for forest products of illegal origin (Leipold and Winkel, 2016).

The Trans-Pacific Partnership (TPP) is a trade agreement between 12 Pacific Rim countries (including the United States) – some of which already had bilateral trade agreements with the United States. The full text of the TPP was released on 26 January 2016, and signed by country representatives on 4 February 2016. The agreement would reduce 18 000 tariffs. Tariffs on all US manufactured goods would be eliminated. China is not a signatory although it has expressed interest in TPP and is paying attention to its development (New Zealand Foreign Affairs & Trade, 2016; USTR, 2016a). All signatories of the North American Free Trade Agreement (NAFTA) (Canada, Mexico and the United States) are also signatories to the TPP.

The Transatlantic Trade and Investment Partnership (TTIP) is a proposed trade and investment agreement under negotiation between the United States and the EU, with the aim of liberalising trade and promoting economic growth (European Commission, 2016; USTR, 2016b).

As part of efforts to increase the participation of SMEs in the negotiations for TTIP, the US Trade Representative requested that the International Trade Commission of the US (USITC) catalogue trade barriers perceived by US SMEs as disproportionately affecting their exports to the EU. USITC conducted a survey of small- and medium-sized enterprises (active companies with up to 500 employees that were not subsidiaries of larger companies) in 2013. Table 63 presents a summary of the general issues highlighted by US SMEs concerning trade with the EU. It is underlined that this quite comprehensive list identifies most of the main types of impediments to trade without necessarily ascribing blame as to an intentional trade barrier to one or other trade partner. For example, a difference in legislation and/or standards between the USA and the EU is neither partner's fault but may impede trade for an SME.

Table 63 Cross-cutting issues raised by US SMEs concerning trade with the EU

Subject area	Trade issue	Specific challenges reported by US SMEs and others
Standards and regulation	Standards and technical regulations	Different regulatory approaches in the United States and the EU; US SMEs' lack of participation in development of EU standards; compliance with standards costly and time-intensive for US SMEs
	Conformity assessment procedures	Lack of national treatment of US certification bodies; high cost of procedures, including testing for Conformité Européenne (CE) marking
IP rights issues	Trade secrets	Inadequate protection of US SMEs' trade secrets, particularly in the regulatory and marketing approval process
	Patent protection	High cost of obtaining patent protection in each member state; member states' divergent standards
Logistical issues	Harmonized System (HS) classification	Challenges in determining correct classification for exports, given that HS codes vary between the US and the EU, and for certain products HS codes vary among EU members; reclassifications result in higher duties and taxes; and incorrect classifications may lead to customs delays
	EU's value-added tax (VAT)	Complexity of VAT and difficulties with providing criteria (documentation and residency) for receiving credits, rendering compliance difficult
	Shipping/distributing products in the EU	Unreliable international deliveries by some domestic postal services in the EU; challenges in distributing products; added costs of working with private couriers and distributors complexity of VAT and difficulties with providing criteria (documentation and residency) for receiving credits, rendering compliance difficult
Finance-related issues	Payment terms	Longer typical payment terms in the EU versus the US; added costs from financing receivables for longer periods
	Protection against non-payment by customers	Higher sales costs due to need to protect against nonpayment (e.g., through export credit insurance)
	Payment transaction fees	Higher transaction costs for payments from the EU to the US than for domestic payments because of higher bank fees (for currency conversion and wire transfers)
	Regulatory and legal framework	Various differences in regulatory and legal framework between the EU and the US pose obstacles to exporting

Source: USITC, 2014 and compilation from roundtable transcripts, hearing transcripts, written submissions, and e-mail responses

The United States and Canada have been involved in a long-running trade dispute concerning softwood lumber. In the 1980s US producers complained that the Canadian federal and provincial governments had subsidised sales to lumber producers and this was anti-competitive, and that this placed US producers at an unfair disadvantage. The United States threatened to impose a 15% import tariff on all softwood lumber imported from Canada. The issue has gone back and forth with a number of rulings in NAFTA and the WTO. An agreement (the Softwood Lumber Agreement - SLA) was reached in 2006 under which the United States agreed to lift anti-dumping duties provided that prices stayed within a certain range. If prices dropped then export tariffs and quotas could be imposed, and compensation for duties that had been collected by the United States were paid back to Canada. The agreement expired in 2015 with no new agreement being reached, and Canada wanting the conditions to be continued and the United States wanting the conditions to be renegotiated (US Lumber Coalition). The SLA allows up to two years for the United States and Canada to negotiate a revised agreement. In 2014 and the first quarter of 2015, the effective export tax on western Canadian shipments to the United States was zero. An export tax of 5% was imposed in April and May 2015 for the first time since October 2013 (UNECE/FAO, 2015). Negotiations are ongoing in May-June 2016; current commentaries indicate that little progress has been made and that the issue is likely to return to the courts (Ljunggren, 2016). The softwood lumber dispute with Canada was mentioned by one

company as having had a negative effect on business (of importing wood from Canada). In general, the regulatory burden has been increasing over the last decade and this trend is expected to continue.

The Global Enabling Trade Report assesses countries with regard to the Enabling Trade Index (ETI). ETI captures various dimensions of enabling trade: market access; border administration; infrastructure; and operating environment. With regard to market access the US was ranked 27th out of 138 countries in terms of the barriers to the domestic market (an assessment of the level and complexity of a country's tariff protection as a result of its trade policy) – meaning that the US was assessed as presenting relatively few barriers to imports into the United States. Vice-versa it was ranked 128th out of 138 countries in terms of foreign market access (an assessment of the barriers its exporters faced) – meaning that US exporters were considered to be facing considerable barriers (WEF, 2014a).

The average duty on imports from countries with most-favoured-nation (MFN) status imposed on imports is 1.3% (range 0-10.7%) on wood products (HS44). Import duties are not imposed on pulp products (HS47) and paper (HS48) (WTO, 2016). Wood, pulp, paper and paperboard products accounted for 3.5% of imports in 2015.

The United States has imposed anti-dumping duties on a number of wood products and pulp, paper and paperboard products. These include certain types of coated and uncoated paper from China, Indonesia, Brazil, Portugal and Germany, and wooden flooring and wooden furniture from China (USITC, 2014a).

Table 64 presents a summary of trade policies for the United States, with their likely cost impact.

Table 64 - Summary table of trade policies for the United States

Policy area	Policy name	Date	Notes	Cost area	Cost implication
Trade	Trans-Pacific Partnership (TPP)	2016	TPP is a trade agreement between 12 Pacific Rim countries (including the United States) – some of which already had bilateral trade agreements with the United States	Reduced tariffs on raw materials and products	↘?
	Transatlantic Trade and Investment Partnership (TTIP)	Not yet in force	TTIP is a proposed trade and investment agreement under negotiation between the United States and the EU, with the aim of liberalizing liberalising trade and promoting economic growth	Reduced tariffs on raw materials and products	↘?

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

6.4.3.6 Analysis of the likely cost impacts of national and EU legislation

Business challenges relate mostly to general economic trends, lumber price fluctuation, availability of qualified labour, and increasing regulatory burden (see also section 6.6.5).

Environmental, employment, safety, taxation and trade legislation were specifically mentioned by a company contact. The respondent mentioned they would not be able to indicate compliance costs of specific legislative acts. One expert mentioned that Health and Safety regulations, Labour rights legislation, and insurance costs are expected to result in increased labour costs. Full compliance with International Labour Organization (ILO) standards is also becoming a factor as a result of procurement demands for FSC and PEFC certification. The latter is not a legal requirement as such but rather part of corporate social responsibility.

One company reported that the changes to medical insurance have been a significant addition to labour costs recently. Occupational safety and health is taken very seriously, but the administrative burden is significant. An expert indicated also that labour safety compliance and labour health care compliance place a significant cost burden on firms. The Patient Protection and Affordable Care Act

(PPACA, 'Obamacare') was signed into law in 2010, and aims to increase the availability and affordability of health insurance (i.e. to the public at large and not for the F-BI specifically). Businesses employing 100 or more full-time equivalent employees had to provide insurance for at least 70% of their full-time workers by 2015, and 95% by 2016. Insurance premiums have increased but the long-term effects remain to be seen.

Forest-related and environmental policy

The effect of the Endangered Species Act (ESA; 1973) and of the National Forest Management Act (1976) on the production of wood has been the subject of a number of studies. Sun and Ning (2014) and Wear and Murray (2004) looked at the effect of the wood harvesting restrictions placed on federal forests different regions of the United States: the West (including the Pacific Northwest, the Pacific Southwest and the Rocky Mountain states); the South (12 states in the south-eastern United States from Texas to Virginia); and the North. The western United States region used to dominate supply of softwood (supplying about 60% of the softwood used in the United States), but since the late 1980s production in the region dropped, and the West the South and Canada have contributed roughly equally to the softwood consumption in the United States since the early 1990s (Sun and Ning, 2014).

In relation to ESA an expert consultant mentioned that "new endangered species seem to be added to the list every week, with resulting land management restrictions: the most recent was the listing of the Northern Long-eared Bat which has a 37 state range. The original proposal would have eliminated wood harvesting throughout the bat's range. The forest-based sector was able to preclude that proposal from becoming final, however the Endangered Species Act is an ongoing concern". ESA requires protection of endangered species and habitats and restricts commercial operations on affected land.

An expert consultant, representing clients in both the wood products manufacturing and the pulp, paper and paperboard sectors in the United States, indicated that compliance with environmental regulations is a considerable cost driver and that overregulation has a very negative impact on cost competitiveness. "New requirements for biomass boilers threatened to impose $US 8 billion in additional costs on the pulp, paper and paperboard sector a couple of years ago. We were able to modify the rulemaking to trim those costs, but that was a major concern. Currently, biomass and the carbon impacts of biomass energy are a very big issue."

The American Forest and Paper Association (AFANDPA) highlighted that the paper and wood products manufacturing industry has met many costly regulatory challenges over the years, spending billions of dollars as part of its environmental stewardship. Those investments have led to major improvements in air quality, including a 23% reduction in emissions of nitrogen oxide (NOx) and 42% for sulphur dioxide (SO2) by the association's pulp, paper and paperboard facilities since 2000. The industry faces challenges from new and existing regulations – driven by lawsuits under the Clean Air Act — that together could impose more than $US 10 billion in new capital obligations on the industry over the next 10 years. The 2013 National Ambient Air Quality Standard for particulate matter and other NAAQS threaten to create permitting gridlock."

From 1973 to 1994 and then from 1999 to 2005 the United States carried out a survey of the Pollution Abatement Costs and Expenditures (PACE). The survey provided information on US industries' capital expenditure and operating costs associated with pollution abatement efforts. The PACE survey was discontinued in 2008 (for the year 2005). The survey for 2005 covered approximately 20 000 manufacturing businesses with 20 or more employees (US Census Bureau, 2008). The survey aimed to answer questions such as: *What has been the economic cost of the Clean Air Act (CAA)?* and *What has been the impact of the Act on productivity growth or international trade?* (Ross et al., 2004).

The wood product manufacturing sector (NAICS 321) and the paper manufacturing sector (NAICS 322) had total abatement **capital expenditures** of $US 142.2 million and $US 573.3 million, respectively (Table 65). The industries with the highest capital expenditure abatement costs in 2005 were petroleum and coal products manufacturing (NAICS 324), with costs of $US 1743.0 million, and Chemical manufacturing (NAICS 325), with costs of $US 1271.6 million. For comparison, in 2006 the turnover of the petroleum and coal products manufacturing (NAICS 324) and Chemical manufacturing

(NAICS 325) were $US546.8 billion and $US657.1 billion, respectively (US Census Bureau, 2016)[105]. With regard to **operating expenditures** in 2005, the wood product manufacturing sector and the paper manufacturing sector had total abatement costs of $US 388.2 million and $1796.2 million, respectively (Table 66). The industries with the highest operating costs in 2005 were Chemical manufacturing, with $US 5217.2 million and Petroleum and coal products manufacturing, with $US 3746.1 million. Abatement of air pollution accounted for much more of the capital expenditure than the abatement of water and solid waste pollution for both the wood product manufacturing and paper manufacturing (Table 65). Abatement of air pollution accounted for more of the operating expenses for the wood product manufacturing, but for paper manufacturing, abatement of water pollution accounted for most of the operating expenses (Table 66). The operating expenditure costs were attributed to various cost categories (Table 67). For wood product manufacturing, Energy accounted for 47.3% of the operating expenses of pollution abatement.

[105] Figures are not readily available for 2005.

Table 65 Pollution abatement capital expenditures – $US million (Pollution Abatement Costs and Expenditures).

	Total capital expenditure (ASM)	Total pollution abatement capital expenditure	Activity				Media		
			Treatment	Prevention	Recycling	Disposal	Air	water	solid waste
Wood product manufacturing NAICS 321	3018.1	142.2	83.0	25.0	23.8	10.3	104.2	5.3	32.7
Paper and paper products manufacturing NAICS 322	5597.9	573.3	294.6	238.3	20.6	19.9	379.9	146.0	47.5
Pulp, paper and paperboard mills (NAICS 3221)		541.0	274.1	233.8	16.0	17.1	359.6	141.7	39.7
Pulp mills (NAICS 32211)		50.9	15.4	32.7	1.8	0.9	35.2	14.6	1.1
Paper mills (NAICS 32212)		309.3	135.7	157.5	7.4	8.7	182.4	99.1	27.8
Paperboard mills (NAICS 32213)		180.8	123.0	43.5	6.8	7.5	142.0	28.0	10.8
Converted paper product manufacturing (NAICS 3222)		32.3	20.5	4.5	4.6	2.8	20.2	4.3	7.7

Source: US Census Bureau 2008, Annual Survey of Manufactures, 2008

Table 66 Pollution abatement operating costs - $US million (Pollution Abatement Costs and Expenditures).

	Total value of shipments (ASM)	Total pollution abatement operating cost	Activity				Media		
			Treatment	Prevention	Recycling	Disposal	Air	water	solid waste
Wood product manufacturing NAICS 321	112 017.5	566.6	310.3	128.3	31.3	96.7	388.2	47.2	131.2
Paper and paper products manufacturing NAICS 322	162 848.2	1796.2	1072.0	189.4	118.6	416.2	571.7	757.9	466.6
Pulp, paper and paperboard mills (NAICS 3221)		1576.1	968.2	169.3	84.6	354.0	488.5	699.9	387.7
Pulp mills (NAICS 32211)		156.5	108.9	15.3	7.4	24.8	48.1	77.2	31.2
Paper mills (NAICS 32212)		878.7	545.8	79.7	46.2	207	267.4	410.2	201.2
Paperboard mills (NAICS 32213)		540.8	313.5	74.3	31.0	122.1	173.0	212.5	155.3
Converted paper product manufacturing (NAICS 3222)		220.1	103.8	20.1	34.0	62.2	83.3	58.0	78.9

Source: US Census Bureau 2008, Annual Survey of Manufactures, 2008

Table 67 Pollution abatement operating costs by cost category – $US million – cost category (Pollution Abatement Costs and Expenditures)

	Pollution abatement operating cost	Cost category									
		Labour		Energy		Materials and supplies		Contract work		Depreciation	
		$ million	%	$ million	%	$ million	%	$ million	%	$ million	%
Wood product manufacturing NAICS 321	566.6	79.7	14.1%	268.2	47.3%	47.0	8.3%	77.3	13.6%	94.3	16.6%
Paper and paper products manufacturing NAICS 322	1796.2	289.6	16.1%	357.6	19.9%	328.4	18.3%	475.5	26.5%	345.0	19.2%
Pulp, paper and paperboard mills (NAICS 3221)	1576.1	242.6	15.4%	293.6	18.6%	308.2	19.6%	416.4	26.4%	315.3	20.0%
Pulp mills (NAICS 32211)	156.5	26.4	16.9%	37.1	23.7%	32.7	20.9%	26.6	17.0%	33.6	21.5%
Paper mills (NAICS 32212)	878.7	144.7	16.5%	147.7	16.8%	180.2	20.5%	250.0	28.5%	156.1	17.8%
Paperboard mills (NAICS 32213)	540.8	71.5	13.2%	108.8	20.1%	95.2	17.6%	139.7	25.8%	125.6	23.2%
Converted paper product manufacturing (NAICS 3222)	220.1	47.0	21.4%	64.0	29.1%	20.3	9.2%	59.2	26.9%	29.7	13.5%

Source: US Census Bureau 2008, Annual Survey of Manufactures, 2008

Climate and Energy policies

An analysis of the relation between energy prices and exports for different manufacturing sectors in the United States was carried out by Riker in 2012. In a comparison of all three-digit NAIC industrial sectors, the study demonstrated that wood products industries have among the highest product price elasticity, while paper manufacturing and wood products industries have among the highest energy price elasticities. The study demonstrated that changes in energy price (through markets or through energy policy) had a significant effect on export performance (Riker, 2012).

An expert consultant stated that energy is a "divisive political issue" at the moment. "CO_2 is now classified as a pollutant" and "the Clean Power Plan is keeping electricity and transport costs high even as prices of oil and natural gas fall".

"EU demand for biomass, i.e. by the EU pellet market, to fulfil member-state obligations under the Renewable Energy Directive in response to climate change policy is altering forestry practices in parts of the United States, especially in the South East, in particular replacing some of the rapidly falling demand for small roundwood caused by shrinkage of the USA pulp industry".

Trade policy

A consulted expert stated that "the Lacey Act generally helps US domestic producers, especially in the hardwood lumber and hardwood plywood industries, by decreasing competing imports from countries using wood from illegal production. While from US point of view, the EUTR acts to increase costs slightly for export to European markets.".

Analysis by Bridegam and Eastin (2014) showed no significant differences in post-policy US imports of wood products possibly not of legalorigins. However, they assumed the policy may be affecting the suspicious imports of major exporters of finished products to the United States. A study by Lu et al. (2014) revealed that Chinese companies' awareness of the Lacey Act has played an important role in their decision to export to the US over the last five years. The companies who are less familiar with the Lacey Act tend to withdraw from the US market and focus on their domestic market. In practice, the smaller Chinese companies were more likely to withdraw from the US market in the aftermath of the Lacey Act as compared to their larger counterparts. According to the authors, this points to a lack of information catered for small and medium companies, as well as a level of compliance costs that such companies cannot bear. Finally, the Chinese companies that have increased their imports of raw materials from the US were found to have increased their sales to the US market over the last five years. (Lu et al., 2014)

Research indicates that the supply made available to the United States for its imports has declined, likely as a result of the Lacey Act Amendment (Jonson et al., 2015). Masiero et al. (2015) demonstrated that imports of tropical wood (logs; sawnwood; veneers and plywood) by Australia, the EU, and the United States halved in the period 2001-2013, while those by emerging economies such as China and India initially remained stable and later increased.

Table 68 Tropical wood product imports by selected countries 2001 and 2013

Country	2001		2013		2001-2013 % variation	
	Volume (m3)	Value (1000 US$)	Volume (m3)	Value (1000 US$)	Volume	Value
Australia	74 539	36 432	36 056	-	–51.6	18.1
EU–28	5 273 893	1 783	2 690 886	1 088 960	–49.0	–38.9
USA	1 458 811	631 438	641 192	586 832	–56.0	–7.1
China	3 496 595	741 297	2 457 090	1 033 272	–29.7	39.4
India	489 585	152 420	2 015 226	925 283	311.6	507.1

Source: Masiero et al. 2015.

The Lacey Act Amendment is the US counterpart of the EU Timber Regulation. An AHEC consultant reported that: "So far sensible interpretation of the risk-based provisions of the EUTR has meant it has not been an obstacle for US hardwood. The assurance of negligible risk of illegality in the US hardwood sector contained in the independent Seneca Creek study commissioned by AHEC in 2008 (Seneca Creek Associates, 2008) seems to have been widely accepted by EUTR Competent Authorities and the EU importing trade. AHEC is currently in the process of commissioning an update of this study. AHEC is concerned that EUTR is sometimes portrayed [by unspecified actors] as a requirement for traceability to specific forest source irrespective of the quality of forest governance and level of risk in the country or region of supply. Traceability to specific forest management units is not possible in the case of US hardwoods due to the complex supply chains and the need to mix material from numerous small non-industrial owners to ensure efficient and cost-effective supply of graded US hardwood lumber into the EU."

The AHEC consultant further stated that EU "public sector procurement policy (one of the instruments encouraged in the EU FLEGT Action Plan) in some EU member states (notably UK, Germany, France, and the Netherlands) do in practice require forest certification, which is much costlier) [than complying with due diligence requirements]." According to the AHEC consultant's view, some procurement policies in the EU are likely in conflict with both the WTO and EU rules for non-discrimination in public procurement. The expert consultant further stated that: "Government procurement policies limiting trade to FSC and PEFC are having a longer term corrosive effect, imposing standards which are not appropriate to the non-industrial forest sector in the United States (and many other non-EU supply countries), which are not matched by equivalent sourcing requirements imposed on non-wood materials (with likely significantly higher environmental impacts), and which are not matched by willingness to pay."

One specific issue concerning the forest-based sector was raised by the US Hardwood Federation[106]. This concerned phytosanitary regulations restricting the import of North American ash into the European Union (USITC, 2014b). No other specific issues concerning the forest-based sector, or raised by associations representing the forest-based industries were found in the report. This issue was also raised by an AHEC consultant– "the cost of implementing the EU requirement is so high to individual operators that it seriously impedes exports into the EU of ash from any EAB [emerald ash borer] affected area in the US (i.e. nearly all main supply regions). Before the controls, this trade was worth around US$ 30 million a year. Meanwhile US ash can be shipped to other destinations without difficulty, so trade is increasingly diverted to emerging markets, notably China." AHEC are monitoring just how far [trade] falls since introduction of the controls from 1 January [2016]. It is unfortunate timing, because EAB has led to higher ash supply in the short term for which there is now a significantly more restricted market. EC Plant Health Authorities are aware of this problem and there has been a lengthy exchange between those authorities and [the Animal and Plant Health Inspection Service] APHIS in an effort to resolve it."

[106] The US Hardwoods Federation represents and advocates on behalf of thousands of hardwood businesses from every state in the U.S.. It is an umbrella organization representing the majority of trade associations engaged in the manufacturing, wholesaling, or distribution of North American hardwood lumber, veneer, plywood, flooring and related products.

6.5 International comparative analysis of regulatory cost impacts

6.5.1 Comparative forest sector data for EU, Brazil, China and USA

In Table 69 an overview is presented of forest resources, industrial production by sub-sectors (woodworking and pulp, paper and paperboard), and apparent consumption for their corresponding product groups for the EU28, Brazil, China and USA.

Looking at **forest resources**, Brazil has the biggest forest area and correspondingly also the biggest growing stock. The EU28 while having the smallest area of forest, has the highest net annual increment per hectare and the highest wood removals per annum. Over the past 15 years, China has increased its forest area annually about as much as Brazil has seen its forest area reduced. Brazil has managed to significantly improve wood productivity in forest plantations, thereby reducing its dependency of wood from natural forests.

The US has by far the highest production of **pulp**; however, it consumes nearly as much as it produces. China consumes nearly twice as much it produces, taking up surplus production from Brazil and the EU. The biggest surplus production is by Brazil.

The biggest surplus of **paper and paperboard** production (i.e. the fraction that is left from apparent consumption) is by the EU28, whereas Brazil, China and US have a production surplus from less than a million tonnes to about 2 million tonnes.

The EU28 is by far the biggest producer of **sawnwood**, also with the biggest apparent surplus. China and also US rely on imports to fulfil domestic demand.

The EU28 is the biggest producer and consumer of OSB **panels**. However, China outperforms the EU28, US and Brazil in the production and consumption of MDF, plywood and veneer.

Table 69 Forest resources, industrial production by woodworking and pulp, paper and paperboard sub-sectors, and apparent consumption for the corresponding product groups by EU28, Brazil, China and USA. Data in each row are colour-coded as follows: cell with lowest number is white, cell with highest number has darkest shade of red colour. For reference years, please see footnote to this table.

Forest Resources	Unit	EU28	BR	CN	US
- Forest Area (2015)	million ha	161	494	208	310
- Forest Area change (1990-2015)	thousand ha/yr	519	-2,127	2,047	306
- Growing Stock on forest (2015)	million m^3	26,526	96,745	16,002	40,699
- Net Annual Increment on forest	million m^3/yr	720	n.a.	748.8	899
- Net Annual Increment on forest	m^3/ha/yr	4.5	n.a.	3.6	2.9
- Fellings per annum	million m^3	522	n.a.	n.a.	n.a.
- Wood removals per annum	million m^3 ub.	356	229	86	324

	Unit	EU28	BR	CN	US
- Industrial Production					
----- Pulp	million tonnes	36.64	16.47	17.54	46.88
----- Paper and Paperboard	million tonnes	92.35	10.37	108.75	73.09
----- Sawnwood	million m^3	103.95	15.23	68.41	74.80
----- Panels - OSB	million m^3	36.81	3.43	20.61	15.91
----- Panels - MDF	million m^3	11.38	4.43	56.83	3.00
----- Panels - Plywood	million m^3	4.36	2.40	104.15	9.45
----- Panels - Veneer sheets	million m^3	1.17	1.23	3.03	0.40
- Apparent consumption					
----- Pulp	million tonnes	41.66	6.28	33.91	45.36
----- Paper and Paperboard	million tonnes	81.09	9.79	106.00	71.05
----- Sawnwood	million m^3	87.00	13.76	95.35	90.10
----- Panels - OSB	million m^3	34.39	3.32	21.12	19.81
----- Panels - MDF	million m^3	9.77	4.29	54.06	4.10
----- Panels - Plywood	million m^3	6.89	0.82	93.89	11.50
----- Panels - Veneer sheets	million m^3	1.56	1.16	3.89	0.66

Sources: EU28 forest resource data from Forest Europe, 2015; BR, CN and US forest resource data from respective country reports for FAO Forest Resource Assessment, 2015; Industrial production and apparent consumption data compiled from FAOSTAT, 2016 Reference years: Forest Area: 2015; Forest Area – average annual change between: 1990-2015; Growing Stock on forest: 2015; Net Annual Increment on forest: 2010; Net Annual Increment on forest: 2010 (EU28), 2015 (BR, CN, US); Fellings per annum: 2010; Wood removals per annum: 2010 (EU28), 2011 (BR, CN, US); Industrial production and apparent consumption: 2014

In terms of trade of pulp, paper and paperboard, the following tables provides a comparison of the imports from EU and exports to EU together with the proportion of imports/exports from/to EU on total imports/exports. The first table clearly highlights the dependency of China in terms of raw materials (pulp) as it imports up to 48.4% of its consumption if 2014 and China's imports represent about 44% of total EU exports of pulp.

Table 70 Imports and exports of pulp

	Brazil		China		US	
	2000	**2014**	**2000**	**2014**	**2000**	**2014**
Imports/Consumption	6.70%	6.70%	16.30%	48.40%	11.30%	11.60%
Imports from EU (000)	3,632	31,795	54,758	865,212	54,665	37,339
Imports from EU / Total Imports	1.20%	12.90%	2.70%	10.40%	1.20%	1%
Imports from EU / Total Exports EU	0.4%%	1.5%%	7.9%%	43.9%%	7.10%	1.50%
Exports to EU (000)	857,650	1,725,820	2,637	21,572	1,569,643	1,036,020
Exports to EU / Total Production	16,7%	24.10%	0%	0.20%	3.60%	3.20%
Exports to EU / Total EU Imports	13.70%	46.90%	0%	0.30%	22.50%	18%

Source: DG Trade Market Access Database, RISI and IMF.

Table 71 Imports and exports of paper

	Brazil		China		US	
	2000	**2014**	**2000**	**2014**	**2000**	**2014**
Imports/Consumption	12.30%	11.50%	18.30%	2.80%	16.80%	14.30%
Imports from EU (000)	300,118	412,300	364,610	809,658	2,607,666	2,035,651
Imports from EU / Total Imports	30.80%	36.10%	5.60%	25.20%	13.00%	18%
Imports from EU / Total Exports EU	2.00%	2.20%	2.90%	3.70%	15.40%	9.30%
Exports to EU (000)	126,907	206,449	337,398	1,772,893	1,539,682	1,294,973
Exports to EU / Total Production	2%	3%	0.3%	0.70%	1.70%	1.90%
Exports to EU / Total EU Imports	2.30%	4.40%	1.3%	11.60%	19.90%	21%

Source: DG Trade Market Access Database, RISI and IMF.

Overall, only Brazil still have tariff barriers with EU (about 4%) for pulp products, while both Brazil and China have tariff barriers for paper products (namely 12% for Brazil and 7.5% for China are the most applied tariff barriers). EU and US have suppressed all import tariffs from January 2004, following the 1994 Uruguay Round sectoral agreement.

6.5.2 Comparative analysis of company structures

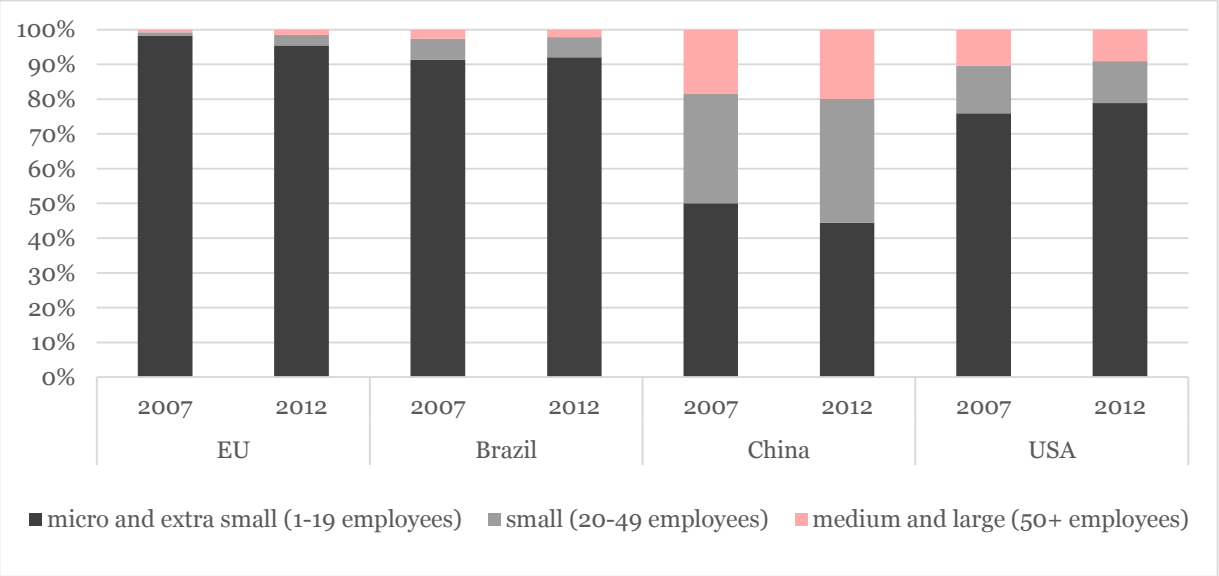
A comparative analysis of company distribution per employment size class as a percentage of total number of companies per country is shown, based on Euromonitor International data re-structured into three categories: 1-19 employees “micro and extra small”, 20-49 employees “small” and more than 50 employees “medium and large” (Figure 89). The figure also includes data on the EU28 which was

constructed from Eurostat industry statistics for NACE Rev. 2, where for 2007 Croatia was added to data for EU27. In case totals were missing then they were calculated on the basis of country data, with missing data filled with the data for the closest year.

In the same figure the similarity in relative company size structure between the EU28 and Brazil is striking. Micro and extra small companies have a very high share in the Brazilian company size structure, being above 90% of the Brazilian total number of companies. Yet for the EU28 this share is still higher, and while the number of micro and extra small companies has decreased from 98% to 95% between 2007-2012, this reflects an actual decrease by 4 thousand to about 170 thousand companies in 2012. The EU28 number of small companies has grown in the same period, from 1,670 to 5,384 companies, while the number of medium and large companies also had significant growth, from 1393 to 2655 companies. In China, the relative importance of micro and extra small companies has declined more than 5% over the past 5 years, however in absolute terms there was a growth in number from 28 to 35 thousand companies. The number of Chinese small companies increased from 18 to 28 thousand and the number of medium and large companies grew from 10 to 16 thousand. This very much reflects the enormous boom in forest products production in China. In the USA there were significant reductions in the numbers of companies in all size classes, due to the economic downturn. Meanwhile, numbers of company by size changed less dramatically in Brazil.

An expert consultant commented on the extremely fragmented nature of forest holdings in hardwood producing states in the United States (there are approximately four million non-industrial forest owners) and the small size of companies (the largest company accounts for less than 5% of total sales). "This is both an opportunity and an obstacle [for the sawmilling sector]." However considering the extent of the US forest area, the number of private forest owners can be considered rather small, especially comparing with the EU's approximately 15 million private forest owners[107]. There has been some consolidation in parts of the sector, but increased specialisation in other parts, so there is no real change in the overall dominance of small- and medium-sized enterprises. "There has been concentration of sawmilling activity in larger, better equipped and more efficient mills, but there has been more specialisation in the secondary processing sector and smaller more customised secondary manufacturers are generally increasing."

Figure 89 Relative evolution of company distribution in the woodworking sub-sector, per employment size class as percentage of total number of companies for the EU Brazil, China and USA



Source: Authors' elaboration based on Euromonitor International data

[107] Approximately 16 million private forest owners according to the Confederation of European Private Forest owners (CEPF). See http://www.cepf-eu.org/welcome.cfm

6.5.3 *Comparative analysis of cost structures*

A **comparison of cost structures for the woodworking sub-sectors** in the EU, Brazil, China and USA shows significant differences in the relative importance of particularly raw materials costs, energy costs, labour costs and service costs (Table 72). Unfortunately, the available data did not include those which would allow the calculation of costs relative to production unit (metric tonne or cubic meter).

Table 72 Cost structure by main cost categories and cost sub-categories for the woodworking sub-sector in EU, Brazil, China and USA (% of total production costs)

Cost categories		%		
Main cost category	**Cost sub-category**	**Brazil**	**China**	**USA**
Materials and equipment	Raw materials	14.4%	28.6%	7.0%
	Intermediate materials	39.7%	43.8%	39.2%
	Durable goods	2.0%	3.3%	4.6%
	Non-durable goods	0.1%	1.3%	0.8%
Operating costs	Labour	27.3%	10.2%	22.0%
	Services	4.8%	3.0%	11.6%
	Transport and communications	4.6%	2.7%	4.4%
	Energy, utilities and recycling	5.9%	5.2%	10.2%
Taxes less subsidies	Taxes less subsidies	1.2%	1.8%	0.2%
Totals		100.0%	100.0%	100.0%

Source: Euromonitor Passport reports on the woodworking industries, for Brazil (2014), China (2013), US (2014)

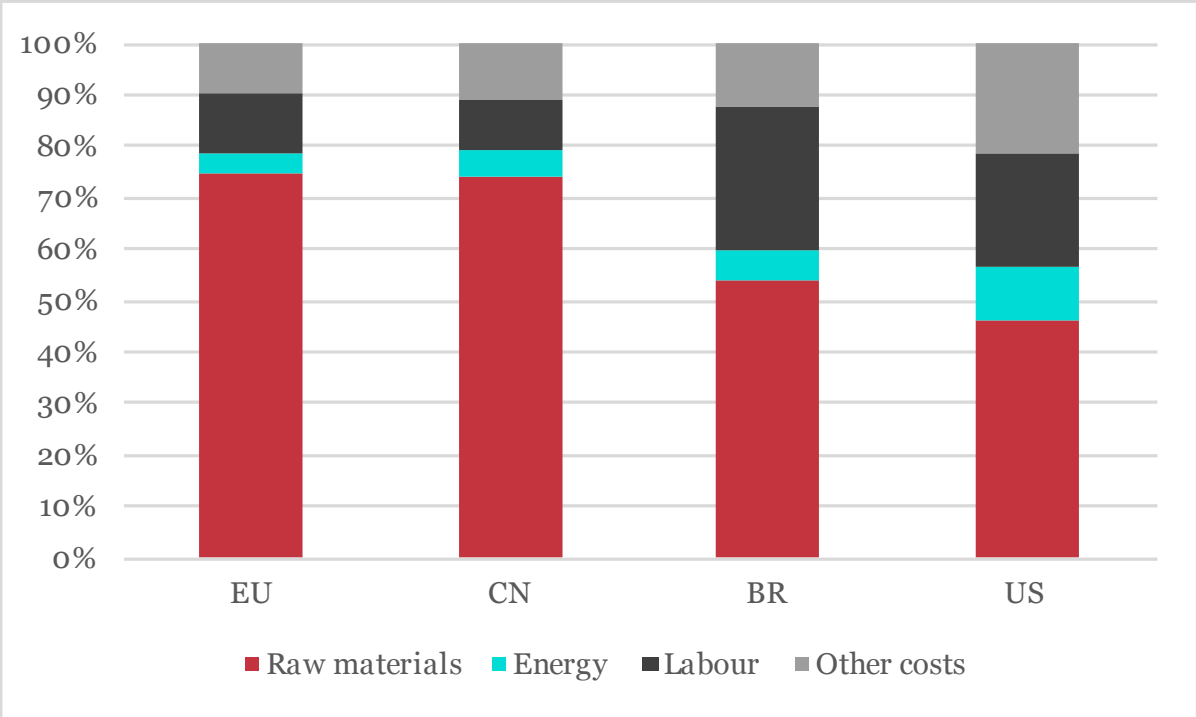
Raw material costs' relative share of costs is four times higher in China than in the USA, and double that in Brazil. Prices of wood raw material as a global commodity are expected to increase due to increasing demand for wood and wood-based products of verified legal origin. Costs for measures related to legality verification, including FLEGT and the EUTR, could not be explicitly identified in the cost structure data. Yet, under the assumption of increasing effectiveness of legality verification policies, the related costs may be increasing. Brazil, China and the USA each have each put their own legal requirements for due diligence in response to global efforts against illegal logging and trade in related products. Related costs are affected by e.g. 1) increased administrative and monitoring requirements, 2) upward pressure on prices for legal wood and 3) modification or development of compliance systems. This is expected to have the biggest effect on the costs for Chinese producers, which do not yet have stringent domestic due diligence requirements and monitoring systems in place like Brazilian, US and EU forest-based industries already do. Yet notably, the costs for legality verification compliance and related measures are critically dependent on the effectiveness of the implementation of the related policies and their geographical scale, e.g., it will be critical in how far China is going to develop stringent legality requirements domestically and how effectively the EU-TR and related legislation in Australia and the US will be implemented (see Section 1.5.4.3). Particularly in China but, presumably also for Brazilian and US producers, the EUTR requirements were seen as an issue for smallest producers which, with due diligence requirements, are inclined on the one hand to import less risky species and/or from less risky sources, or on the other hand, they may be less inclined to export to markets with stringent legality requirements, seeking to supply to other markets instead, depending on the origin and tree species. Each operator addressing due diligence will choose the approach that with available means will lead to the optimal market result.

Employment costs are relatively highest in Brazil (27%), followed by the USA (22%). In China and in the EU, the employment costs form respectively only 10% and 11% of total costs. In monetary terms, average employment costs are much lower in China than in Brazil and the USA. Increasing living standards particularly in China, but also in Brazil, and corresponding employment cost increases are set to reduce the competitive advantage of these countries on this cost category.

Services costs represent a relatively high proportion of costs in the USA, particularly due to high costs of business and management consulting, which were not reported as a separate category as such for Brazil and China. Service costs in the EU are not discernible as a separate category in the respective dataset and hence a comparison could not be compared.

The following picture shows the comparison between the four geographic zones, in relative terms, as % of production costs. Cost categories have been aggregated compared to the previous table, to enable the comparison with the dataset for EU.

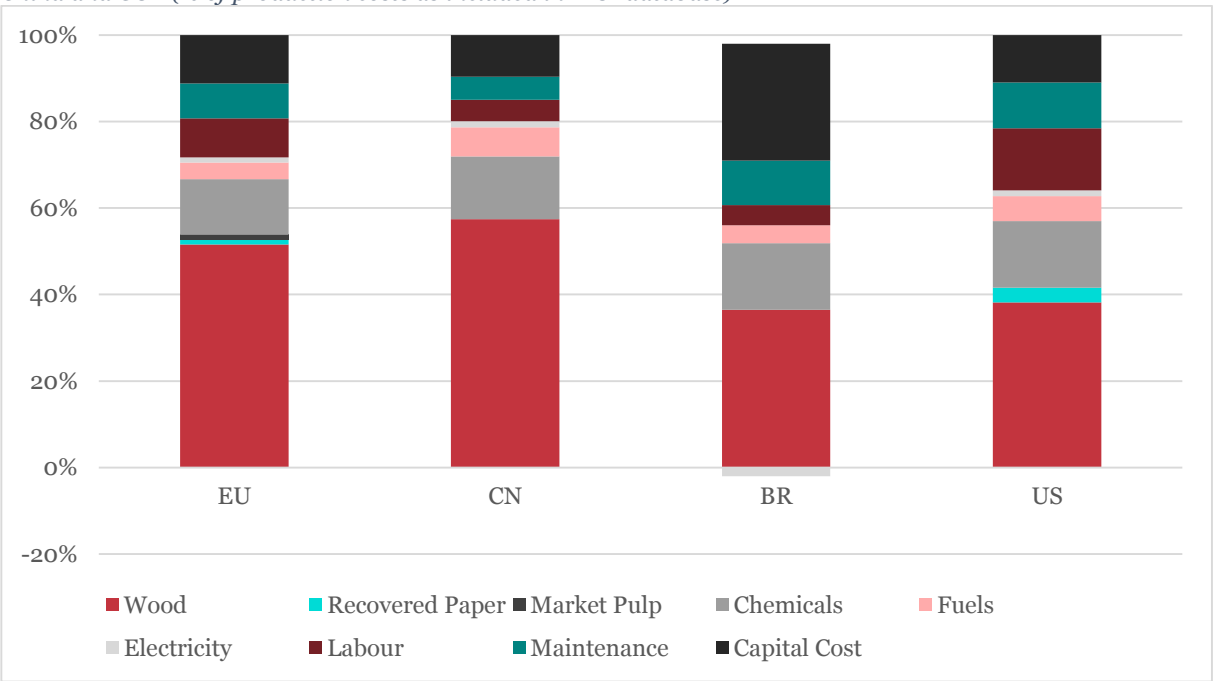
Figure 90 Cost structure by main cost categories for the woodworking sub-sector in EU, Brazil, China and USA (% of country total production costs)



Source: Euromonitor for US, China and Brazil (2012, 2013, 2014) and ToSIA for EU (2005)

For the overall **pulp, paper and paperboard sector** (Figure 91), the main differences between costs in EUR/tonne produced lies mainly in wood costs, labour, capital costs and maintenance costs. Electricity costs do not display large differences, except for the case of Brazil, where the negative share is to be attributed to the increasing self-generation capacity through the use of bioenergy (black liquor) to the detriment of oil and gas. The Chinese wood raw-material costs stand out for being the highest of the four global regions. This may be at least partially an effect of lower other costs, e.g. labour. In addition, the explanation for this can be traced back to the large amount of wood that China has to import from abroad due to the high internal demand and, as a consequence, the exposure to market exchange rate fluctuations (i.e. the appreciation of the RMB in the last years contributed substantially to this effect). Labour costs are the highest in the US and in Europe, but these are statistics that need to be interpreted in a context of high labour productivity accompanied by diminishing labour inputs in the two areas: as a matter of fact, despite high labour costs, the two areas can stay productive due to high labour productivity.

Figure 91 Cost structures by main cost categories for the pulp, paper and paperboard sub-sector in EU, Brazil, China and USA (% of production costs as included in RISI database)



Source: RISI database

6.5.4 Comparative analysis of the impact of legislation

6.5.4.1 Forest policy

The EU, Brazil, China and USA, all have basic forestry related policy (such as the Forestry Code in Brazil, the Forestry Law in China and the National Forest Management Act in USA) in place that result in a likely upward impact on cost or availability of raw materials. In particular restrictions imposed on forests' availability for wood supply increase resource costs.

However, during the same time, particularly in China huge efforts have been made in increasing the forest area (e.g. China National Action Programme To Combat Desertification; Key Shelterbelts Programme), to decrease its dependency on wood resources from abroad. In Brazil progressive increases of the forest wood productivity on plantation forests with improved tree-breeding material means an ever reducing dependency on natural forests and opportunities for its forest-based industries.

In all four regions, forest legislation sets the basic regulatory requirements for forest management which is, in turn, crucially important (however to different degrees, depending on the import orientation) for the possibility of the forest based industries to achieve a continuous and cost-efficient supply of forest products. Given this importance, it is still hardly possible to assess the impacts of forest legislation on the cost structures in the four regions in a satisfactorily manner.

Firstly, in the US as well as in the EU, forest legislation shows great regional diversity with rules for sustainable forest management being very diverse depending on the country/state. Secondly, in several cases, ordinances, programmes or plans have great effects on forest management practices despite being not codified law (e.g., the Pacific Northwest Forest Plan decreased logging on federal forest lands by more than 90% in the US Pacific Northwest region, but has not been codified as a law, and National Forest Programmes or plans/strategies might have significant effects on forest

management despite not being legally approved), and provisions made by national legislation may be subject to notable discretion by the implementing authorities. Given these factors, our limited information does not allow substantial assessment of the effects of forest legislation on the cost structures of the forest based industries.

Even so, four factors may be pointed to for further consideration: firstly, the regulation for public forest lands may have a crucial effect for the forest-based industry: more specifically, public forestry companies can build an essential forest biomass supply pillar for a targeted industrial policy (e.g. in some EU countries), while in other regions (for instance, in parts of the US) public forest lands are mostly managed in view of recreation and protection. This may give a considerable advantage to the industry in regions/countries where public forest lands are managed for industrial development.

Secondly, private forest lands (in so far existing) are subject to different degrees of (state) regulation and control as well as support schemes through subsidies and (public) advice, which might, together with the economic interests and forest related beliefs, greatly affect the possibilities and interests of private forest owners to supply forest biomass.

Thirdly, forest legislation in all regions is subject to a diversity of societal demands, and aims to balance them. Social and environmental demands have, and will likely continue to, restrict options for low cost industrial forest management in large forest areas in all four regions. It will be critical to investigate in how far approaches of "integrated" forest management (mostly in Europe) will perform economically compared to approaches the split the forest land base into plantations and strictly protected areas (mostly in the US; China and Brazil).

Fourthly, a tendency in forest law to increase societal participation in forest management planning in all regions might, on the one hand, negatively impact the possibility to use forests for cost effective biomass supply, but will, in turn, possibly provide the social licence to operate for the forest based industries in the future. Concluding, while it is impossible to assess the impacts of forest legislation (and policy) on the cost structure of the forest industry in a comprehensive manner, some key factor can be made out that could be analysed in more depths on a narrower scale in the future.

6.5.4.2 Environmental policy

Forest related environmental policy has, in all four regions, been a major impacting factor for forest management in the last decades. First, environmentally motivated (forest and environmental) legislation has resulted in substantial set-asides of (specifically) public forest lands in all four regions, thus reducing the land base available for forest biomass supply (but in turn partially increasing the social acceptability of forest management on the remaining areas). Regulation related to endangered species and habitats has, in addition, had substantial impacts on forest management outside strictly protected forest areas, partially also on privately owned forest lands, specifically in the EU and US.

Again, comparing the cost impact of these regulations across the four regions is not possible at the general level as: a) these regulations are regionally diverse, and subject to regionally diverse implementation practices and b) a thorough assessment would require in-depth-knowledge about ecological aspects of forest management, forest economics and implementation practices (and the costs of species and habitats protection are even subject to contested debates within single regions and countries). Yet as stated above, environmental regulation for forest management, and related major strategic decisions to either integrate species protection and forest production, or separate them, has potentially significant impacts on the both the raw material costs of the forest based industry and its social license to operate – with both aspects having potentially major/decisive impacts on the cost of the forest-based industry.

Environmental policy has been increasing a lot and affecting compliance costs of the forest-based industries themselves as well in Brazil, China and the USA. However particularly in the USA there was reference of high cost impacts on capital and operational costs in the pulp, paper and paperboard sectors.

6.5.4.3 Trade related legislation

Brazilian forest-based industry is expected to benefit from the national export strategy. In US context, the Trans-Pacific Partnership (TPP) and Transatlantic Trade and Investment Partnership (TTIP) are expected to reduce tariffs on raw materials and products and hence to reduce costs and enhance trade. CEPI has stated in this context that "If the negotiations end in agreement, the TTIP would put an end to disproportionate subsidies and secure access to US energy" (CEPI, 2016).

Of all EU legislation, the EU Timber Regulation comes forward as having an important impact on businesses and their production costs for particularly products destined to the EU market, in the three studied countries. The effect on costs is most profound in China, as the forest-based industries in Brazil and the United States had already taken measures to tackle illegally sourced domestic wood as in the case of Brazil, or imported wood through the Lacey Act Amendment in the case of the United States. Also the Australian Illegal Logging Prohibition Act has helped increase pressure on producers to rely on legally sourced wood. A comparison of the US Lacey Act amendment, the EU Timber Regulation and the Australian Illegal Logging Prohibition Act is presented in Appendix J. China meanwhile is taking steps to implement due diligence systems for its forest products industries. Taking into account the bilateral trade relations between the four regions, legality requirements for trade with the EU are mostly an issue for China due to its massive trade with EU while its national due diligence requirements are a set system not yet fully developed, then followed by USA and Brazil.

Li et al. (2008) predicted that world prices would rise due to policies countering illegal logging, by 1.5 to 3.5% for industrial roundwood and by 0.5 to 2% for processed products, depending on the assumption on illegal logging rates. World consumer expenditures for wood products and producer revenues would rise by 1 to 2% without illegal logging. World added value in forest industries would remain the same. However, in countries dependent on illegally logged wood (such as Indonesia), or those dependent on imported wood (such as China), the changes in consumer country expenditures[108] would be more than double the changes in producer country revenues. Similarly, in countries with little illegal logging and efficient industries, such as Canada, Germany and the United States, changes in producer country revenues would be almost twice the changes in consumer country expenditures. Added value in forest industries would decrease most in countries with heavy illegal logging (12% in Indonesia and up to 9% in Brazil). (Li et al., 2008)

The low number of responses from company representatives and experts representing F-BI sectoral associations of Brazil, China and the United States should be noted when considering results from the survey of these countries. Representatives of two Brazilian exporting companies did not consider EU regulation (in their case the EUTR being of relevance) harder (costlier and/or more administratively burdensome) to comply with than regulation from other countries (e.g. the US Lacey Act Amendment).

Conversely, some experts considered that EU legislation was harder to comply with than domestic legislation. For example, an expert answering from the point of view of a woodworking sub-sector stated for China stated EU regulation is "definitely harder [to comply with]." A consultant commented that for the United States domestic regulatory impacts are expected to "increase a bit" in the future, but that this "would depend on the outcomes of the elections. There is a tendency for government authorities to progressively extend reach. Processes of deregulation, however desirable, are rare. The current trend is for environment (particularly climate change) and trade (particularly populist appeals for protectionism)". On the one hand, the expert stated that "many EU policies offer long-term opportunities for US hardwood sector, which is being marketed as a natural, organic, carbon-neutral, and resource efficient material." On the other hand, the expert stated, "the pioneering work of the EU to develop tools – such as supplier due diligence, product environmental footprints (PEFs), environmental product declarations (EPDs), and strategies to move towards a green economy and resource efficiency – are expected to offer rewards in the form of higher market share and prices for suppliers of legal and sustainable wood products."

[108] Producer revenues are the sum of the value of production of all the 14 products considered in the referred study (Li et al., 2008), at local prices. Consumer expenditures are the sum of the value of consumption (production plus imports, minus exports), for the same products and prices. Value added is the value of all products, minus the cost of wood or fibre input.

An element that is deemed to have an effect on the transport costs in maritime transportation is the Marine Fuels Regulation (2005/33/EC) as regards the sulphur content of marine fuels. The regulation serves as the EU legal instrument to incorporate the sulphur provisions of International Convention for the Prevention of Pollution from Ships (MARPOL)[109] Annex VI. In 2015, CEPI claimed the main effect would be a shipping cost increase in the range of 20 to 45%, further to a 50 to 80% price increase for marine fuels. The estimated price increase effect in Euro per tonne for the paper industry was up to 10 EUR/tonne for the final products[110]. However, due to the current low marine fuel prices compared to before the entry-into-force of the low sulphur requirements on 1st January 2015, estimated price increase effect in Euro per tonne for the paper industry remains limited. In a survey carried out among ship owners by the European Community Ship Owners' Association (ESCA) in 2015, 53.8% of respondents indicated that the increase of freight rates resulting from the low sulphur content in marine fuel obligation varied between 1-10%[111]. Nevertheless, if marine fuel prices increase again in the future, prices per tonne paper transported by ship may however go up.

6.5.4.4 Labour policy

Salary increases have put labour costs up in Brazil, China and US as well as the EU, but most significantly in China where labour costs in the woodworking sector increased nearly three-fold between 2007-2012. This will possibly affect its competitiveness with lower wage countries in the near-to-medium future, and some companies might relocate to countries with still lower salaries. Particular mention in the US was given to the Affordable Care Act as having an increasing labour cost impact. While there was a reduction of the US workforce in woodworking activities, yet the labour cost share of total costs has remained stable.

6.5.4.5 Climate and energy policy

Climate and energy policy has huge potential to be of critical impact on the costs of the forest-based industries in the future. While our assessment does not provide data that is detailed enough for a thorough assessment and comparison, some general factors can be identified: first, whilst it was clear from the study that EU Climate Policy has a significant cost impact on the pulp, paper and paperboard sectors operating in the EU, concerns about the likely impact of comparable legislation in the competing countries was not so evident from the interviews and surveys. Second, it will be critical for the forest-based industry in how far political priorities for forest biomass production are set towards (renewable) energy or (first) material use of forest biomass. The respective regulations are under continuous political debates in all regions. Second, it will be critical how the mitigation potential of the forest based industries is accounted and politically incentivised or not. Climate-smart forestry holds great potential as contribution to an overall (global) climate change mitigation policy, but the political and academic debates relating to the mitigation potential of forests, forestry and the forest-based industries could result in quite distinct future policies that will, in turn, possibly greatly impact the competitiveness of the forest based industries a) in comparison to other (competing) sectors and b) in a regional perspective.

Of particular significance in the US, the Clean Power Plan is assumed to increase energy costs. However, taking into account the potential of forest-based industries to make money from renewable energy production, there may be a potential gain. EU renewable energy targets have given comparable impetus to forest-based industries to increase resource use efficiency and invest in green energy production.

[109] International Convention for the Prevention of Pollution from Ships (MARPOL): Adoption: 1973 (Convention), 1978 (1978 Protocol), 1997 (Protocol - Annex VI); Entry into force: 2 October 1983 (Annexes I and II). Further info: http://www.imo.org

[110] CEPI position paper on marine fuels (2010)

[111] European Sustainable Shipping Forum (March 2015), Report on on-line survey for ship operators, Brussels

6.5.4.6 Monetary policies

Identified in the Brazil country section, yet not considered in detail as part of this study, concerns the impact of monetary policies on currency exchange rates (impact on particularly export goods but also on imported intermediate goods) and interest rates (impact on cost of lending). Monetary policy however has a profound impact on the market environment and cost structures of the forest-based industries. Nevertheless, the impacts of interest rates and currency exchange rates on the forest industry investments have a very complex nature. Capital investments into the Chinese and Brazilian forest-based sectors has mainly been driven by inflows of foreign public and private capital, and the state was often subsidising the full costs of infrastructure. QE (Quantitative Easing) programmes in the USA, the EU and in China since 2015 have been affecting money supplies by effectively serving to depress the interest and currency exchange rates. The US QE programme was phased out in 2014, and since then the US dollar exchange rate started to rise. In addition, the USA started to increase interest rates from December 2015, which had some additional impact on the rising US$ currency exchange rate. A rising US$ currency exchange rate will reduce US forest-based sector export competiveness, and this in turn will increase other regions export opportunities with declining currencies. Bolkesjo and Buongiornio (2006) demonstrated for a range of US forest products exports and imports that "appreciation of the US dollar tended to matter more than depreciation, but the hypothesis that the effect of exchange rate was symmetric [for appreciation and depreciation] could not be rejected". The study showed that the effect also varied through time and was stronger in the first 12 to 18 months, and reduced afterwards while still remaining significant. Forest products are global commodities and as such they are often priced and traded in US$, sometimes under contracts that keep prices fixed (in US$) over a long period of time. In such cases, non-US traders can face initial windfall profits, while in the longer term they may suffer reduced demand.

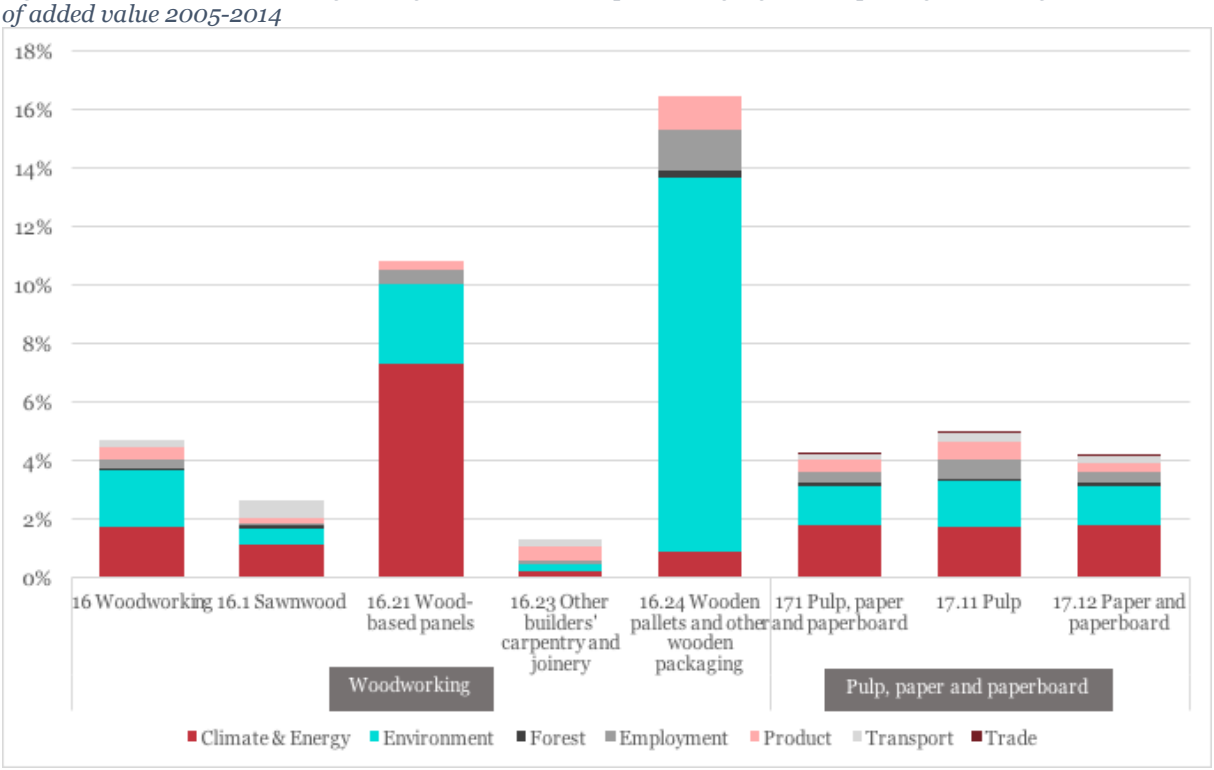
However, currency exchange rates alone do not decide competiveness of the industry, and currency rates are often volatile and they can't decide long-term capital investments behaviour. They are just one more factor, which condition (dampen or accentuate) the overall impacts of policies.

7 Conclusions

Regulatory costs differ considerably within and across F-BI sub-sectors

The **variability of costs across the different F-BI sub-sectors** is significant and reflects differences in product groups and their production chains. The highest cost by far as a percentage of added value is observed in wooden containers and packaging, amounting to 16.4% (average annual figure over 2005-2014), and the lowest in builders' carpentry and joinery, at 1.3%. The cost for wood-based panels represents 10.8% of the sub-sector's added value, for pulp 5%, for paper and paperboard 4.2% and for sawnwood 2.6%.

Figure 92 Cumulative direct regulatory costs and its composition by legislation package – average annual share of added value 2005-2014



Source: Authors' elaboration based on cost data from companies' books and online survey; comparators of turnover, AV and GOS from Eurostat, Structural Business Statistics

Woodworking sub-sector

When all legislation relevant to **woodworking** companies is cumulated, the estimated average annual total direct cost borne by its sub-sectors covered during the period 2005-2014 approaches 4.7% of added value, representing around 1.3% of their turnover and 13.7% of their gross operating surplus.

Two legislative packages clearly stand out as the main causes of the EU legislative burden, namely the environmental and the climate and energy packages, generating respectively 41.5% and 36.3% of direct regulatory costs for the overall woodworking sub-sector.

Major milestones of the evolution of costs have been the establishment of EU climate and energy targets, known as "20-20-20" targets for a low-carbon economy, the revision of the Renewable Energy Directive in 2009, the adoption of the Integrated Pollution Prevention and Control (IPPC) in 2008 and the transposition of the Industrial Emissions Directive in 2013. Other legislative acts such as the Waste Framework Directive or the EU Eco-Label Directive also contribute to regulatory costs in the sector.

Overall, costs generated by the EU legislation related to the manufacture of woodworking are operating costs and monetary obligations, both amounting to 1.7% of added value (35% each of the total regulatory costs for the woodworking sector).

Pulp, paper & paperboard sub-sector

When all legislation relevant to **pulp, paper and paperboard** companies is cumulated, the estimated average annual total direct costs borne by the subsectors covered during the period 2005-2014 approaches 4.3% of added value, representing around 0.9% of their turnover, 10.8% of the gross operating surplus, 7.6% of EBITDA and 21.9% of EBIT.

The same two legislative packages as for woodworking clearly stand out as the main cause of legislative burden, namely the climate and energy package and the environmental package, generating respectively 41.5% and 32% of direct regulatory costs for pulp, paper and paperboard sectors.

Major milestones of the evolution of costs are the establishment of EU ETS, covering pulp, paper and paperboard since its start in 2005. The second increase in 2012-2013 may also be linked to the ETS's second phase, e.g. from 2013 the ETS requires a reduction of 21% of carbon emissions compared with 2005. The Energy Efficiency Directive was also implemented during this period and it would also have been preceded by investments to meet new legal requirements.

Regulatory costs for the manufacture of pulp, paper and paperboard are monetary obligations, amounting to 1.5% of added value (35% of the total regulatory costs for the sector), and capital expenditures, reaching 1.4% of added value (33% of the total regulatory costs), closely followed by operating expenditures, representing 1.1% of added value (26% of the total regulatory costs).

Costs depend on the company profile

Within the two main sub-sectors woodworking and pulp, paper & paperboard, variability reflects the size of companies and their organisational structure, efficiency, level of integration and product portfolio. For instance, regulatory costs represent a larger burden for SMEs (i.e. a larger share of their turnover or profitability) than for large firms because the costs to comply with legislation are not linear and cannot be amortised by SMEs on a large volume of products.

Main findings on direct costs

Direct costs include monetary obligations, capital and operating expenditures and administrative burden.

Monetary obligations include regulatory charges such as fees, levies or taxes on certain stakeholders that are straightforward to identify, as the amounts are usually known by companies. From all sectors in the forest-based industries, the highest monetary obligations cost is observed in the manufacture of wood-based panels, reaching 6.9% of the added value. Monetary obligations are mainly driven by the climate and energy package and the environment package.

The pieces of legislation generating them are the Renewable Energy Directive, the Emissions Trading System and the Energy Taxation Directive. The Energy Renewable Directive applies larger fees directly to energy bills from energy-intensive companies, added to each unit of gas and electricity purchased. ETS net costs for CO2 emission allowances also represent significant monetary obligations and all sectors not covered by ETS are covered by the Energy Taxation Directive, which imposes a minimum tax rate, based on the CO2 and energy content of the energy consumed. The Industrial Emission Directive also introduces monetary obligations to the business sector, as it requires fees for permits.

Capital expenditures include any acquisition or upgrading of physical assets (land, building or equipment), usually "fixed costs", but also investment costs from investments necessary to meet legal obligations. The highest capital expenditure cost is observed in the manufacture of wooden containers and packaging (2% of added value), and closely followed by wood-based panels (1.8% of added value),

pulp (1.6% of added value) and paper and paperboard (1.4% of added value). Capital expenditures are also mainly driven by the environment and climate and energy packages. The pieces of legislation generating them are the ETS, requiring emission abatement equipment, energy and process efficiency equipment, that go beyond business-as-usual expenditures, and phytosanitary regulations as significant investments are necessary for companies to collect and process returned products and waste in accordance with the principle of extended producer responsibility. Additional costs occur related to the disposal of waste under the Waste Incineration Directive and to reducing volatile compounds emissions under the VOC Directive. Overall, costs may rise from investments in new technologies to comply with the required standards under Best Available Techniques, (BAT).

Operating expenditures include additional expenses for personnel (wages), energy inputs, materials, consumables associated with legal acts, and are usually "variable costs". The highest operating cost is observed in the manufacture of wooden containers and packaging (11.4% of added value), followed by wood-based panels (2% of added value), pulp (1.5% of added value) and paper and paperboard (1% of added value). Operating expenditures are mainly driven by the environmental legislative package, but also by the product-specific package. The main pieces of legislation which have generated these costs have been the phytosanitary regulations, that introduce personnel and maintenance costs to support the collection and process of returned products and wastes, and the IPPC Regulation and VOC Directive which required companies to invest in non-standard production processes to reduce volatile organic compounds. Operating expenditures have also been incurred due to maintenance efforts in new installations and, more recently, supplies for compliance with the Industrial Emissions Directive and its Best Available Techniques, as well as for training of personnel under the Eco-Label Directive (although not mandatory, if a company chooses to use the eco-label and hence to meet its requirements, compliance with the specifications must be proven), in order to fulfil eco-design requirements, obligations connected to distribution and labelling, etc.

Administrative burden includes the additional cost of fulfilling the information obligations to public authorities or other third parties as required by legislation. The highest administrative burden is observed in the manufacture of wooden containers and packaging (1,2% of added value), followed by sawnwood (0.7% of added value), builder's carpentry and joinery (0.6% of added value) and pulp production (0.5% of added value). Administrative burdens are mainly driven by the product-specific legislative package, and is mostly generated by reporting obligations linked to inspections and compliance as regards to permits, labelling, safety and provisions for ensuring traceability and authorisation of substances.

Indirect costs also matter

In addition to the direct legislative costs, companies also bear **indirect legislative costs**. Indirect costs were consistently reported in the wood-based panels sub-sector, related to the Renewable Energy Directive by apparently contributing to increase the raw material costs (e.g. wood) and progressively led to the substitution of wood-based panels by less expensive materials in some cases. The scarcity of and upward pressure on the price of wood, as initiated by the incentives (including subsidies as state aids) to burn wood for fuel, may well have triggered a strong competition for companies processing wood for material use against those using wood-based fuels for bioenergy, a particularly strong competition was recorded by wood-based panel producers who compete with bioenergy companies for wood, in particular in the form of industrial residues and recovered post-consumer material. This is likely to also be an issue for the pulp, paper and paperboard sectors, since they use the same types of fresh wood as part of their raw material intake.

Moreover, most pulp, paper and paperboard companies undergoing the interview process, as well as stakeholders taking the online survey, have reported the significant impact of the ETS's indirect costs of regulation, which occur when utility companies pass-on some of their ETS-related costs to the F-BI. Such indirect costs from electricity providers become particularly substantial for pulp, paper and paperboard production, which are energy-intensive sectors. Indirect costs from the ETS are close to four times as much as direct costs from the climate and energy package, which contains, inter alia, direct costs from the ETS.

The future role of existing and prospective regulation

Existing legislation and prospective legislative acts (i.e. those new acts already identified but only likely to have their cost impacts during the coming years) will be likely to generate additional compliance costs for the forest-based industries to meet new objectives and standards.

Legislation likely to bring more costs to both sub-sectors emanates from the **climate and energy package,** and from the **environmental legislation package**. For the climate and energy package, such acts will probably include the Clean Air Policy Package and/or the roadmap for moving to a competitive low-carbon economy in 2050, the 2030 climate & energy framework and the energy roadmap 2050- although they do not present quantifiable direct costs, they all aim to reduce carbon emission and energy consumption by improving efficiency. Effects from the Third Energy package are not clear-cut though. The woodworking sector is particularly concerned with the enshrinement of the cascading principle in a detailed legislation and with the revision of the Renewable Energy Directive that may lead to an increase is wood price (i.e. raw material). On the other hand, a new proposal for the LULUCF legislation has been published in July 2016, which should potentially limit the administrative burden on businesses. There is also a high degree of uncertainty for the pulp, paper and paperboard sub-sector, relating to increased administrative burden and lack of harmonisation under the revision of the ETS.

Further costs from the other legislation package are likely to impact both sub-sectors as well, to a lesser extent. Under the **forest-related package**, businesses encourage further coordination and enforcement of the EU Timber Regulation to prevent the increasing administrative burden arising from different national transposition regimes. Regarding the **employment package**, both woodworking and pulp, paper and paperboard sub-sectors may be impacted by the amendments on better workers' protection against cancer causing chemicals, now under proposal, as adding 13 new substances to the original list could increase administrative burden for hazard identification and risk assessments, capital expenditure for equipment and operating costs of training.

Regulation trigger costs for forest-based industries in all the studied regions

The **comparative synthesis** of the competitors' likely cost impacts of the national and EU legislation put the climate and energy legislation as a critical component of the regulatory framework: a common agenda on the international scene will be essential to contribute to a global climate change mitigation policy and to avoid the establishment of disparate future policies worldwide.

Other major impacts on the forest-based industries also emanate from the environmental legislation and the forest-relate legislation, both very present in all four regions. Regional disparities have been observed in US and EU with respect to forest policies. On a positive note, non-binding acts and not codified law have appeared to trigger great effects on forest management practices.

The EU Timber Regulation, while being considered as forest policy for EU, mostly affects trade between the analysed countries, and the respective production costs for products aimed to be traded on the EU market. Legality requirements under the EU Timber Regulation mostly impact China.

Lastly, the employment policies in the four regions appear to face similar patterns, namely salary increases that have put labour costs up in Brazil, China and US as well as the EU, but most significantly in China where labour costs in the woodworking sector increased nearly three-fold between 2007-2012.

Appendix A Estimation of direct costs

The quantification of direct regulatory costs followed the following procedure:

- Initial cost figures per year were calculated based on data from pilot and in-depth interviews;
- These figures were adjusted based on the on-line survey results;
- Different comparators were used to produce different types of final costs ratios.

7.1.1.1 Calculation of cost ratios based on the interviews

Based on the data provided by the companies via the pilot interviews and in-depth interviews, average cost ratios were calculated as follows (i being an index for firm) for direct regulatory costs:

$$Cost/turnover\ ratio = \frac{\sum_i cost_i}{\sum_i turnover_i}, \text{ where } i \text{ is a plant}$$

This ratio corresponds to a weighted average of the costs/turnover ratios of the companies. The idea is to combine the cost figures of the companies by using a procedure that transforms the figures into relative terms in order to make them more comparable (see section on compliance efficiency and comparability of companies) and less sensitive to the selection of companies than in absolute values. The turnover used for the calculations corresponds to the turnover provided by the companies in the company information form. The numerator of this cost ratio refers to the same level of activity (i.e. plant) than the denominator. This cost ratio was calculated for each cost category (i.e. monetary obligations, capital expenditure, operating expenses and administrative burden), each year (over the period 2005-2014) and each legislative package.

Choosing turnover to rescale costs at the company level is based on the following considerations:

- Turnover is consistently reported across respondents;
- Turnover values are easy to cross-validate using secondary data (i.e. annual reports of the companies);
- Turnover is readily available for respondents and follows a harmonised and straightforward definition;
- Turnover correlates with both volume and value of activities (while production only represents volume);
- Like costs, turnover corresponds to a flow of money, not a stock, unlike number of employees;
- Turnover is non negative, while negative values for profitability indicators like EBITDA are likely to occur at the individual company level and thus a positive legislative cost as a proportion of a negative EBITDA value would not make sense.

7.1.1.2 Variation in time

The above cost ratio was calculated for each year between 2005 and 2014 by using the turnover reported by the companies in the company information forms. However, the turnover reported in those forms corresponds only to the last year available, which is 2014. Thus, in order to reflect the evolution of turnover over the last decade, turnover statistics at the product group level were used to implement an adjustment factor as follows:

$$Adjusted\ Cost/turnover\ ratio_t = Cost/turnover\ ratio_t \frac{Turnover\ sector_{2014}}{Turnover\ sector_t}$$

7.1.1.3 Adjustment of cost figures with data from the online survey

In addition to cost figures collected via pilot and in-depth interviews, data on 103 companies collected from the online survey were used as another source of information to quantify regulatory costs. The idea here was to use the larger number of observations to recalibrate the initial (and more detailed) costs which are based on fewer companies. The survey collected information on cost ranges as a percentage of turnover for each legislative package and cost category. Results from the survey were used to adjust the initial estimates of cost figures as follows:

$$Adjusted\ cost = Initial\ cost + adjustment\ term$$

$$= Initial\ cost + w(Survey\ result - Initial\ cost)$$

where w is a weight for the adjustment of the initial cost. The adjustment term can be positive or negative and is based on the difference between the cost observed in the survey results and the initial cost. This calculation was performed by legislative package, product group and size category (i.e. SMEs and large firms). The above expression is equivalent to calculating the weighted average between the initial cost and the survey result, with corresponding weights being (1-w) and w.

The cost value used from the survey data corresponds to the middle of the cost range of the 50th percentile of the respondents. This is a median approach that removes the impact of outliers from the calculations.

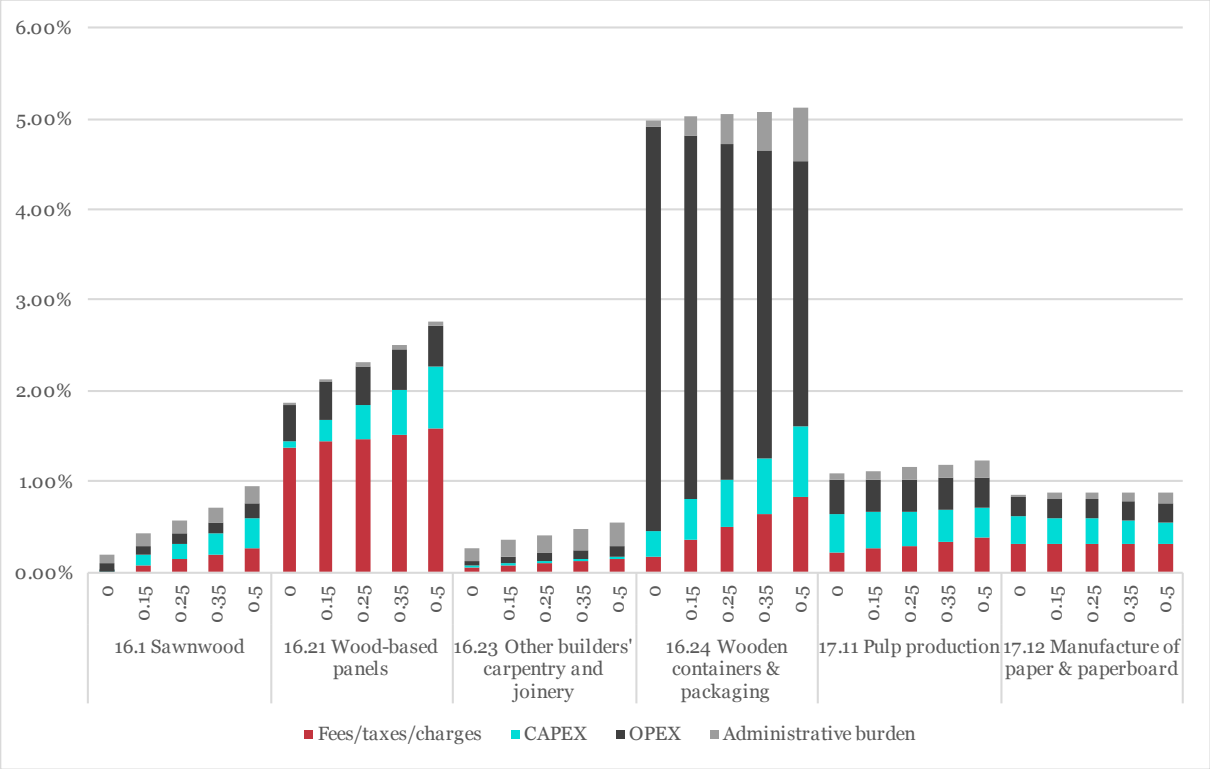
The weights for the adjustment term that were tested are the following: 50%, 35%, 25% and 15%. The weights are not a direct reflection of the number of companies, but they correspond to the fact that the validation procedures conducted via interviews and workshops on the initial cost figures should weigh at least as much as the survey in the calculation process. We also acknowledge that data collected via the interviews are likely to be more precise than the cost ranges reported in the online survey.

For each product group, cost category and legislative package, figures for SMEs and large companies were then combined by calculating the weighted average of the costs ratios between the two categories, with the weighting being the turnover of the product group (from Eurostat) in the corresponding category.

The adjustment of the initial cost figures (from pilot and in-depth interviews) with the on-line survey data was applied to the average cost over the 2005-2014 period.

The adjustment with the survey results does not significantly impact the initial costs for the pulp, paper and paperboard industries. Initial costs related to capital expenditure for sawnwood and wood-based panel firms appear to be underestimated according to the survey results, which is in line with the analysis performed in section 3.4. Total costs for other product groups are slightly affected by the adjustment. The direction of the adjustment is not systematic. Some costs are revised upwards, others downwards.

Figure 93 Sensitivity analysis of adjusted figures (as a % of turnover) based on different weights for the adjustment (0, 0.15, 0.25, 0.35 and 0.5)



Source: Authors' elaboration

The final cost of phytosanitary treatment for pallet producers was calculated separately in order to avoid extrapolating this specific cost to other products in the product group 16.24 Wooden pallets and other wooden packaging. The average cost for a single pallet was calculated based on the detailed information provided by the pallet producers during the in-depth interviews. This cost was multiplied by the number of pallets observed in Prodcom (Eurostat). As a consequence, the average cost related to the environmental legislative package was reduced from 3.5% to 2.8% of turnover.

7.1.1.4 Comparators

In order to compare costs with other indicators, statistics for the product groups were collected: added value and gross operating surplus for both main product groups, and Euros/tonne, EBITDA and EBIT for pulp, paper and paperboard product groups[112]. Additional cost ratios using different comparators from turnover were computed, based on the cost/turnover ratio calculated previously and can be obtained as follows for each of the comparator (added value, EBITDA, etc.):

$$Cost/comparator\ ratio_t = Adjusted\ Cost/turnover\ ratio_t \frac{Turnover\ sector_t}{Comparator\ sector_t}$$

7.1.1.5 Main assumptions to assess direct costs

Hypotheses to perform the cumulative cost assessment are summed up in Table 73.

Table 73 Hypothesis for cumulative cost assessment

Hypotheses	Explanation

[112] Data on sector turnover, value added and production were collected from the Historic Statistics Report. EBITDA was collected

Time scope	All costs before 2005 and after 2014 included in questionnaires have been withdrawn from our computation.
Cost across time	Most respondents have indicated a starting year for costs and their related frequency, or the period of investment for which capital expenditures were annualised. For cases where no indication of time was provided, we used a working assumption that the cost impact started one year after the introduction of the piece of legislation causing it.
Outliers	The final cost ratios should be robust in dealing with outliers and should not be the reflection of only one single marginal firm with abnormal costs. These outliers should be verified and their affect should not be extrapolated to other firms if they do not reflect the situation of the rest of the product group according to the other companies.[113] In order to detect outliers, costs were compared between years and between companies. Overall, it appeared that costs were consistent over time and across companies by following this process. Only three large amounts of capital expenditures were identified as outliers. After investigation, these costs, related to equipment with long service life (e.g. boilers), were smoothed out over the period by dividing the values by the service life of the corresponding equipment in the mill (based on additional data on the mill provided by the companies). This allows to acknowledge the existence of these costs without extrapolating unreasonable values to the rest of the product group for specific years.
Ranges	If respondents have provided ranges of costs for a cost category (e.g. between 1 and 2 days of training), we have used the mid range (e.g. in this case 1.5 day).
Administrative burden	If respondents refer to the question on OPEX personnel when filling the Administrative Burden question (e.g. "for administrative burden, see Q4, already included"), we used the answers for administrative personnel (FTE) to estimate administrative burden.
Estimation of salaries	If respondents have not provided salaries for each package, we have used the average of other companies in the sample.

Source: Authors' elaboration

[113] This follows a methodology similar to http://ec.europa.eu/eurostat/documents/64157/4374310/11-STANDARD-COST-MODEL-DK-SE-NO-BE-UK-NL-2004-EN-1.pdf/e703a6d8-42b8-48c8-bdd9-572ab4484dd3.

Appendix B Literature review relating to the indirect costs due to ETS and carbon pass-on of electricity to the pulp, paper and paperboard sector

Electricity is the most important energy sector covered by the **European Union Emissions Trading System** (ETS). This section is concerned with the impact of ETS on electricity prices, and more specifically on the extent that this effect is passed on to the price that the pulp, paper and paperboard sector pays for electricity. This section opens with an explanation of the main effect of the ETS on electricity prices and on pass-on rate. It then reviews the literature on pass-on rates and it concludes with an assessment of the pass-on rates to be used for the calculation of pass-on rate for the pulp, paper and paperboard sector.

For energy-intensive industries, like pulp, paper and paperboard, electricity prices can be a determinant factor in influencing competitiveness. The introduction of the ETS in 2005, has developed a market around carbon emission allowances (EUAs), which are issues free to companies, based on a threshold which is calculated according to the best performance in their sector, but traded as a commodity between firms which respectively under or over-perform. This has triggered other industrial mechanisms of response and adaptation; one of these is the extent to which the price paid for carbon allowances can be passed-on to industrial and final consumers (i.e. pass through rates).

The effect of the ETS on electricity prices and on pass-on rate depends largely on two factors: The first is **the impact of the allocation of allowances on electricity prices.** The EU Emission Trading system is a 'cap and trade' system. The system allows trading the free emission allowances received by the installation of electricity producers. By allowing trading, it aims at ensuring that the least cost alternative to comply with the assigned cap is implemented either by reducing emissions or buying allowances[114]. There are three implementation phases: The Pilot First Phase (2005-2007), the Second Phase (2008-2012) and the Third Phase (2013-2020). During the First Phase and the Second Phase most of the allowances were given for free, based on historical GHG emissions. During the Third Phase a benchmarking principle based on product-related GHG emission benchmarks is applied[115]. In the Third ETS Phase, with some exception for member countries in need of support to modernise their power sector[116], electricity operators will not receive any free allowance. The main explanation is that the experience during the first two phases showed that they were able to pass-on the cost of allowances to customers, even when received for free[117]. In other words, free allocation lead to a distortion in the way the opportunity cost of the allowances is internalised by the power generator. Power generators considered (free) emission allowances in terms of the cost of having to use them, instead of trading them at their market price and realise profits (i.e. its opportunity cost). The 'missed profit' was charged on the electricity prices and passed-through the users. This, in turn, has generated windfall profits for electricity providers. Within a system of auctioning (more similar to Phase Three), the opportunity cost of traded emissions will be still reflected in the price of electricity, but the allocation of the economic rents generated is different; in the case of auctioning the producer surplus for electricity providers should be smaller, because the effect of windfall profits generated by free allocation should not occur[118]. It is important to understand that the allocation system does not affect the pass-on rate: pass-on rate can be the same with or without free allocation, but the allocation

[114] Instead of, for example, forcing companies to directly invest heavily in abatement technologies.

[115] European Commission EU ETS Handbook. This progressive change in is also in line with the increase in the share of auctioned allowances; between 2008 and 2012 no more than 4% of the allowances were auctioned, in 2013 over 40% of the allowances were, and the estimation for the period 2013-2020 is of 50% or more, http://ec.europa.eu/clima/policies/ets/cap/auctioning/index_en.htm.

[116] http://ec.europa.eu/clima/policies/ets/cap/auctioning/index_en.htm and EU ETS Handbook, Op.Cit

[117] European Commission EU ETS Handbook. This progressive change in is also in line with the increase in the share of auctioned allowances; between 2008 and 2012 no more than 4% of the allowances were auctioned, in 2013 over 40% of the allowances were, and the estimation for the period 2013-2020 is of 50% or more, http://ec.europa.eu/clima/policies/ets/cap/auctioning/index_en.htm.

[118] Sijm, J., Hers, S, Lise, W. and Wetzelaer, B. (2008), The impact of EU ETS on electricity prices, Final report to DG Environment and the European Commission, Energy Research Centre of the Netherlands

system explains one of the mechanisms by which the pass-on occurs, and also paves the way for justifying possible compensation schemes for electricity prices increases when quantified effects are proven[119]. However, differences in the rate of pass-on rate are also expected to materialise between phases, due to the fact that higher costs are expected in the Third Phase (given less or inexistent free allocation)[120].

The second factor that explains more specifically the pass-on rate is **the impact of the market structure on electricity prices**, and includes, among others, the number of players in the market, the market power and concentration, and the elasticity of the demand curve for electricity (how customers are sensible to changes in prices). Other factors, such as the production constraints, changing technologies and market regulation are also deemed to affect the pass-on rate[121].

The choice of the pass-on rate(s) to calculate the pass-on rate to electricity prices and its effect on the pulp, paper and paperboard sector is not trivial, and depends on a number of contingent elements, often acting at national level. As Gully and Chernyavs'ka (2013) explain, the assumption of full pass-on is generally made in simulation models of emission trading performances[122]. Full pass-on derives from the assumption that the carbon cost of the less efficient technology used by the electricity provider is charged in the price, regardless of the allocation mechanism of the allowances (auction or benchmark). The theoretical basis set on carbon pass-on by Sijm at al. (2006) [123] and by Bonacina and Gullì (2007)[124] also confirms that perfect competition is the market condition for full pass-on.

Yet, Gullì and Chernyavs'ka (2013) point out that full pass through is not confirmed by empirical analyses of wholesale electricity spot market prices: pass-on rates can be much lower, or much higher, and they can substantially vary over time and between markets. In several cases they are not significantly different from zero. For the authors, the main explanation for missed full pass-on is to be found in imperfectly competitive markets and the different energy markets (i.e. organisation, firm strategy, etc.). Gullì and Chernyavs'ka (2013) is one of the most detailed overview of average pass-on rates, and it contains references to other literature that investigated the subject, reporting country differences for Finland, France, Germany, Italy, Spain, the Netherlands and the UK. Table 74 summarises these results[125].

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[119] In 2012, the European Commission has adopted under State Aid measures a framework under which Member States may compensate some electro-intensive users, such as steel and aluminum producers, for part of the higher electricity costs expected to result from a change to the EU Emissions Trading Scheme (ETS) as from 2013. The rules allow subsidies of up to 85% of the increase faced by the most efficient companies in each sector from 2013 to 2015, a cap that will gradually fall to 75% in 2019-2020. Moreover, the construction of new highly efficient power plants which will implement an environmentally safe capture and geological storage of CO2 (CCS-ready) by 2020 may receive support of up to 15% of the investment costs.

[120] PointCarbon Advisory Services (2008), EU ETS Phase II – The potential and scale of windfall profits in the power sector, a report to the WWF

[121] A peculiar case is the one of the UK. The UK Government has introduced the so called "carbon price floor" to be paid starting from April 2013 out to March 2031, which aims at determining an 'all in' price for carbon. To reach this goal, the Government has introduced a tax, 'Climate Change Levy (CCL) carbon price support rate' that will concern power generators using fossil fuels. This will be paid in addition to the EUA price. The sum of the two should not overpass the targeted all-in carbon price. The effects can be multiple. It is expected that such tax will reduce the demand for EUAs, and then lower its price. As a second consequence, if EUA price falls, revenues from auctioning allowances can also fall. This example makes clear how national measures in the context of renewable energy can have parallel effects on the ETS system and allowances prices, in turn affecting the price of electricity and power generation.

[122] Gullì, F. and Chernyavs'ka, L. (2013), Theory and Empirical Evidence for Carbon Cost Pass-Through to Energy Prices, The Annual Review of Resource Economics

[123] Sijm, J., Neuhoff, K. and Chen, Y. (2006), Cost pass-through and windfall profits in the power sector, Clim. Policy 6 (1), 49-72

[124] Bocacina, M. and Gulli, F. (2007), Electricity pricing under carbon emission trading: a dominant firm with competitive fringe model, Energy Policy, 35, 4200-4220

[125] The Table also includes other results found for Portugal and Poland, as well as the results of the PointCarbon 2008 study.

Sijm at al. (2008)[126] estimated pass-on rates of carbon cost on the forward market in 2005 and 2006, for five countries: Germany, France, the Netherlands, Sweden and the UK. They found that 17 out of 22 estimates were between 38 and 83%, four were slightly above one (103% to 134%) and one was significantly larger than one (182%).

About the estimation of carbon pass-through rates in the power market in the Second Phase, Jouvet and Solier (2013)[127] considered ten European countries between 2005 and 2012. Interestingly, the authors found that pass-on were high during the First Phase, and that the rate declined during the economic crisis. In 2009 no significant pass-on rate was found for the countries investigated. Jouvet and Solier attributed very low or negative pass-on to allowances over-allocation, in the Fist Phase, and to market instability with negative impact on power demand in the Second Phase.

Another explanation of low or negative pass-on could be linked to imperfect competition, and more specifically to cases in which firms do not maximise profits due to regulatory pressures. In other words, they do not externalise the full cost of emission allowances[128].

PointCarbon (2008)[129] built estimates of the pass-on rates for the Second Phase in the UK, Germany, Spain, Italy and Poland looking at out-turn power spreads. The pass-on levels were then used to calculate the windfall profits for ETS Phase Two. Pass-on rates between 75% and 100% were used for countries for which the analysis gave a high level of pass-on (Germany, the UK and Spain), for Poland a rate between 45 and 60% was applied (spot spreads showed a good level of response to developments in the carbon price). PointCarbon used the lowest pass-on in the case of Italy (0% - 70%), where the level of spot spreads showed no consistent pattern to the level of the carbon price, although this was expected given the market structure[130].

Finally, estimates of pass-on rates for Portugal were run using a vector error correction model (VECM) approach by Pereira Freitas and Pereira da Silva (2012)[131]. The authors estimated the pass-on in the Portuguese electricity market to range between 33 and 51%.

The ranges of the estimates are quite broad, and it must be noted that the results reported above derive from the application of many empirical methods. While some methods (like the econometric approach) allow calculating precise pass-on rates, they cannot justify its value, because they assume a single marginal technology and generic fuel efficiency. Differently, non-econometric approaches allow calculation of pass-on rate hour by hour, providing a more precise description of pass-on over time and accounting for market structure factors that econometric models do not include, however, they do not provide specific pass-on rate but only ranges of variability[132]; the two can be used complementarily for the pass-on rate analysis.

Despite the literature on the calculation of pass-on rates of carbon price is vast, in agreement with the IEA (2007)[133], it must be noted that a precise estimation of pass-on rates is not possible. This is due to several factors. Further than the ones already mentioned, there is also the fact that not in all EU28 countries electricity prices are set by pool-like bidding procedures, but rather by a limited number of trader and generators, or that, different types of contracts (long-term, short-term day-ahead) can influence the capacity of pass-on.

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[126] Sijm, J. P. M., Hers, S. J., Lise, W., Wetzelaer, B.J.H.W., (2008), The impact of EU ETS on electricity prices, final report to DG Environment and the European Commission

[127] Jouvet, P-A. Solier, B., (2013), An overview of CO2 cost pass-through to electricity prices in Europe, Energy Policy, 61, 1370-1376

[128] Gullì, F. and Chernyavs'ka, L., (2013), Op. Cit

[129] PointCarbon Advisory Services, (2008), Op. Cit.

[130] PointCarbon (2008), Ibidem.

[131] Pereira Freitas, C. and Pereira da Silva, P., (2012), Phase II CO2 cost pass-through in MIBEL:a cointegrated VECM approach

[132] Gullì, F. and Chernyavs'ka, L. (2013), Op. Cit.

[133] IEA (2007), Op. Cit.

To conclude, the capacity of pass-on rather relies on the electricity provider strategy of charging in its bill the opportunity cost, or the actual cost (no pass-on) of the carbon purchased.

Factors such as the presence of compensation schemes for the effect of higher electricity prices due to the ETS, and the level of dependency of the sector on electricity, as expressed by its cost structure, must be also taken into account to interpret the results of a pass-on calculation on the pulp, paper and paperboard sector. Looking at the DG Competition database on State Aid notifications of the Member states[134], only three compensation measures for indirect EU ETS costs were approved (by decision of not raising objections) in the pulp, paper and paperboard sector (NACE codes 17.11 and 17.12), since 2013[135], respectively for, Greece (which is, however out of our sample panel of companies); Slovakia, and the Netherlands. Expenditure information for 2014 was available only for the Netherlands[136].

[134]http://ec.europa.eu/competition/elojade/isef/index.cfm?clear=1&policy_area_id=3

[135] Year of first applications after the decision of 2012: http://europa.eu/rapid/press-release_IP-12-498_en.htm?locale=en

[136] A compensation for indirect costs of carbon price floor has been approved for energy intensive industries in 2014, however no specific information was found on sectoral coverage in details (http://europa.eu/rapid/press-release_IP-14-577_en.htm). A support scheme for energy intensive industries was also approved in 2013 for Germany, but no specific information on pulp and paper coverage was found (http://ec.europa.eu/competition/sectors/energy/news_en.html)

Table 74 Carbon cost pass-on rates, results from the literature[137] [138] [139] [140] [141]

Country and study	***Methodology***	***Price***	***Period***	***Average min***	***Average max***	***Peak min***	***Peak max***	***Off-peak min***	***Off-peak max***
Finland (Honkatukia et al. 2008)	Econometric VEAC and AR-GARCH	Wholesale spot	2005-2006	0.50	1.00				
France (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2005-2006			0.17	1.75	0.65	1.05
France (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2008-2010			-0.49	0.27	- 0.46	-0.21
Germny (Bunn & Fezzi 2008)	Econometric VEAC	Wholesale spot	2005-2006	0.52					
Germany (Sijm et al. 2008)	Econometric OLS	Wholesale forward	2005			0.60		0.41	
Germany (Sijm et al. 2008)	Econometric OLS	Wholesale forward	2006			0.57		0.64	
Germany (Solier &	Econometric autoregressive	Wholesale spot	2005-2006			-0.34	1.18	0.47	1.03

[137] Bunn D, Fezzi C. 2008. A vector error correction model of the interaction among gas, electricity and carbon prices: an application to the case of Germany and the United Kingdom

[138] Chernyavs'ka L, Gullì F. 2008b. Marginal CO2 cost pass-through under imperfect competition. Ecol. Econ. 68:408–21

[139] Honkatukia J, Mälkönen V, Perrels A. 2008. The impact of the European Emissions Trading Scheme on Finnish wholesale electricity prices

[140] Sijm S, Hers S, Wetzelaer B. 2008b. Options to address concerns regarding EU ETS–induced increases in power prices and generators' profits: the case of carbon cost pass-through in Germany and the Netherlands.

[141] Solier B, Jouvet P. 2011. An overview of CO2 cost pass-through to electricity process in Europe.Work. Pap. Ser. 2011-08, Cahier Chaire Econ. Clim.

Country and study	*Methodology*	*Price*	*Period*	*Average min*	*Average max*	*Peak min*	*Peak max*	*Off-peak min*	*Off-peak max*
Jouvet 2011)									
Germany (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2008-2010			-0.66	0.84	-1.29	0.15
Germany (PointCarbon 2008)	Out-turn power spreads scenarios		2008-2012	0.75	1.00				
Italy (Chernyavs'ka & Gulli 2008)	Load duration curve approach	Wholesale spot	2006			1.15	1.5	0.9	1.5
Italy (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2005-2006			-0.64	1.05	-3.56	-0.03
Italy (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2008-2010			-6.39	-1.23	-5.43	1.01
Italy (PointCarbon 2008)	Out-turn power spreads scenarios		2008-2012	0.00	0.70				
Spain (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2005-2006			1.29	2.03	-0.18	0.67
Spain (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2008-2010			-2.98	3.43	-0.76	4.24
Spain (PointCarbon 2008)	Out-turn power spreads scenarios		2008-2012	0.75	1.00				

Country and study	*Methodology*	*Price*	*Period*	*Average min*	*Average max*	*Peak min*	*Peak max*	*Off-peak min*	*Off-peak max*
The Netherlands (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2005-2006			0.33	0.79	-0.30	0.99
The Netherlands (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2008-2010			-4.36	4.56	-0.74	0.53
The Netherlands (Sijm et al. 2008)	Econometric OLS	Wholesale forward	2005			1.34		0.40	
The Netherlands (Sijm et al. 2008)	Econometric OLS	Wholesale forward	2006			1.10		0.38	
The UK (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2005-2006			0.83	1.12	0.57	1.66
The UK (Solier & Jouvet 2011)	Econometric autoregressive	Wholesale spot	2008-2010			2.83	3.69	-0.97	0.37
The UK (Bunn & Fezzi 2008)	Econometric VEAC	Wholesale spot	2005-2006	0.30					
The UK (PointCarbon 2008)	Out-turn power spreads scenarios		2008-2012	0.75	1.00				
Poland	Out-turn power		2008-2012	0.45	0.60				

Country and study	***Methodology***	***Price***	***Period***	***Average min***	***Average max***	***Peak min***	***Peak max***	***Off-peak min***	***Off-peak max***
(PointCarbon 2008)	spreads scenarios								
Portugal (Pereira Freitas & Pereira da Silva 2012)	Econometric Vector error correction model (VECM)		2008-2012	0.33	0.51				

Appendix C Detailed explanation on RISI data for cost structures

According to RISI definitions, wood is considered solid pulpwood excluding bark; recovered paper means recovered paper as raw material for pulping; market pulp includes chemical, mechanical, semi-chemical, de-inked and other pulps, which are sold in open competition with that of other producers; chemicals mean all the chemicals used in pulping and/or papermaking processes (these include, for example, pulping and bleaching chemicals, fillers, pigments, binders and additives). Wood fibre consumption is based on typical and/or known yields for the pulping process used at the mill. Several variables are considered when wood consumptions are calculated for pulp mills: amount of purchased chips; wood species used; debarking method; type of digester; cooking process; and bleaching sequence. Chemical consumption estimates are modelled for various processes involved in the manufacturing of pulp or paper such as: mechanical pulping, deinking, papermaking, chemical pulping, bleaching, drying, and water/wastewater treatment.

Energy costs comprise either purchased bark/waste, biofuels, coal, natural gas or oil. Energy costs are determined by the energy balance of the mill. The balance is made up of the consumption of the energy and co-generation capacity of the mill. Estimates for both fuel and electrical power consumption are based on the grade(s) produced and the process equipment used at the mill. The level of technology and technical age of the machines are also evaluated and the impact on energy efficiency is modelled. Each benchmarked mill is compared against external public references on an annual basis to validate the consumption values of the energy model.

Labour includes the work related costs of operators, maintenance, exempt and non-exempt personnel. Labour cost estimates for each pulp mill include hourly labour costs and salaried labour costs. There are two components for hourly labour costs: operations labour cost and maintenance labour cost. Three variables determine the level of cost for operations and maintenance labour: average regional wage rate, number of hours worked per year and number of days of operation per year. There are also two components for salaried labour costs: exempt labour cost and non-exempt labour cost. RISI breaks out salaried overtime-exempt labour and salaried non-exempt labour that is eligible for overtime because each employee type is paid differently, impacting the total cost to the mill. These costs have been developed on a per ton basis and then proportioned based on the product and fibre furnish at each mill.

Maintenance includes maintenance materials, operating supplies, contract maintenance and waste disposal. Material costs are estimated from benchmark data collected year-over-year which combines maintenance material costs, maintenance labour costs, and direct costs specific to the grades being produced. Materials include maintenance parts, contract maintenance, supplies, shipping materials, felts, wires and other incidental costs not included in other natural expense categories. RISI uses regional benchmark data on maintenance man-hours per ton to estimate maintenance costs for each mill. If a mill's actual maintenance man-hours per ton are above or below the benchmark average, an adjustment is made to the maintenance materials calculation to reflect the variance.[142]

RISI uses the existing macroeconomic and industry models, databases, surveys, and in-house expertise to evaluate major pulp, paper and paperboard grades capacity.[143] Grades include newsprint/directory, wood containing uncoated and coated papers, wood-free uncoated and coated papers, wrapping papers, tissue, cartonboard, containerboard and market pulp. Capacity indicates average annual production. Regional cash manufacturing cost average multiplied by regional capacity is considered the total value of the pulp, paper and paperboard production:

Value (€/Y) = Cash manufacturing cost (€/Tn) * Capacity (Tn/Y)

[142] For more details on RISI cost calculation methodology see: http://www.risiinfo.com/approach/methodology/benchmarking-methodology/

[143] For more details, please refer to RISI (2015) Methodology Business Impact Assessment Tool

Appendix D International comparison: Key data sources

D.1 Brazil

D.1.1 National trade data sources

Instituto Brasileiro de Geografia e Estatística (IBGE) http://www.ibge.gov.br/

System Of Analysis of Foreign Trade Information AliceWeb - Bureau of Foreign Trade, of the Ministry of Development, Industry and Foreign Trade http://aliceweb.desenvolvimento.gov.br/

D.1.2 Legislation

Government of Brazil – Legislation portal http://www4.planalto.gov.br/legislacao/legislacao-1/

D.1.3 Trade Associations and Federations

Brazilian Pulp and Paper Association (BRACELPA) http://bracelpa.org.br/

Founded in 1997 as the successor of the National Association of Pulp and Paper Manufacturers. The association is responsible for the institutional representation of the sector nationally and globally. BRACELPA's headquarters are in Sao Paulo, Brazil. BRACELPA members account for all the Brazilian pulp production and approximately 80% of the Brazilian paper production. Internationally, BRACELPA participates in the CICEPLA – Latin America Pulp and Paper Industrial Confederation, ICFPA and Advisory Committee on Paper and Wood Products from FAO/UN

Indústria Brasileira de Árvores (Ibá) http://iba.org/

The Brazilian Tree Industry (Ibá) is the association responsible for institutionally representing the planted tree production chain, from the field to the industry with its main stakeholders. The association was established in April/2014 and represents 61 companies and nine state entities that provide products obtained from planted trees, with special mention to wood panels and laminate flooring, pulp, paper, energy forests and biomass. The association also represents independent planted tree producers and institutional investors. Ibá unites the member-companies of the Association of the Wood Panels Industry (Abipa), the Brazilian Association of Manufacturers of Laminate Flooring (Abiplar), the Brazilian Association of Forests Plantation Producers (Abraf) and the Brazilian Pulp and Paper Association (Bracelpa).

Associação Brasileira da Indústria de Madeira Processadamecanicamente (ABIMCI). Brazilian Association for Mechanically Processed Timber http://www.abimci.com.br/

Founded in 1972, the Brazilian Association for Mechanically Processed Timber – ABIMCI unifies and represents companies linked to several segments and phases of the wood supply chain, such as reforestation (forestry) companies; wood industries (manufacturers of plywood, veneer, lumber, flooring, frames, doors and other products); suppliers of raw materials and machinery for the wood industry; agents and importers of wood products, distributors and retailers of wood products manufactured by associated companies in the logistics and customs clearance industry sector in addition to specialist press.

D.2 China

D.2.1 State and Trade Associations and Federations

State Forestry Administration: http://www.forestry.gov.cn/

Responsible for the protection, development, supervision and management of forest resources.

Chinese Academy of Forestry – Forest Research Institute. http://www.caf.ac.cn/

China Paper Association http://en.chinappi.org/

The China Paper Association (CPA) was formed in 1992 and is located in Beijing, China. CPA is a nationwide association of the paper industry. The association has more than 620 members, including companies, corporations, groups of companies, research institutes, colleges and universities and manufacturing organizations.

China Timber and Wood Products Distribution Association (CTWPDA) [formerly China Timber Distribution Association] http://www.cnwood.org/

China National Forest Product Industry Association (CNFPIA) http://www.cnfpia.org/

D.3 United States of America

D.3.1 Data sources

US Census Bureau http://www.census.gov/en.html

The Census Bureau is responsible for the Annual Survey on Manufactures (ASM); Statistics of US Businesses; Nonemployer statistics; and a large amount of other data. ASM provides information by manufacturing sector on value of shipments, cost of materials, employment, payroll for industries by state; more statistics at national level. The ASM provides estimates of statistics for all manufacturing establishments with one or more paid employee. Results are available via http://factfinder.census.gov/

US Bureau of Labour Statistics http://www.bls.gov/home.htm

The Bureau of Labor Statistics of the US Department of Labor is the principal Federal agency responsible for measuring labour market activity, working conditions, and price changes in the economy. Its mission is to collect, analyze, and disseminate essential economic information to support public and private decision-making.

International Trade Association TradeStatsExpress http://tse.export.gov/tse/TSEHome.aspx

National trade data for the US. Data can be presented according to different classification systems: Harmonized System (HS); Standard International Trade Classification (SITC); North American Industry Classification System (NAICS).

D.3.2 Trade Associations and Federations

American Forest and Paper Association (AF&PA) http://www.afandpa.org/

The American Forest and Paper Association (AF&PA) is the nationwide trade association of the forest products industry and enhances public policies that promote a strong and sustainable US forest products industry in the global arena. AF&PA's member enterprises account for more than 75% of the US's pulp, paper-based packaging and wood building materials.

Technical Association of Pulp and Paper Industry (TAPPI) http://www.tappi.org/

As an ANSI-Certified Standards development organization, TAPPI's peer-reviewed standards ensure that products meet industry recognized best practices.

Economic, Statistics and Life Cycle Analysis (ESLCA) Research Unit of Forest Products Laboratory (FPL), USDA Forest Service http://www.fpl.fs.fed.us/index.php

The ESLCA Research Unit of the FPL provide analysis of the national economic outlook and statistics for the forest products sector.

Appendix E Cross-correspondence between NACE Rev. 2 and ISIC 3.1 classifications

ISIC 3.1 Code	ISIC 3.1 Title	NACE Rev. 2 Class	NACE 2 Title	Notes
NACE Rev. 2 Division 16 / ISIC Rev. 3.1 Division 20: Manufacture of wood and of products of wood and cork, exceptfurniture; manufacture of articles of straw and plaiting materials				
2010	Sawmilling and planing of wood	16.10	Sawmilling and planing of wood	
2021	Manufacture of veneer sheets and wood-based panels	16.21	Manufacture of veneer sheets and wood-based panels	
2022	Manufacture of builders' carpentry and joinery	16.22	Manufacture of assembled parquet floors	
		16.23	Manufacture of other builders' carpentry and joinery	
2023	Manufacture of wooden containers	16.24	Manufacture of wooden containers	
2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	16.29	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	Manufacture of various wood products, fire logs etc.
1920	Manufacture of footwear			Manufacture of wooden shoe parts (e.g. heels)
NACE Rev. 2 Division 17 / ISIC Rev. 3.1 Division 21: Manufacture of paper and paper products				
2101	Manufacture of pulp, paper and paperboard	17.11	Manufacture of pulp	
		17.12	Manufacture of paper and paperboard	
2102	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	17.21	Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	
2109	Manufacture of other articles of paper and paperboard	17.22	Manufacture of household and sanitary goods and of toilet requisites	
		17.23	Manufacture of paper stationery	
		17.24	Manufacture of wallpaper	
		17.29	Manufacture of other articles of paper and paperboard	
1729	Manufacture of other textiles n.e.c.	17.22	Manufacture of household and sanitary goods and of toilet requisites	Manufacture of textile wadding and articles of wadding: sanitary towels, tampons etc.
2221	Printing	17.23	Manufacture of paper stationery	Printed registers, accounting books, albums etc.
3699	Other manufacturing n.e.c.	17.29	Manufacture of other articles of paper and paperboard	Manufacture of paper novelties

Appendix F Differences between North American Industry Classification System (NAICS) and ISIC Rev. 3.1

Appendix C Table 1. Differences between NAICS class 321 (Wood product manufacturing) and ISIC Rev. 3.1 Division 20 (Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials) (n.e.c.: not elsewhere classified).

2002 NAICS US Code	2002 NAICS US Title	ISIC 3.1	ISIC 3.1 Title	Notes
Codes from other than NAICS 321 included in ISIC Division 20				
113310	Logging	2010	Sawmilling and planing of wood	production of wood chips in the forest, portable chipper mills
324199	All Other Petroleum and Coal Products Manufacturing	2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	fire logs made of pressed wood and purchased refined petroleum binders
337215	Showcase, Partition, Shelving, and Locker Manufacturing	2022	Manufacture of builders' carpentry and joinery	wood partitions (except free-standing)
337920	Blind and Shade Manufacturing	2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	wooden window blinds and curtain and drapery rods and fixtures
339113	Surgical Appliance and Supplies Manufacturing	2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	cork life preservers
339942	Lead Pencil and Art Good Manufacturing	2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	frames for artists' canvases
339950	Sign Manufacturing	2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	wooden signs
339991	Gasket, Packing, and Sealing Device Manufacturing	2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	cork gaskets
339999	All Other Miscellaneous Manufacturing	2029	Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials	wooden mirror and picture frames
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance	2023	Manufacture of wooden containers	repairing or reconditioning wooden pallets, shipping drums or barrels, and similar items
Codes from other than ISIC 20 included in NAICS 321				
321912	Cut Stock, Resawing Lumber, and Planing	3699	Other manufacturing n.e.c.	blocks for the manufacture of smoking pipes
321999	All Other Miscellaneous Wood Product Manufacturing	1920	Manufacture of footwear	wood heels
321999	All Other Miscellaneous Wood Product Manufacturing	2520	Manufacture of plastics products	plastic shoe lasts
321999	All Other Miscellaneous Wood Product Manufacturing	3699	Other manufacturing n.e.c.	handles for umbrellas, canes and similar

Source: UN Statistics Division

Appendix C Table 2. Differences between NAICS class 322 (Paper manufacturing) and ISIC Rev. 3.1 Division 21 (Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials) (n.e.c.: not elsewhere classified).

2002 NAICS US Code	2002 NAICS US Title	ISIC 3.1	ISIC 3.1 Title	Notes
Codes from other than NAICS 322 included in ISIC Division 21				
339944	Carbon Paper and Inked Ribbon Manufacturing	2101	Manufacture of pulp, paper and paperboard	bulk carbon paper or stencil paper in rolls or large sheets
323110	Commercial Lithographic Printing	2109	Manufacture of other articles of paper and paperboard	lithographic printing on purchased labels or tags
323111	Commercial Gravure Printing	2109	Manufacture of other articles of paper and paperboard	gravure printing on purchased labels or tags
323112	Commercial Flexographic Printing	2109	Manufacture of other articles of paper and paperboard	flexographic printing on purchased labels or tags
323113	Commercial Screen Printing	2109	Manufacture of other articles of paper and paperboard	screen printing on purchased labels and tags
323119	Other Commercial Printing	2109	Manufacture of other articles of paper and paperboard	other printing on purchased labels and tags
339944	Carbon Paper and Inked Ribbon Manufacturing	2109	Manufacture of other articles of paper and paperboard	ready to use carbon paper, duplicator stencils, etc.
339991	Gasket, Packing, and Sealing Device Manufacturing	2109	Manufacture of other articles of paper and paperboard	paper or paperboard gaskets made from purchased paper
Codes other than ISIC 21 included in NAICS 322				
322222	Coated and Laminated Paper Manufacturing	1729	Manufacture of other textiles n.e.c.	pressure-sensitive cloth tape
322291	Sanitary Paper Product Manufacturing	1729	Manufacture of other textiles n.e.c.	manufacturing sanitary paper products, such as tampons and napkins, from purchased textile fibers
322222	Coated and Laminated Paper Manufacturing	2520	Manufacture of plastics products	plastic wallpaper made from purchased plastic, plastics self-adhesive tapes and similar
322121	Paper (except Newsprint) Mills	2699	Manufacture of other non-metallic mineral products n.e.c.	tar paper made in paper mills
322221	Coated and Laminated Packaging Paper and Plastics Film Manufacturing	2720	Manufacture of basic precious and non-ferrous metals	laminating purchased foil and paper for packaging uses, foil as primary component
322222	Coated and Laminated Paper Manufacturing	2720	Manufacture of basic precious and non-ferrous metals	precious metal foil laminates made from purchased foil, aluminum foil laminates made from purchased aluminum foil as primary component
322225	Laminated Aluminum Foil Manufacturing for Flexible Packaging Uses	2720	Manufacture of basic precious and non-ferrous metals	aluminum foil packaging laminates made from purchased foil, tinfoil packaging laminates made from purchased tinfoil
322223	Plastics, Foil, and Coated Paper Bag Manufacturing	2899	Manufacture of other fabricated metal products n.e.c.	foil bag manufacturing
322299	All Other Converted Paper Product Manufacturing	3699	Other manufacturing n.e.c.	paper novelties made from purchased paper

Source: UN Statistics Division

Appendix G International comparison: List of contacts for questionnaire and interview invitations

All those listed were invited by email to contribute to the on-line questionnaire and attempts were been made to establish contact by phone.

Country	Organisation	Status as of 03/29
Brazil	Brazilian Pulp and Paper Association (BRACELPA) / Brazilian Tree Industry (Ibá)	called 03/23 referred to consultants
Brazil	STCP Engenharia de Projetos Ltda	++ called 03/23
Brazil	Brazilian Agricultural Research Enterprise (EMBRAPA)	no response
Brazil	Universidade Estadual de Santa Cruz	+++
Brazil	Universidade Brasilia	
Brazil	Instituto de Biodiversidade e Florestas, Universidade Federal do Oeste do Para	+++
Brazil	Forestry Science and Research Institute	
Brazil		++
Brazil	Universidade Federal de Santa Maria	
Brazil	Universidade Federal de Viçosa	
Brazil	ABIMCI - Association for Mechanically Processed Timber	
Brazil	American Hardwood Export Council	
China	China Paper Association	
China	Forestry Economics and Development Research Center, State Forest Administration	
China	China National Forestry Industry Association	
China	China National Forestry Industry Association	++
China	China Timber and Wood Products Distribution Association	
China	China Timber and Wood Products Distribution Association	++
China	Shanghai timber industry association	+++
China	Guangdong timber industry association	
China	State Forestry Administration	
China	China National Furniture Association	
China	Beijing Forestry University, School of Economics and Management	+++
China	Wood Markets	
China	Wood Markets	
China	Canada Wood China	

China	American Hardwood Export Council	
China	Lumber Liquidators / University of Washington	
USA	American Forest and Paper Association	++
USA	Forest Products Laboratory, USDA Forest Service	
USA	Forest Products Laboratory, USDA Forest Service	-
USA	Hardwood Federation	++
USA	Center for International Trade in Forest Products (CINTRAFOR) University of Washington	
USA	Southern Research Station, USDA Forest Service	+++
USA	American Hardwood Export Council	+++

-: declined; + telephone interview promised; ++: questionnaire reply promised; +++questionnaire return fulfilled (either by correspondence or through interview)

Appendix H International comparison: Online survey for companies, federations, associations and industry experts

Survey on key factors affecting costs of the Forest-Based Industries

(F-BI: i.e. woodworking, pulp & paper manufacturing industries and their sub-sectors)

Please indicate from what **perspective** you are replying this to questionnaire:

1. from the point of view of a sector (e.g. as a sectoral expert)
2. from the point of view of an association
3. from the point of view of a company

From the perspective of what **country** is this reply: (please select one country)

i. Brazil
ii. China
iii. USA

Please focus your survey contribution on one **sector or sub-sector**. You are most welcome to cover additional (sub-)sector(s) with a separate questionnaire reply.

Please select the (sub-)sector that is the subject of this questionnaire reply:

1. **Woodworking sector**
   (a) Sawnwood sub-sector
   (b) Wood-based panels sub-sector
   (c) Other builders' carpentry and joinery sub-sector
   (d) Wooden containers & packaging sub-sector
2. **Pulp, paper and paper products manufacturing sector**
   (a) Pulp production sub-sector
   (b) Manufacture of paper & paperboard sub-sector
   - Graphic paper sub-sector
   - Packaging paper and paperboard sub-sector
   - Household and sanitary paper sub-sector
   - Other paper & paperboard grades sub-sector

Impacts on investments and innovation

What are the key current and future drivers or barriers for investment and innovation for your sector in your country (e.g. interest rates, loan securities, subsidies, tax shelters, market growth, RDTI support)?

	Current	Future
drivers/stimulators		
barriers/blockages		

Sectoral Structure

Are there any factors related to the size-class structure of the F-BI sectors you have indicated above which could influence the performance /competitiveness of companies? (e.g. predominance of multinationals/SMEs etc.)

How do you expect company size distribution of those (sub-) sectors will change in the next ten years? What are the main factors that are driving this change?

Breakdown of key cost components and cost structures

If answering from the point of view of a company, please specify the number of employees in your company

Presentation of the overall cost structure of the specified (sub-)sectors. From your perspective, please provide an indicative level (%) of cost structure for the following cost categories: (Even rough estimates of percentages are OK).

Cost segment	**Indicative share of total production costs:**
-. raw materials (e.g. wood, pulp, chemicals)	
-. operating and maintenance costs	
-. labour costs	
-. energy costs (e.g. heat, steam, electricity)	
-. transport and fuel costs	
-. capital costs (fixed one-time expenses)	
-. other costs	
	∑ = 100 %

If possible, please specify the total average production cost per cubic metre or metric tonne of product produced? (that is including all types of costs as specified above) (indicate currency)

	Value	**Currency**	**/ Unit (Mt or m3)**
Total average production cost per output unit			

Do companies in your sector differentiate their products for different markets (e.g. local vs. EU market), in view of existing differences in regulations and policies (e.g. local vs. EU)? If so, to what extent?

1. No
2. Yes. Please explain to what extent:

In your view what are the primary costs that are affected by legislation and to what extent?

Cost category	I don't know	A cost decrease	No cost change	A cost increase	Please add any details if possible:
-raw materials (e.g. wood, pulp, chemicals)					
-operating and maintenance costs					
-labour costs					
-energy costs (e.g. heat, steam, electricity)					
-transport and fuel costs					
-capital costs (fixed one-time expenses)					
-other costs					

In the following table, can you identify specific legislation or categories of legislation which are likely to have a significant cost impact for companies?

Policy category	**Significant impact**	**No significant impact**	**Don't know**	**Please explain**
1. Climate Policy (e.g. LULUCF)				
2. Energy Policy				
2. Environmental Policy (e.g. relating to air and water quality, phytosanitary, environmental liability, or waste related)				
3. Forest-related Policy (e.g. FLEG-T policy such as EU Timber Regulation, Lacey Act etc.)				
4. Employment Policy (e.g. relating to workers health and safety, working time limits etc.)				
5. Products Policy (e.g. ecolabels, product safety rules etc.)				

6. Transport (e.g. quarantine regulations, road safety, transport vehicle emission limits etc.)				
7. Trade (e.g. WTO rules, trade defence or trade defence mechanisms, quarantine rules etc.)				

Is EU regulation/legislation harder (e.g. costlier and/or more administratively burdensome) to comply with for companies in your sector than other trade destinations? Please explain.

Do you expect **domestic (i.e. Brazil, China, USA) regulatory impacts** to change for your sector in the coming years? [Please mark your selection in colour].

1. increase a lot
2. increase a bit
3. stay the same
4. decrease a bit
5. decrease a lot

Considering your answer in the previous question, If possible, explain and give details:

Do you expect **EU regulatory impacts** to change for your sector in the coming years? [Please mark your selection with colour].

1. increase a lot
2. increase a bit
3. stay the same
4. decrease a bit
5. decrease a lot

Considering your answer in the previous question, If possible, explain and give details:

Please let us know if you have any comments or suggestions relating to this questionnaire or concerning the topic of our study in general.

Thank you for participating!

Appendix I Company size-class distribution of the ORBIS query result.

Country	**Company size category**				**Total**
	Very large	*Large*	*Medium sized*	*Small*	
Brazil	9	15	23	52	99
China	44	119	152	98	413
USA	27	34	15	23	99
Total	80	168	190	173	611

Note: The QuestionPro e-mail tracking functionality allowed monitoring how many of the emails were actually delivered to the intended recipients. Numbers in the above table correspond to the number of active, functional email addresses.

Appendix J Comparison of the US Lacey Act Amendment, EU Timber Regulation, Australian Illegal Logging Prohibition Act

	US Lacey Act Amendment	*EU Timber Regulation*	*Australian Illegal Logging Prohibition Act*
Entry into force	22 May 2008	3 March 2013	30 November 2012
Regulated parties	Applies to all operators	Applies to the "first placer" of products on the EU market	Applies to importers and processors
Due diligence	Lacey Act import declaration for certain species, otherwise no imposed system	Obligation to follow a due diligence system	Obligation to comply with a due diligence system
lMonitoring body	No body providing systems/procedures	Recognised Monitoring Organisations	No body providing systems/procedures
Definition of legality	Unlawful to import, export, transport, sell, receive, acquire, purchase interstate or from foreign country plants in violation of state or foreign law	Illegally harvested= harvested in violation of the legislation in force in the country of harvest	Illegal wood= wood harvested in contravention of laws in force in the place of harvest
Key requirements	Declaration form No obligation of "due care" Up to the government to prove illegality	Mandatory due diligence: • Provide information • Risk assessment • Risk mitigation	Mandatory due diligence: • Gather information • Risk assessment • Risk mitigation • Custom declaration • Statement of compliance • Auditing
VPA[1] / CITES[2]	VPAs / CITES not considered	VPAs / CITES proof of compliance	VPAs / CITES not considered
Product scope	Applies to plants and products derived from plants	Applies to wood and wood products	Applies to wood
Sanctions	• Forfeiture of goods and vessels • Fines • Jail time	• Fines • Seizure of the wood • Suspension of authorisation to trade	• Seizure, forfeiture • Fines • Jail time
Role of certification	No preferential role for certification	Minor to no role for certification (risk assessment/mitigation)	No preferential role for certification

[1] Voluntary Partnership Agreements are a specific legal instrument of the EU Timber Regulation. They are a legally binding trade agreement between the European Union and a wood-producing country outside the EU; [2] Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Source: modified after CEPI.

Appendix K Summary table for Brazil

Policy area	Policy name	Date		Cost area	Cost impact
Environment	National Environmental Policy	1981	Areas covered by the NEP include: definition of standards, licensing, environmental impact assessments, establishing special areas for preservation, incentives for cleaner production, and environmental zoning	Cost/Availability of raw materials	↗
	Water Resources Policy	1997	Protection of Brazil's river basins and the natural vegetation	Cost/Availability of raw materials	↗
	Environmental Crimes Law	1998	Establishment of criminal penalties for those found guilty of committing environmental crimes.	Cost/Availability of raw materials	↗
Forest-related	Forest Code of 1965 (amended in 2012)	1965 (latest amendment 2012)	The 2012 law regulates and restricts activities in specifically environmentally protected areas. The 1965 law established that 50% of rural land should be maintained as forest (legal reserves) and prohibited the clearing of natural vegetation in sensitive areas.	Cost/Availability of raw materials	↗
	Decree 3179 on penalties for forest crimes	1999	Regulating the application of penalties for forest crimes	Cost/Availability of raw materials	↗
	Decree 3420	2000	Creation of the national forest programme. The aims of the NFP aims are to: (1) promote and implement sustainable forest development; (2) protect biodiversity of forest ecosystems; (3) harmonize sustainable forest development with sectoral policies and other sectors; (4) institutional development, with the Federal Government playing a key role in the coordination and modulation of activities. Specific objectives include: ensuring the production of raw materials to meet the needs of the domestic and external markets; and boosting the supply of forest products and by-products, restoring degraded areas, reducing waste, introducing technologies and new markets and promoting employment and income.	Cost/Availability of raw materials	↗
	Agriculture and Livestock Plan 2011-2012	2011	The Agriculture and Livestock plan aims to increase agriculture production (including the area of forest plantations) and encouraging environmentally sustainable practices.	Cost/Availability of raw materials	
Trade	Brasil Maior	2011	The plan Brasil Maior aims to foster innovation and competitiveness in the Brazilian economy. It focuses on strengthening production processes, developing technological and entrepreneurial skills, improving energy supply, diversifying exports and increasing internationalization, and developing competences for sustainable development. The plan targets specific productive sectors [including the pulp, paper and paperboard sector], and it deals with cross-cutting issues such as international trade, investment, innovation, technical and vocational training, sustainable production, small and medium enterprises'	Cost/Availability of capital	↘

			competitiveness, special initiatives for regional development, customers' well-being, labour conditions and relations.		
	Brazilian Export Strategy	2008	The document provides a diagnostic analysis of the current export performance of Brazilian economy and it outlines a strategy aiming to increase exports and meet the targets contained in the national productive development policy. The strategy envisages five main objectives: 1) increase competitiveness of Brazilian exporters; 2) increase exports added-value; 3) increase the number of exporters; 4) increase access to foreign markets; 5) increase exports of services.	Cost/Availability of capital	↘

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

Appendix L Summary table for China

Policy area	Policy name	Date	Notes	Cost area	Cost impact
Environment	Wildlife Conservation and Nature Reserve Development Programme		The WCNRDP targeted conservation of species and habitats. Between 2001 and 2006, 831 natural reserves were created and 19.5 million ha of forest and other sites were protected. By 2010, the number of reserves was predicted to reach 1800 (16% of the total land area) with 220 national nature reserves.	Cost/Availability of raw materials	↗
Forest-related	Forestry Law	1984	Enacted with a view to protecting, cultivating and rationally exploiting forest resources, accelerating territorial afforestation and making use of forests in water storage and soil conservation, climate regulation, environmental improvement and supply of forest products to meet the requirements of socialist construction and people's livelihood.	Cost/Availability of raw materials	↘
	The Natural Forest Protection Programme	1998	Affecting logging restrictions, protected areas, replanting, and a range of other policies aimed at protecting China's forests and reducing the risk of erosion and flooding	Cost/Availability of raw materials	**?**
	Conversion of Agricultural Land to Forests and Grasslands (Grain for Green)	1999	Initiated in 1999 in order to combat deforestation, ecological degradation and soil erosion resulting from over-cultivation. At the 16th Party Congress in 2002, the GFG programme was expanded to a nation-wide programme. Some 151.36 billion yuan was committed to the programme. The grain-for-green policy aimed to move 15 million ha of low-yield farmland to forest and to afforest another 17 million ha of barren land. The programme was suspended in 2007. By 2008, 8.2 million ha of cropland had been converted to forest through the programme.	Cost/Availability of raw materials	↘
	China National Action Programme To Combat Desertification	1994-	China signed UN Convention to Combat Desertification in 1994 and ratified the convention in 1997. The first national action programme was published in 1996. An update was issued in 2005. The long-term objective (-2050) is to establish 34 million ha of forest and grassland, 1.8 million ha of forest shelterbelts, enclose a further 19 million ha of desert to enable regeneration of forest and grassland.	Cost/Availability of raw materials	↘
	Key Shelterbelts Programme	1978	The program was planned initially for the period (1978-2050) in 8 phases. The total planned investment was 7.68 billion yuan and 35.08 million ha of afforestation was planned. By the end of 2008, a total 24.47 million ha afforestation had been conserved by the program	Cost/Availability of raw materials	↘
Trade	China Timber Legality Verification Scheme (CTLVS)	n.a.	In order to meet the new requirements set by the Lacey Act Amendment and the EU Timber Regulation, China is in the process of implementing the China Timber Legality Verification Scheme (CTLVS)	Cost/Availability of raw materials	↗

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

Appendix M Summary table for US

Policy area	Policy name	Date	Notes	Cost area	Cost implication
Climate and Energy	Clean Power Plan	2015	Cut harmful pollution from the power sector by 32% below 2005 levels and smog-and soot-forming emissions that threaten public health by 20%. States are free to reduce emissions by various means and must present their plans to do so to the Environmental Protection Agency by September 2016 (with possible extension to September 2018). If they do not do so, the EPA will impose a plan for the state.	Energy costs	Energy costs ↗ Potential for F-BI industries to make money from production of renewable energy ?
Environment	Endangered Species Act	1973	protection of endangered species and habitats	Cost/Availability of raw material	↗
	Clean Air Act	1970 -	The CAA of 1970 initiated four important regulatory programmes: the National Ambient Air Quality Standards (NAAQS); State Implementation Plans (SIPS); New Source Performance Standards (NSPS); and National Emission Standards for Hazardous Air Pollutants (NESHAPs)	Capital and Operational costs	↗
	Clean Water Act	1972	Affecting disposal of waste products	Capital and Operational costs	↗
	Safe Drinking Water Act	1974	Affecting disposal of waste products	Capital and Operational costs	↗
	Resource Conservation and Recovery Act	1976	Affecting disposal of waste products	Capital and Operational costs	↗
	Comprehensive Environmental Response, Compensation, and Liability Act	1980	Affecting disposal of waste products	Capital and Operational costs	↗
Forest-related	National Forest Management Act	1976	NFMA requires that publicly owned (federal and state) forests are managed in a way that gives due consideration to forest ecosystem services other than wood production	Cost/Availability of raw material	↗
Labour	Patient Protection and Affordable Care Act (PPACA, 'Obamacare')	2010	Aims to increase the affordability and availability of health care and to keep the costs of health care down. Employers with ≥50 full-time employees must offer health insurance to full-time workers by 2015-2016. (*) Costs of healthcare for employers have increased as employers ensure that their and insurance companies have increased premiums to prepare for the impacts of the Act (**) In the long-term, the act aims to keep the cost of health insurance down, and the longer term impacts for employers are less clear	Labour	↗ (*) ? (**)
Trade	Trans-Pacific Partnership (TPP)	2016	TPP is a trade agreement between 12 Pacific Rim countries (including the United States) – some of which already had bilateral trade agreements with the United States	Reduced tariffs on raw materials and products	↘?

	Transatlantic Trade and Investment Partnership (TTIP)	Not yet in force	TTIP is a proposed trade and investment agreement under negotiation between the United States and the EU, with the aim of liberalizing liberalising trade and promoting economic growth	Reduced tariffs on raw materials and products	↘?

Legend: ↗ : cost increase ; ↘ : cost decrease ; → : no significant cost implication ; ? : cost impact uncertain

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