



MANAGEMENT QUALITY AND CARBON PERFORMANCE OF PAPER PRODUCERS: A COMMENTARY

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EXECUTIVE SUMMARY

The TPI and this report

The Transition Pathway Initiative (TPI) is a global, asset owner-led initiative, supported by asset owners and managers with over £5/\$6.5 trillion of assets under management. The initiative assesses how companies are preparing for the transition to a low-carbon economy.

This report contains our assessment of the management quality and carbon performance of 19 of the largest paper producers globally.

Management quality refers to the quality of companies' governance/management of their greenhouse gas emissions and of risks and opportunities related to the low-carbon transition.

Carbon performance refers to how paper companies' emissions intensity of production compares with the international targets and national pledges made as part of the UN Paris Agreement on climate change.

Management quality

Our management quality assessment rates companies on 14 indicators, including whether the company has a policy on climate change, the extent of its emissions disclosures and targets, and whether climate change is demonstrably a boardroom issue. Companies are placed on a staircase comprising five levels, from 0 to 4.

We find paper companies on all five levels (see Figure ES1), from Unaware of (or not Acknowledging) Climate Change as a Business Issue (Level 0), through to Strategic Assessment (Level 4).

The companies with the lowest management quality score are Lee & Man Paper Manufacturing, and Nine Dragons Paper Industries. They are on Level 0.

The companies with the highest management quality are International Paper, Sappi and Stora Enso. They are on Level 4. Stora Enso is the only company satisfying all 14 criteria.

Compared with other sectors, paper producers are weak on having operational (Scope 1 and 2) emissions verified, as well as on incorporating environmental, social and governance issues in executive remuneration. On the other hand, proportionally more companies in the paper sector have reduced their Scope 1 and 2 emissions over the last 3 years than in any other sector assessed by TPI so far.

The average score of the 19 paper producers is 2.1, putting the average company in this sector in the middle of the staircase: Level 2, Building Capacity. This is very close to the average score of all 138 companies across 7 sectors that have been assessed by TPI so far, which is 2.2.

Carbon performance

To assess the carbon performance of these paper producers, we translate greenhouse gas emissions targets made at the international level into paper-sector benchmarks, based on modelling from the International Energy Agency. Our two benchmarks are:

1. A *2 Degrees* scenario, commensurate with the overall aim of the Paris Agreement to limit global warming to below 2°C.
2. A *Paris Pledges* scenario, reflecting the global aggregate of emissions reductions actually pledged by countries as part of the Paris Agreement in the form of Nationally Determined Contributions or NDCs.

Seven out of the 11 paper producers disclosing sufficient data have been aligned with the benchmarks over the period 2013 to 2016, meaning that their emissions intensity of paper production has been lower than the benchmarks in recent years (Table ES1). They are: Domtar; CMPC; Fibria Celulose; Hokuetsu Kishu Paper; Stora Enso; Suzano Papel e Celulose; and UPM-Kymmene.

The remaining 4 companies have had higher carbon intensity and have therefore not been aligned. They are International Paper, Mondi, Nippon Paper Industries and Sappi.

Eight companies make insufficient disclosures for us to estimate their carbon performance using our chosen metric of Scope 1 and 2 greenhouse gas emissions per unit of pulp, paper and paperboard production. Across the sector, inconsistent and incomplete reporting of emissions and production volumes is a particular challenge.

We estimate companies' future carbon intensity on the basis of quantitative targets they have set themselves to reduce emissions (Table ES1 and Figure ES2). Only 7 out of 19 companies have set such targets. Only 3 of these targets extend beyond 2020, making it difficult to form a clear view of the direction of carbon performance in the paper sector.

In 2020, 3 out of the 7 companies with targets are aligned with the 2 Degrees benchmark: Domtar, Stora Enso and UPM-Kymmene. International Paper is aligned with the Paris Pledges benchmark, but its carbon intensity is too high to be aligned with 2 Degrees.

In 2030, 2 out of the 3 companies with targets extending this far are aligned with 2 Degrees: Stora Enso and UPM-Kymmene. Mondi remains above the benchmarks.

Figure ES1 Management quality of top global paper producers

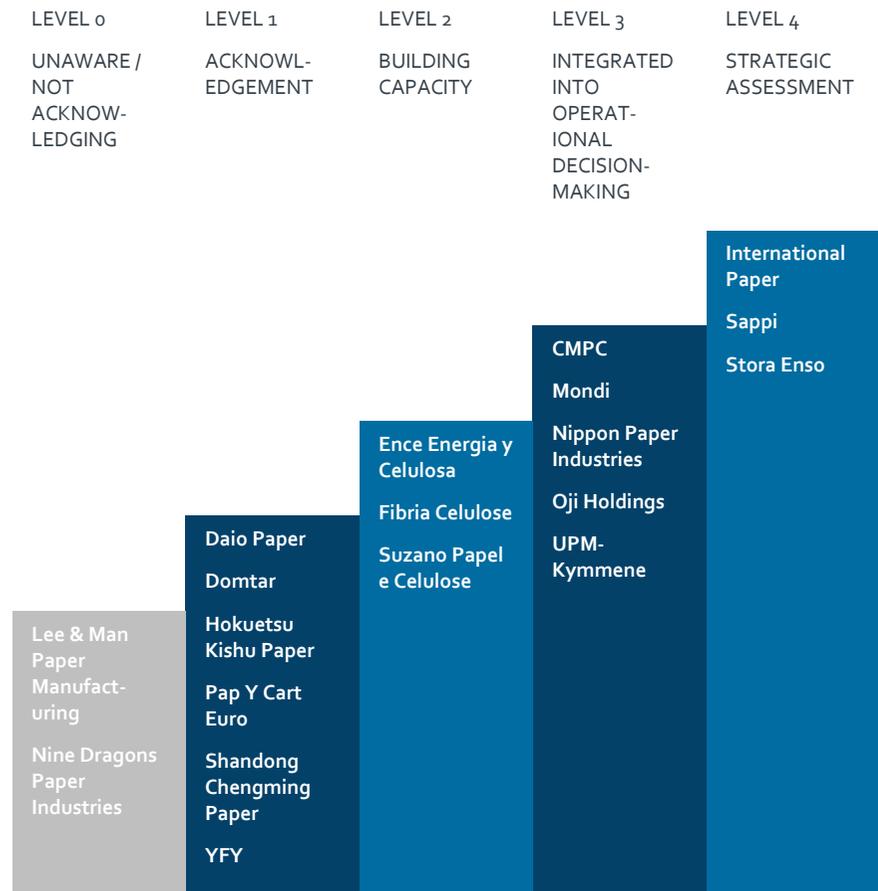
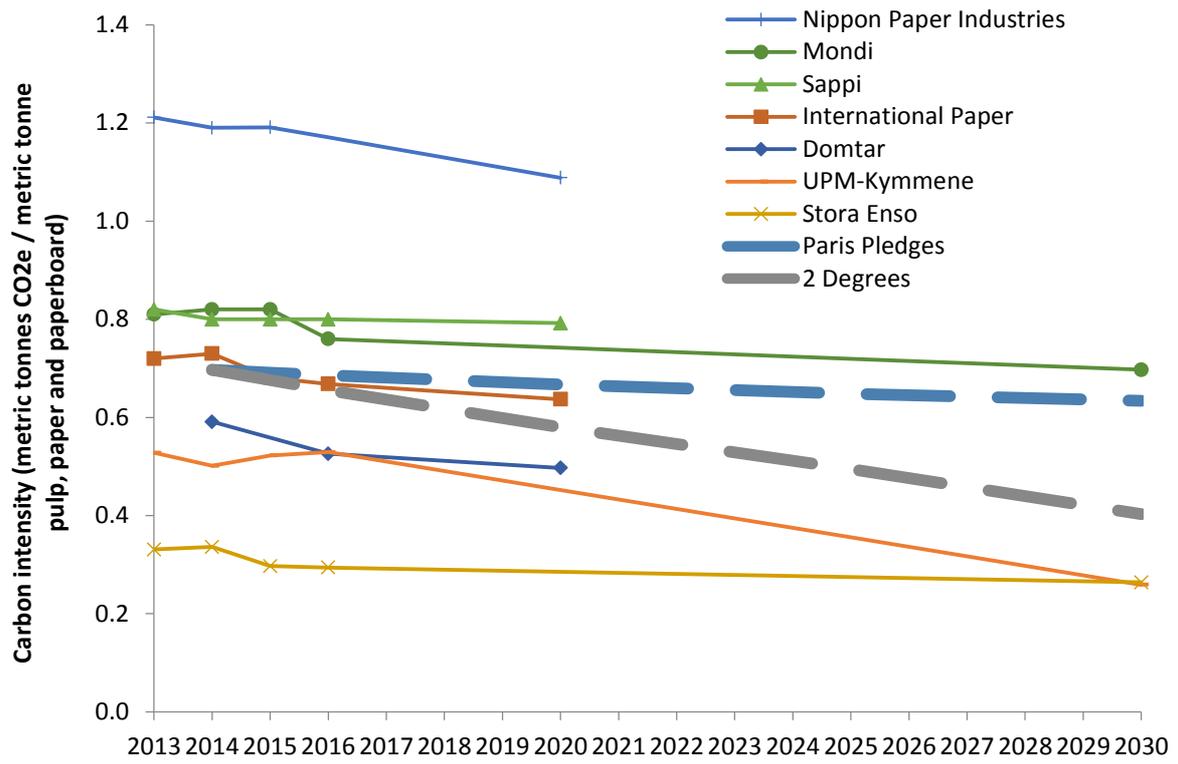


Table ES1 Carbon performance of top global paper producers

Company	Carbon intensity (t CO ₂ e / t pulp, paper and paperboard)					
	2014	2015	2016	2020	2025	2030
Daio Paper	No data					
Domtar	0.591		0.526	0.497		
CMPC	0.473	0.381				
Ence Energia Y Celulose	No data					
Fibria Celulose	0.256	0.247	0.241			
Hokuetsu Kishu Paper	0.393	0.389				
International Paper	0.730	0.681	0.668	0.637		
Lee & Man Paper Manufacturing	No data					
Mondi	0.820	0.820	0.760	0.742	0.720	0.697
Nine Dragons Paper Industries	No data					
Nippon Paper Industries	1.190	1.191	1.189	1.088		
Oji Holdings	No data					
Pap Y Cart Euro	No data					
Sappi	0.800	0.800	0.800	0.792		
Shandong Chenming Paper	No data					
Stora Enso	0.336	0.297	0.294	0.285	0.275	0.264
Suzano Papel e Celulose		0.226	0.223			
UPM-Kymmene	0.501	0.523	0.529	0.452	0.356	0.259
YFY	No data					
2 Degrees	0.697	0.676	0.656	0.580	0.495	0.403
Paris Pledges	0.697	0.691	0.686	0.667	0.648	0.634
Key	Aligned with 2C		Aligned with Paris Pledges only		Not aligned	

Figure ES2 Emissions intensity paths for companies with targets



1. INTRODUCTION

1.1. The Transition Pathway Initiative

The TPI is a global, asset owner-led initiative, supported by asset owners and managers with over £5/\$6.5 trillion of assets under management. The initiative assesses how companies are preparing for the transition to a low-carbon economy. The analysis is in two parts:

1. *Management Quality*: TPI evaluates and tracks the quality of companies' management of their greenhouse gas emissions and of risks and opportunities related to the low-carbon transition. Companies are assigned to one of five levels, from level 0 ("Unaware of, or not Acknowledging, Climate Change as a Business Issue") to level 4 ("Strategic Assessment"), based on how they perform against 14 criteria.
2. *Carbon Performance*: TPI also evaluates how companies' recent and future carbon performance might compare to the international targets and national pledges made as part of the Paris Agreement. This is the subject of this methodology note.

TPI publishes the results of this analysis through an online tool that is publicly available and free to use and is hosted by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics (LSE). The tool can be accessed at <http://www.transitionpathwayinitiative.org>.

TPI encourages investors to use the data, indicators and online tool to inform their investment research, decision-making, engagement with companies, proxy voting and dialogue with fund managers and policy makers, bearing in mind the Disclaimer that can be found in Section 5.

1.2. About this report and the companies assessed

This report discusses the results of TPI's assessment of the management quality and carbon performance of 19 of the world's largest paper producers, by market capitalisation.¹

The companies that it assesses are set out in Table 1. Companies are listed in 10 different countries, with 4 based in Japan and 3 in China. The American paper producer International Paper is by far the largest paper producer, with a market capitalisation in excess of \$23 billion as of October 2017. Only 2 other companies in the sample have a market capitalisation in excess of \$10 billion (Mondi and UPM-Kymmene), while the market capitalisation of 6 companies is less than \$1 billion.

¹ Companies are drawn from the Paper subsector, as identified by Industry Classification Benchmark (ICB).

Table 1 Paper producers covered in this report, further details

Company	Country	Investibility-weighted ² market capitalisation (USD millions)
Daio Paper	Japan	858
Domtar	United States	2,667
CMPC	Chile	2,949
Ence Energia y Celulosa	Spain	619
Fibria Celulose	Brazil	3,019
Hokuetsu Kishu Paper	Japan	881
International Paper	United States	23,017
Lee & Man Paper Manufacturing	China	1,982
Mondi	United Kingdom	10,085
Nine Dragons Paper Industries	China	3,289
Nippon Paper Industries	Japan	1,779
Oji Holdings	Japan	4,739
Pap Y Cart Euro	Spain	458
Sappi	South Africa	3,697
Shandong Chenming Paper	China	844
Stora Enso	Finland	8,033
Suzano Papel e Celulose	Brazil	2,609
UPM-Kymmene	Finland	14,545
YFY	Taiwan	538

The results of the assessment are also available to browse on the TPI's online toolkit, at <http://www.transitionpathwayinitiative.org>. This report provides a more detailed analysis of the results, as well as a commentary.

² Using the FTSE Russell free-float methodology, as of 6 October 2017.

2. AN OVERVIEW OF THE METHODOLOGY

2.1. Management quality³

In practice, companies tend to implement their carbon management systems and processes in a relatively staged and structured manner. They often start by publicly acknowledging the relevance of climate change to their business and developing a high-level policy or statement. They then tend to set some relatively short-term, process-oriented targets, before progressively extending the duration and stringency of their targets, and defining these in a more precise, quantitative way. A similar phenomenon is often seen in reporting: companies tend to start by reporting on the operational (or Scope 1 and 2) carbon emissions from part of their business, and then progressively extend this reporting to apply to more of the business and, in time, to cover some of the emissions from their supply chains and from the use of their products (Scope 3 emissions).

Accordingly, TPI's management quality framework tracks the progress of companies through the following five levels:

- **Level 0 – Unaware of (or not Acknowledging) Climate Change as a Business Issue.**
- **Level 1 – Acknowledging Climate Change as a Business Issue:** the company acknowledges that climate change presents business risks and/or opportunities, and that the company has a responsibility to manage its greenhouse gas emissions. This is often the point where companies adopt a climate change policy.
- **Level 2 – Building Capacity:** the company develops its basic capacity, its management systems and processes, and starts to report on practice and performance.
- **Level 3 – Integrated into Operational Decision-Making:** the company improves its operational practices, assigns senior management or board responsibility for climate change and provides comprehensive disclosures on its carbon practices and performance.
- **Level 4 – Strategic Assessment:** the company develops a more strategic and holistic understanding of risks and opportunities related to the low-carbon transition and integrates this into its business strategy and capital expenditure decisions.

Some companies are still at an early stage of establishing carbon management and reporting processes, whereas others have assessed the resilience of their businesses and business models to a range of future low-carbon scenarios, published details of their low-carbon energy research and development (R&D) and investment strategies, and aligned their strategic key performance indicators (KPIs) on climate change and their executive incentives. Companies can move both up and down levels; for example, if the threat of carbon regulation or taxation recedes, companies may assign a lower priority to efforts to reduce emissions or improve energy efficiency.

Fourteen criteria are used to map companies on to the 5 levels of the TPI management quality framework (see Table 2 and Appendix 1 for more detail). Answers to the 14

³ A fuller description of the methodology is provided in Sullivan, R., Dietz, S., Garcia-Manas, C., Matthews, A. and Ward, F. (2017), *Methodology and Indicators Report. Version 1.0.* 11 January 2017 (Transition Pathway Initiative, London, UK), <http://www.lse.ac.uk/GranthamInstitute/tpi/wp-content/uploads/2017/01/Methodology.pdf>

questions are based on data provided by FTSE Russell, specifically the data and indicators it uses to develop its ESG Ratings.⁴ These data are based on public disclosures by the companies themselves, which encourages companies to provide a better account of how they manage climate change, and ensures that companies are assessed consistently. Improved company disclosures on climate change are a core objective of TPI.

Table 2 TPI management quality indicators

Level 0: Unaware of (or not Acknowledging) Climate Change as a Business Issue	
Question 1	Does the company acknowledge climate change as a significant issue for the business? (Yes/No) If the company does not acknowledge climate change as a significant issue for the business, it is considered to be at Level 0.
Level 1: Acknowledging Climate Change as a Business Issue	
Question 2	Does the company explicitly recognise climate change as a significant issue for the business? (Yes/No)
Question 3	Does the company have a policy (or equivalent) commitment to action on climate change? (Yes/No)
Level 2: Building Capacity	
Question 4	Has the company set energy efficiency or relative or absolute greenhouse gas emission reduction targets? (Yes/No)
Question 5	Has the company published information on its operational (Scope 1 and 2) greenhouse gas emissions? (Yes/No)
Level 3: Integrated into Operational Decision-Making	
Question 6	Has the company nominated a board member or board committee with explicit responsibility for oversight of the climate change policy? (Yes/No)
Question 7	Has the company set quantitative relative or absolute targets for reducing its operational greenhouse gas emissions (Scope 1 and/or 2)? (Yes/No)
Question 8	Does the company report on Scope 3 emissions? (Yes/No)
Question 9	Has the company had its operational (Scope 1 and 2) greenhouse gas emissions data verified? (Yes/No)
Question 10	Does the company support domestic and international efforts to mitigate climate change? (Yes/No)
Level 4: Strategic Assessment	
Question 11	Has the company reduced its total operational (Scope 1 and 2) greenhouse gas emissions over the past 3 years? (Yes/No)
Question 12	Does the company provide information on the business costs – for example, capital investments, costs of carbon permits – associated with climate change? (Yes/No)
Question 13	Has the company set long-term relative or absolute targets for reducing its operational greenhouse gas emissions (Scope 1 and/or 2)? (Yes/No)
Question 14	Has the company incorporated environmental, social and governance issues into executive remuneration? (Yes/No)

⁴ For further information see <http://www.ftse.com/products/downloads/ESG-ratings-overview.pdf?800>.

With the exception of Level 0, companies need to be assessed as Yes on all of the questions on a level before they can advance to the next level. For example, in order to be on Level 3, companies need to score Yes on each of Questions 1 to 5. Similarly, in order to be on Level 4, companies need to score Yes on each of Questions 1 to 10.

2.2. Carbon performance⁵

TPI's carbon performance assessment is based on the Sectoral Decarbonization Approach (SDA).[1] The SDA translates greenhouse gas emissions targets made at the international level (e.g. under the Paris Agreement to the UN Framework Convention on Climate Change) into appropriate benchmarks, against which the performance of individual companies can be compared.⁶

The SDA is built on the principle of recognising that different sectors of the economy (e.g. oil and gas production, electricity generation and automobile manufacturing) face different challenges arising from the low-carbon transition, including where emissions are concentrated in the value chain, and how costly it is to reduce emissions. Other approaches to translating international emissions targets into company benchmarks have applied the same decarbonization pathway to all sectors, regardless of these differences.[2]

Therefore the SDA takes a sector-by-sector approach, comparing companies within each sector against each other and against sector-specific benchmarks, which establish the performance of an average company that is aligned with international emissions targets.

Applying the SDA can be broken down into the following steps:

- A global carbon budget is established, which is consistent with international emissions targets, for example keeping global warming below 2°C. To do this rigorously, some input from a climate model is required.
- The global carbon budget is allocated across time and to different regions and industrial sectors. This typically requires an integrated economy-energy model, and these models usually allocate emissions reductions by region and by sector according to where it is cheapest to reduce emissions and when (i.e. the allocation is cost-effective). Cost-effectiveness is, however, subject to some constraints, such as political and public preferences, and the availability of capital. This step is therefore driven primarily by economic and engineering considerations, but with some awareness of political and social factors.
- In order to compare companies of different sizes, sectoral emissions are normalised by a relevant measure of sectoral activity (e.g. physical production, economic activity). This results in a benchmark path for emissions *intensity* in each sector:

$$\text{Emissions intensity} = \frac{\text{Emissions}}{\text{Activity}}$$

⁵ The methodology followed in assessing the carbon performance of paper producers is described in detail in a separate report, "Carbon Performance Assessment of Paper Producers: Note on Methodology", which is also available on the TPI website. Therefore we will only provide a condensed version here.

⁶ Another initiative that is also using the SDA is the Science Based Targets Initiative (<http://sciencebasedtargets.org/>).

Assumptions about sectoral activity need to be consistent with the emissions modelled and therefore should be taken from the same economy-energy modelling, where possible.

- Companies' recent and current emissions intensity is calculated and their future emissions intensity can be estimated based on emissions targets they have set (i.e. this assumes companies exactly meet their targets).⁷ Together these establish emissions intensity paths for companies.
- Companies' emissions intensity paths are compared with each other and with the relevant sectoral benchmark path.

TPI uses two sectoral benchmark paths, both of which are derived from data from the International Energy Agency (IEA), via its biennial *Energy Technology Perspectives* report:[2]

1. A **2 Degrees scenario**, which is consistent with the overall aim of the Paris Agreement to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels".[3]
2. A **Paris Pledges scenario**, which is consistent with the global aggregate of emissions reductions pledged by countries as part of the Paris Agreement in the form of Nationally Determined Contributions or NDCs. Several studies have documented that this aggregate is currently insufficient to put the world on a path to limit warming to 2°C, even if it will constitute a departure from a business-as-usual trend.[4]–[6]

In the paper sector, the specific measure of emissions intensity that we use is **Scope 1 and 2 greenhouse gas emissions from paper making, per unit of pulp, paper and paperboard produced**, in units of (metric) tonnes of CO₂ equivalent per (metric) tonne of pulp, paper and paperboard. Unlike some other sectors, whose carbon performance is being assessed by TPI (e.g. cement, and electricity utilities), Scope 2 emissions from purchases of power are sufficiently important in the paper sector that they should be included in the measure of company emissions, alongside direct or Scope 1 emissions.

In line with TPI's philosophy, companies' emissions intensity paths are derived from public disclosures (including responses to the annual CDP questionnaire, as well as companies' own reports, e.g. sustainability reports) as far as possible. In particular, only company disclosures are used to estimate recent and current emissions intensity, and company disclosures are also the source of information on targets for future emissions.

But some companies have set targets to reduce the absolute quantity of future emissions, rather than the intensity of their emissions. This raises the particular question of what to assume about those companies' future activity (i.e. paper production in this case). The approach taken by TPI is to assume company activity increases at the same rate as the sector as a whole (i.e. this amounts to an assumption of constant market share), using sectoral growth rates from the IEA in order to be consistent with the benchmark paths.

⁷ Alternatively, future emissions intensity could be calculated based on other data provided by companies on their business strategy and capital expenditure plans.

2.3. Quality assurance

Both TPI's management quality and carbon performance assessments are subject to internal quality assurance, as well as a company review stage, in which all companies are contacted with a draft of TPI's assessment and invited to check the veracity of the disclosed data being used, as well as being requested to answer specific queries in some cases. The process is described in more detail in the TPI Methodology and Indicators Report.⁸ The underlying data used in the management quality assessment are also subject to quality assurance by the provider, FTSE Russell.

Nineteen companies in the paper sector were contacted by TPI on 19th December 2017 with a draft of their assessment, and given until 23rd January 2018 to respond. In total, 4 out of 19 companies responded, as a result of which the assessments of 3 companies changed.

⁸ Sullivan, R., Dietz, S., Garcia-Manas, C., Matthews, A. and Ward, F. (2017), *Methodology and Indicators Report. Version 1.0*. 11 January 2017 (Transition Pathway Initiative, London, UK), <http://www.lse.ac.uk/GranthamInstitute/tpi/wp-content/uploads/2017/01/Methodology.pdf>

3. FINDINGS

3.1. Management quality

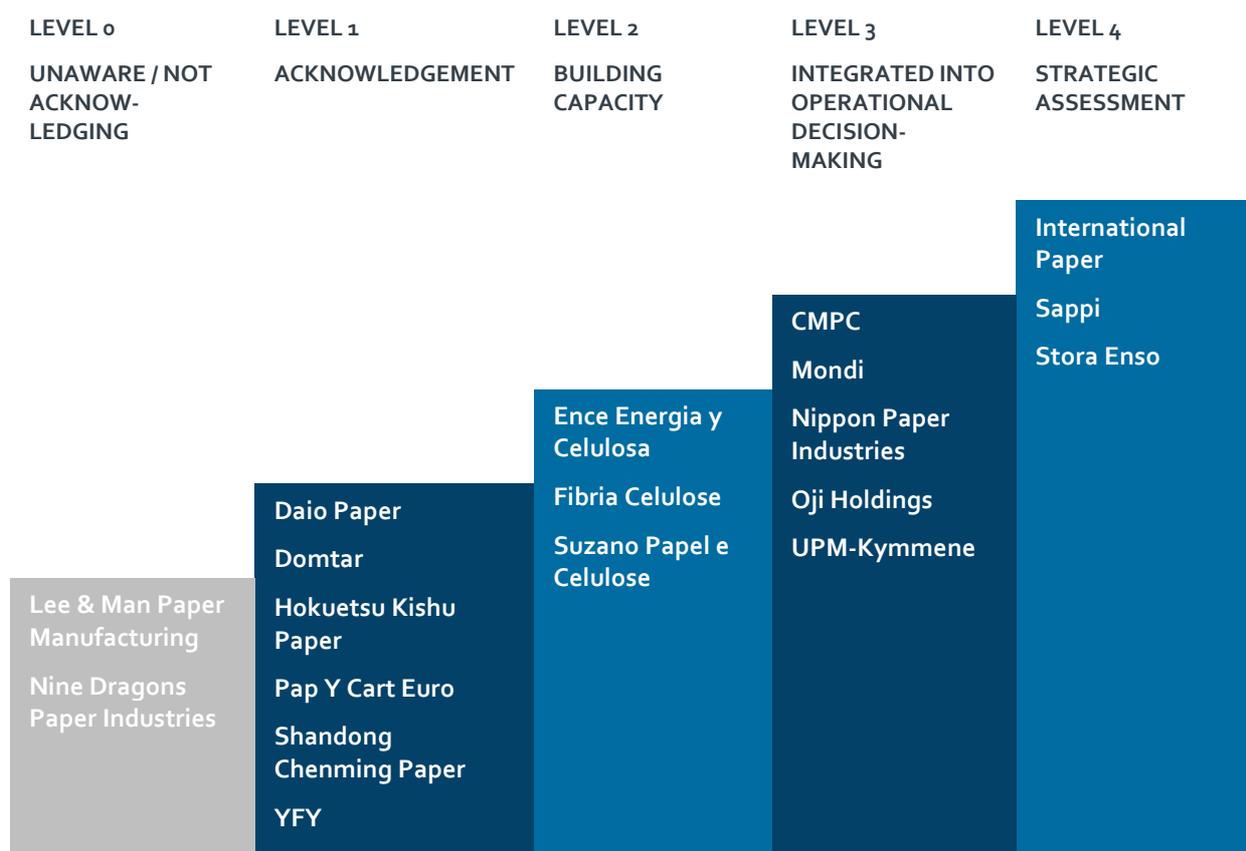
3.1.1. Overview

Figure 1 shows where these 19 companies sit on the management quality framework. Readers may refer to Appendix 2 for a question-by-question assessment of each company.

Two companies are assessed as being “Unaware of (or not Acknowledging) Climate Change as a Business Issue” (Level 0): Lee & Man Paper Manufacturing and Nine Dragons Paper Industries. This means they do not have any of the following:

- A policy or an equivalent statement committing them to take action on their greenhouse gas emissions;
- A formal statement recognising climate change and its potential impacts as a significant or material issue for their business;
- Time-specific targets, even qualitative, relating to energy efficiency or relative or absolute greenhouse gas emissions; or
- Disclosures on their Scope 1 and 2 greenhouse gas emissions.

Figure 1 Management quality of 19 of the world's largest paper producers



Six companies are assessed as “Acknowledging Climate Change as a Business Issue” (Level 1): Daio Paper; Domtar; Hokuetsu Kishu Paper; Pap Y Cart Euro; Shandong Chenming Paper; and YFY. There are more paper producers on Level 1 than any other individual level. As Appendix 2 shows, 4 out of these 6 companies have a published policy or commitment statement on climate change, which commits them to addressing the issue or to reducing

or avoiding their impact on climate change (question 3). However, none of them is assessed as formally recognising climate change and its potential impacts as a significant or material issue for the business (question 2).

There are **3** companies on Level 2, defined as “Building Capacity”. These are: Ence Energia y Celulosa, Fibria Celulose and Suzano Papel e Celulose. Fibria Celulose and Suzano Papel e Celulose publish information on their Scope 1 and 2 emissions (question 5). However, none of the 3 companies has set time-specific energy efficiency or greenhouse gas emissions targets (question 4).

Five companies are on Level 3, where climate change has been “Integrated into Operational Decision-Making”: CMPC, Mondi, Nippon Paper Industries, Oji Holdings, and UPM-Kymmene. As Level 3 companies, these paper producers all publish information on their operational emissions, and have all set time-specific targets for improving their energy efficiency or reducing their emissions. With the exception of CMPC, all of these companies have set quantitative targets to reduce their operational emissions (question 7). In addition, all of these companies apart from Nippon Paper Industries support domestic and international efforts to mitigate climate change (question 10). However, the only companies in the group of five to report any Scope 3 emissions, or have had their operational emissions data verified, are Mondi and UPM-Kymmene (questions 8 and 9 respectively).

Three companies are on Level 4: International Paper, Sappi and Stora Enso. These companies have reached the stage of “Strategic Assessment” of climate change. Reaching Level 4 means these companies have assigned board responsibility for climate change, set quantitative targets for their operational emissions, had their operational emissions data verified, report on their Scope 3 emissions, and demonstrate support for domestic and international efforts to mitigate climate change (questions 6 through 10). In addition, the operational emissions reduction targets of all three companies qualify as long-term (question 13). Stora Enso is the only company to satisfy all 14 management quality criteria.

The average level-score of the 19 paper producers is 2.1, with 11 out of the 19 companies on Level 2 or below. Asian paper producers tend to score lower on the management quality framework: of the 8 companies incorporated in Japan (4), China (3) and Taiwan (1), only Nippon Paper Industries and Oji Holdings are above Level 1 (Level 3). In addition, the higher level-scores appear to be more easily attained by larger companies in the sample: the average market capitalisation of the 7 companies reaching Levels 3 or 4 is \$9,158 million, versus \$1,875 for the 12 companies on Levels 0, 1 and 2.

3.1.2. Scores against individual criteria

Figure 2 looks at how the 19 paper producers as a whole perform against the 14 individual criteria/questions (details in Appendix 2). It helps us identify areas of strength and weakness across all companies.

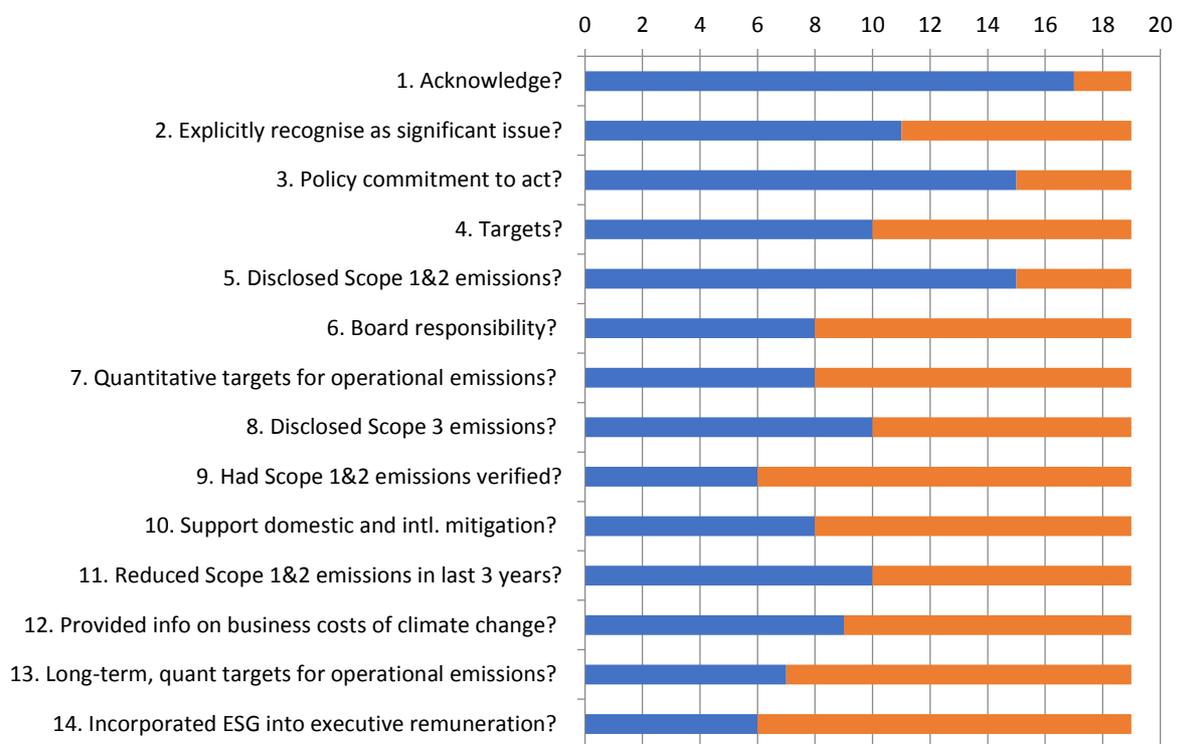
We see a similar pattern to other sectors whose management quality has been assessed by TPI at the time of writing,⁹ insofar as a majority of companies satisfy the criteria on Levels 0

⁹ Besides the 19 paper producers assessed in this particular report, TPI has also assessed the management quality of the global top 20 coal mining companies, electricity utilities, oil and gas producers, steel makers and automobile manufacturers, and the global top 19 cement producers. These data can be viewed at <http://www.lse.ac.uk/GranthamInstitute/tpi/the-toolkit/>

to 2, particularly acknowledging climate change as a significant issue (i.e. question 1), and having a policy (or equivalent) commitment to action on climate change. Fifteen of the 19 companies assessed also disclose information on their Scope 1 and 2 emissions.

Performance against the more demanding Level 3 and 4 criteria is naturally weaker, with fewer than half of companies satisfying any of these criteria individually, except for reporting data on Scope 3 emissions (10 out of 19)¹⁰ and having reduced Scope 1 and 2 emissions in the last 3 years (also 10 out of 19). Compared with other TPI sectors, notably few companies (6 out of 19) have had their Scope 1 and 2 emissions verified, while only 6 out of 19 companies have incorporated environmental, social and governance issues in executive remuneration. On the other hand, 10 out of 19 companies have reduced their Scope 1 and 2 emissions over the last 3 years, which is the highest proportion across all sectors analysed by TPI thus far.

Figure 2 Number of companies scoring Yes (blue) against individual questions, and No (red)



3.1.3. Comparison with other sectors

Since the beginning of 2017, TPI has assessed the management quality of 138 companies across 7 high-impact sectors:

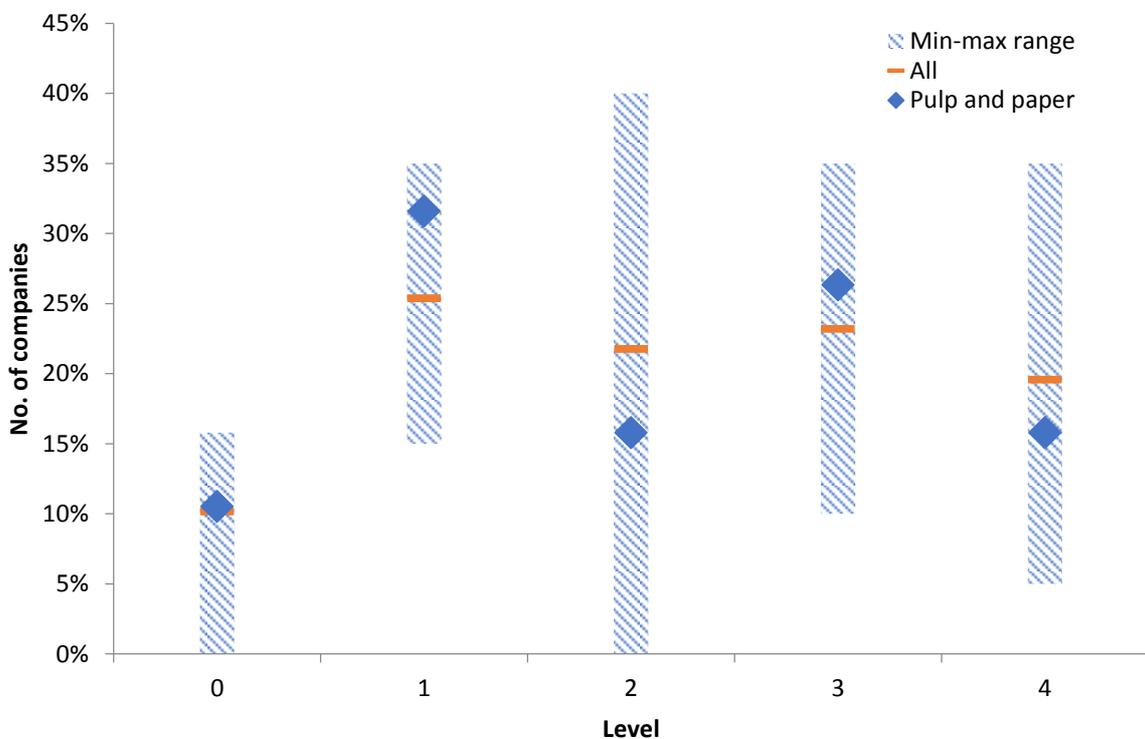
- In the electricity utilities sector, TPI’s assessment of which was launched in January 2017, there were no Level 0 companies, there were 10 companies on Levels 3 or 4, and the average score for the sector was a relatively impressive 2.6.

¹⁰ In general, the comprehensiveness of companies’ Scope 3 emissions disclosures can vary significantly. Currently we are unable to take into account how comprehensive they are, due to the lack of underlying data in a systematic and comparable form, but expect to be able to do so in future versions of the management quality framework (see Section 4).

- In the oil and gas sector, also launched in January 2017, there was one Level 0 company, there were 5 companies on Levels 3 or 4, and the average score for the sector was 2.0.
- In the coal mining sector (July 2017), there were 3 companies on Level 0, 7 companies on Levels 3 or 4, and the average score for the sector was 2.1. There was also a stark difference in the coal mining sector between the performance of the diversified miners (average score 3.8) and the coal mining specialists (average score of 1.3).
- In the cement sector (September 2017), there were 3 companies on Level 0, 9 companies on Levels 3 and 4, and the sector's average score was 2.1.
- In the steel sector (September 2017), there were 2 companies on Level 0, 6 companies on Levels 3 or 4, and the sector's average score was 1.8.
- Finally in the automobile manufacturing sector, the assessment of which is being launched at the same time as these data for paper, there are 3 companies on Level 0, 14 companies on Levels 3 and 4, and the sector's average score is 2.6.

Figure 3 compares the share of paper producers on each level with the overall share of all 138 companies on each level. It also shows the range from the minimum share of companies on a level in any sector, to the maximum. It shows that the paper sector has more companies than average on Levels 1 and 3, but fewer companies than average on Levels 2 and 4. It has a roughly average share of companies on Level 0. Accordingly, the average management quality score for the paper sector, which is 2.1, is very close to the average of all 138 companies assessed by TPI at this time, which is 2.2.

Figure 3 Comparison of management quality in paper with other sectors



3.2. Carbon performance

3.2.1. Data availability

TPI's carbon performance assessment is based on companies' public disclosures of their recent and current emissions, as well as quantitative targets they have set to reduce their emissions in the future. Table 3 provides details of the extent of these disclosures and targets.

Table 3 Publicly disclosed information on company emissions intensity and targets

Company	Country	2013-16 emissions intensity data?	Quantitative emissions targets	Type of target (absolute/intensity)
Daio Paper	Japan	No	No	
Domtar	United States	2014, 2016	2020	Absolute
CMPC	Chile	2013-2015	No	
Ence Energia y Celulosa	Spain	No	No	
Fibria Celulose	Brazil	Yes	No	
Hokuetsu Kishu Paper	Japan	2013-2015	No	
International Paper	United States	Yes	2020	Absolute
Lee & Man Paper Manufacturing	China	No	No	
Mondi	United Kingdom	Yes	2030	Intensity
Nine Dragons Paper Industries	China	No	No	
Nippon Paper Industries	Japan	Yes	2020	Absolute
Oji Holdings	Japan	No	No	
Pap Y Cart Euro	Spain	No	No	
Sappi	South Africa	Yes	2020	Intensity
Shandong Chenming Paper	China	No	No	
Stora Enso	Finland	Yes	2030	Intensity
Suzano Papel e Celulose	Brazil	2015-2016	No	
UPM-Kymmene	Finland	Yes	2030	Absolute
YFY	Taiwan	No	No	

We can provide recent and current carbon performance data on **11 out of 19** companies. Of the 8 companies we have had to exclude, 4 companies (Ence Energia y Celulosa, Lee & Man Paper Manufacturing, Nine Dragons Paper Industries and Shandong Chenming Paper) do not appear to publicly disclose any emissions data for the years 2013-2016. The remaining 4 companies (Daio Paper, Oji Holdings, Pap Y Cart Euro and YFY) disclose some emissions data, but they do not appear to be sufficiently complete or well-documented for us to estimate company-wide Scope 1 and 2 greenhouse gas emissions from paper-making. Problems include failing to disclose Scope 2 emissions, only disclosing emissions for a small

share of the company's production capacity¹¹ and disclosing emissions intensities that are either insufficiently clear or unsuitable for the TPI carbon performance analysis (e.g. Pap Y Cart Euro only discloses CO₂ emissions per megawatt-hour of electricity generated).

Only 7 paper producers have set company-wide, quantitative targets for their future emissions, which we can use to estimate carbon performance. Of these targets, 4 expire in 2020 and 3 in 2030.

3.2.2. Overview of results

Table 4 summarises the paper producers' carbon performance data and also includes emissions intensity along the 2 Degrees and Paris Pledges benchmark pathways. A company whose emissions intensity is below the benchmarks can be said to be aligned with those benchmarks and therefore with the international commitments underpinning them. A company whose emissions intensity is above the benchmarks is not aligned.

Table 4 Company emissions intensity paths and paper sector benchmarks, 2013-2030

Company	Carbon intensity (t CO ₂ e / t pulp, paper and paperboard)						
	2013	2014	2015	2016	2020	2025	2030
Domtar		0.591		0.526	0.497		
CMPC	0.516	0.473	0.381				
Fibria Celulose	0.242	0.256	0.247	0.241			
Hokuetsu Kishu Paper	0.441	0.393	0.389				
International Paper	0.720	0.730	0.681	0.668	0.637		
Mondi	0.810	0.820	0.820	0.760	0.742	0.720	0.697
Nippon Paper Industries	1.211	1.190	1.191	1.189	1.088		
Sappi	0.820	0.800	0.800	0.800	0.792		
Stora Enso	0.331	0.336	0.297	0.294	0.285	0.275	0.264
Suzano Papel e Celulose			0.226	0.223			
UPM-Kymmene	0.528	0.501	0.523	0.529	0.452	0.356	0.259
2 Degrees		0.697	0.676	0.656	0.580	0.495	0.403
Paris Pledges		0.697	0.691	0.686	0.667	0.648	0.634
Key		Aligned with 2C		Aligned with Paris Pledges only		Not aligned	

Between 2013 and 2016, **4 out of 11** companies had an emissions intensity¹² that was higher than either the 2 Degrees or Paris Pledges benchmarks. These companies, which are therefore not aligned at present, are: International Paper, Mondi, Nippon Paper Industries

¹¹ The latter is a relatively widespread problem in the sector. However, in some cases, such as Nippon Paper Industries, we have been able to find evidence to suggest that the emissions intensity that is disclosed is likely to be representative of all the company's paper production facilities.

¹² Calculated as the unweighted average of each company's emissions intensity between 2013 and 2016.

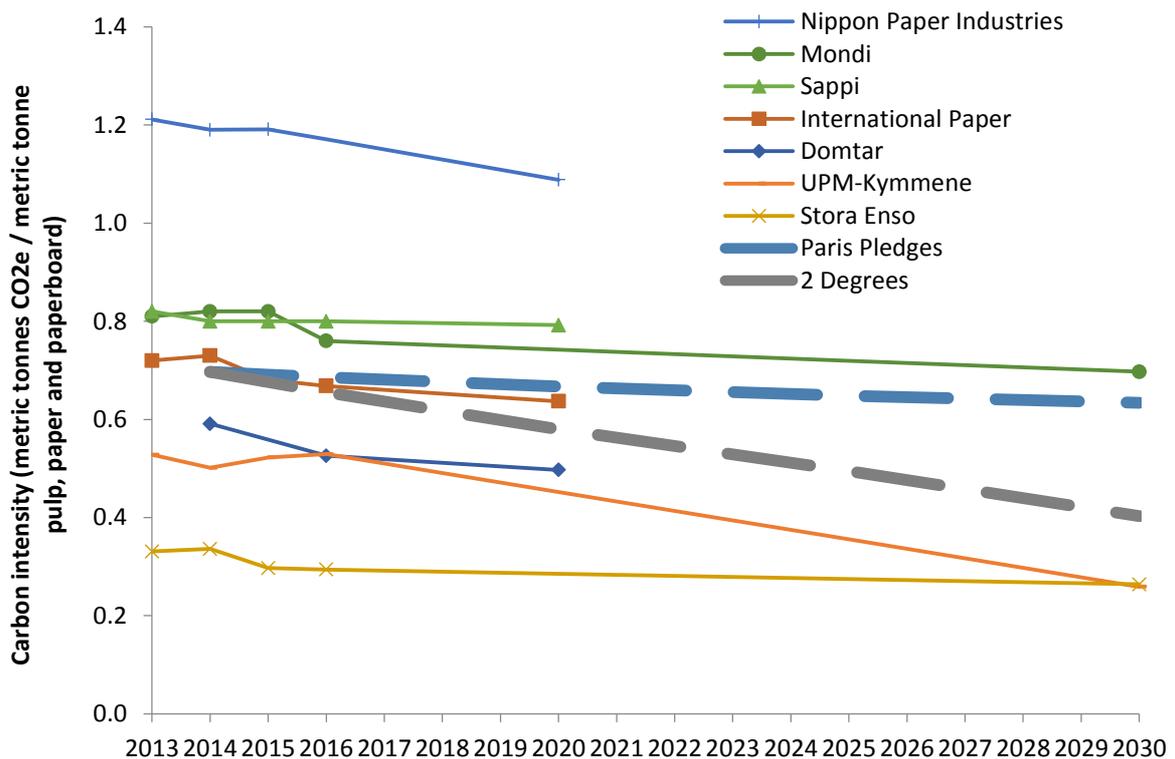
and Sappi. The remaining 7 paper producers had an emissions intensity that was below the benchmarks over the period 2013 to 2016. These companies are aligned.

On average, the 11 paper producers included in our assessment had an emissions intensity of 0.591 tonnes of CO₂e per tonne of pulp, paper and paperboard (“t CO₂e / t pulp, paper and paperboard”) over the period 2013-2016, which is also below both of the benchmarks (see Figure 5).¹³ The average emissions intensity between 2013 and 2016 of the 7 companies with future targets was 0.705 tCO₂e / t pulp, paper and paperboard, while the average of the other 4 companies was 0.336 tCO₂e / t pulp, paper and paperboard, which indicates that, for this sample of 11 paper producers, the presence of future targets is associated with higher emissions intensity today.

Beneath the averages, there is wide variation in recent and current emissions intensity across the 11 companies, from a low of 0.225 tCO₂e / t pulp, paper and paperboard (Suzano Papel e Celulose) to a high of 1.195 tCO₂e / t pulp, paper and paperboard (Nippon Paper Industries).

Figure 4 plots emissions intensity paths for the 7 companies with quantitative targets for their future emissions, which TPI could use to estimate carbon performance. The chart uses data from Table 4. The chart allows us to see more clearly whether companies’ emissions intensity is aligned with the benchmarks in the future.

Figure 4 Emissions intensity paths for companies with targets



Assuming company targets are met, **3 out of 7** paper producers will be aligned in the period 2020-2030, with emissions intensities below both the 2 Degrees and Paris Pledges benchmarks. They are Domtar, Stora Enso and UPM-Kymmene. Stora Enso has particularly low emissions intensity today, while UPM-Kymmene has aggressive emissions targets for

¹³ This is the unweighted average emissions intensity across companies.

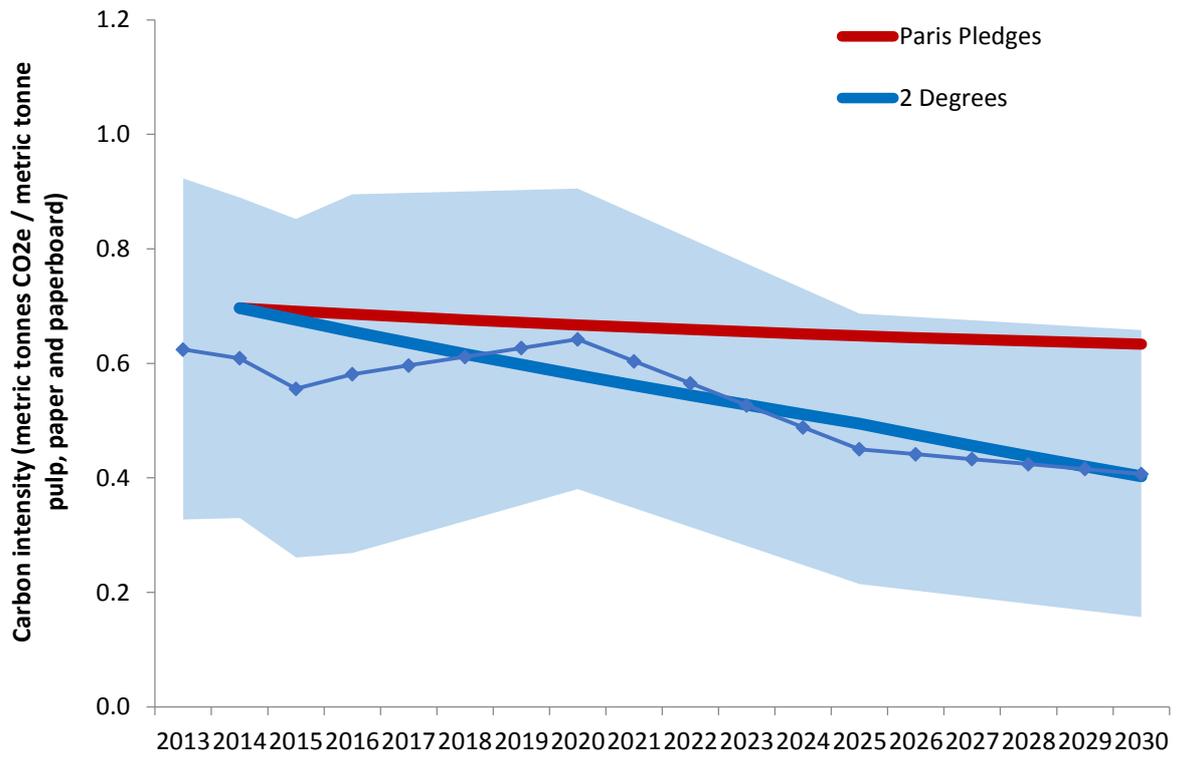
2030, entailing a reduction of its 2016 emissions intensity by 51% (from 0.529 to 0.259 tCO₂e / t pulp, paper and paperboard).¹⁴

Of the remaining **4 out of 7** companies, International Paper is the only one that is aligned with at least the Paris Pledges benchmark today. In addition, we estimate that International Paper's target to reduce its 2010 emissions by 20% by 2020 will result in a reduction of emissions intensity of approximately 5% between 2016 and 2020 – which is sufficient to remain aligned with the Paris Pledges benchmark, but insufficient to become aligned with the 2 Degrees benchmark. The other three companies (Mondi, Nippon Paper Industries and Sappi) remain above both benchmarks and therefore not aligned, despite Mondi having a 2030 target that brings it closer to the Paris Pledges benchmark.

Figure 5 shows that the emissions cuts targeted by those companies with future targets are collectively sufficient to ensure that the average emissions intensity of those companies is below the Paris Pledges benchmark in 2020 and 2030 (0.642 and 0.407 tCO₂e / t pulp, paper and paperboard respectively), but insufficient to ensure that it is below the 2 Degrees benchmark. In 2025, the average emissions intensity is below both benchmarks, though only marginally below the 2 Degrees benchmark, at 0.456 tCO₂e / t pulp, paper and paperboard. However, because only 7 paper producers have future targets (of which only 3 extend beyond 2020) and because those have, on average, significantly higher emissions intensity today, care must be taken in drawing broader conclusions. For instance, were we to assume that the emissions intensity of the 4 companies without future targets remained constant between their last disclosure and 2020, the 11 companies' average emissions intensity in 2020 would be 0.483 tCO₂e / t pulp, paper and paperboard, which is comfortably below both benchmarks. Unfortunately, nothing can be said about the 8 companies without any emissions intensity data.

¹⁴ The TPI online toolkit contains further details of specific assumptions made to forecast a company's emissions intensity: see <http://www.lse.ac.uk/GranthamInstitute/tpi/the-toolkit/>.

Figure 5 Average emissions intensity of companies, including range +/-1 standard deviation for companies with data



4. SUMMARY

4.1. Summary of the results

This report has assessed the management quality and carbon performance of 19 of the world's largest publicly-listed paper producers.

Paper producers' average management quality score is 2.1, corresponding with Level 2 (Building Capacity), which is very close to the average of all 138 companies across 7 sectors that have been assessed by TPI to date (2.2). The worst performing TPI sector on management quality is steel (average score of 1.8), while the joint best performing sectors are automobile manufacturing and electricity utilities (average score of 2.6).

The paper companies with the lowest management quality score are Lee & Man Paper Manufacturing, and Nine Dragons Paper Industries. They are on Level 0. The companies with the highest management quality are International Paper, Sappi and Stora Enso. They are on Level 4. Stora Enso is the only company satisfying all 14 criteria.

Paper producers follow other sectors in performing better on the less demanding Level 0-2 indicators than they do on the more demanding Level 3-4 indicators. Performance is comparatively weak on having operational (Scope 1 and 2) emissions verified and on incorporating environmental, social and governance issues in executive remuneration. On the other hand, proportionally more companies in the paper sector have reduced their Scope 1 and 2 emissions over the last 3 years than in any other sector assessed by TPI so far.

Based on public disclosures, we are able to estimate the carbon performance of 11 of the 19 paper producers today:

- Seven companies have been aligned with the benchmarks over the period 2013 to 2016, meaning that their emissions intensity of paper production has been lower than the benchmarks in recent years. They are: Domtar; CMPC; Fibria Celulose; Hokuetsu Kishu Paper; Stora Enso; Suzano Papel e Celulose; and UPM-Kymmene.
- Four companies have had higher carbon intensity and have therefore not been aligned. They are International Paper, Mondi, Nippon Paper Industries and Sappi.
- The remaining 8 companies make insufficient disclosures for us to estimate carbon performance using our chosen metric of Scope 1 and 2 greenhouse gas emissions per unit of pulp, paper and paperboard production. Across the sector, inconsistent and incomplete reporting of emissions and production volumes is a particular challenge.

We estimate companies' future carbon intensity on the basis of quantitative targets they have set themselves to reduce emissions. Only 7 out of 19 companies have set such targets. Only 3 of these targets extend beyond 2020, making it difficult to form a clear view of the direction of carbon performance in the paper sector.

In 2020, 3 out of the 7 companies with targets are aligned with the 2 Degrees benchmark: Domtar, Stora Enso and UPM-Kymmene. International Paper is aligned with the Paris Pledges benchmark, but its carbon intensity is too high to be aligned with 2 Degrees.

In 2030, 2 out of the 3 companies with targets extending this far are aligned with 2 Degrees: Stora Enso and UPM-Kymmene. Mondi remains above the benchmarks.

4.2. Limitations

The current version of TPI's management quality assessment framework was developed from October 2015 to December 2016. The development work involved: a comprehensive review of the literature, in particular to ensure alignment with existing initiatives and disclosure frameworks; piloting the indicators on a sample of 60 companies across 4 high-impact sectors (automobiles, diversified mining, electricity utilities, and oil and gas); and review by the TPI Steering Group, and by investment and climate change experts. The choice of indicators/questions and their ordering in the management quality framework are inevitably subjective, but the iterative process of research, testing and review just described was designed to make the framework as robust as possible. At present the breadth and depth of indicators is limited by the data FTSE Russell collected in their 2015-16 and 2016-17 research cycles, but enhancements to the 2017-18 FTSE Russell data set, building on the recommendations of Financial Stability Board's (FSB's) Task Force on Climate-related Financial Disclosures (TCFD), will provide TPI with the opportunity to extend and refine the management quality framework later this year.

TPI's carbon performance assessment is subject to a number of limitations. Perhaps the most obvious of these is that, like any forward-looking exercise, the accuracy of the conclusions is limited by the accuracy of the projections. TPI's projections could turn out to be inaccurate for two broad reasons. The first is that the benchmarks turn out to be inaccurate, because reality turns out differently to what the IEA's energy model predicts. IEA updates its modelling frequently with the aim of improving the accuracy of its projections and TPI plans to update its benchmark paths accordingly. The second is that the company emissions intensity paths turn out to be inaccurate. An obvious source of inaccuracy in this regard is that company targets are exceeded or missed. Again, TPI will update its company emissions intensity projections as company targets are added and revised. Another reason why company paths could turn out to be inaccurate is that estimating the future emissions intensity of companies usually involves a number of specific assumptions. For instance, four paper producers have set targets to reduce the absolute quantity of their emissions and therefore TPI has had to make an assumption about these companies' future production (based on the IEA data), in order to convert the target into intensity terms. Another limitation of the assessment is that, since TPI uses companies' self-reported emissions and activity data to derive the emissions intensity paths, companies' paths are only as accurate as the underlying disclosures.

As a result of these caveats, it is clear that the closer a company is to a benchmark, the less confident we can be in conclusions regarding whether it is aligned or not. It is beyond the scope of this study to formally quantify the degree of confidence in the benchmarks.¹⁵

The principal challenge in the paper sector, relative to some (though not all) of the other sectors whose carbon performance TPI is assessing, is inconsistent reporting of emissions and production, particularly in terms of whether emissions disclosures are paper-making-specific or operations-wide, whether production is measured in tonnes of pulp, paper and paperboard, an equivalent measure or something different (which itself is not always clear), and whether disclosures cover all or merely a subset of a company's production facilities.

¹⁵ Without a random sample of companies, standard statistical measures of confidence cannot be applied.

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APPENDIX 1 TPI MANAGEMENT QUALITY INDICATORS

Level 0: Unaware of (or not Acknowledging) Climate Change as a Business Issue	
Question 1	Does the company acknowledge climate change as a significant issue for the business? (Yes/No)
Explanatory Notes	<p>Acknowledging climate change as a business issue is an important first step towards implementing a comprehensive approach to the low-carbon transition.</p> <p>Companies are assessed as Yes if they:</p> <ul style="list-style-type: none"> • Have a policy or an equivalent statement committing them to take action on their greenhouse gas emissions (e.g. to reduce emissions, to improve their energy efficiency); or • Have a formal statement recognising climate change and its potential impacts as a significant or material issue for their business; or • Have set energy efficiency or relative or absolute greenhouse gas emission reduction targets; or • Have published information on their operational (Scope 1 and 2) greenhouse gas emissions. <p>Companies are assessed as No if they do not meet any of these conditions.</p>
Level 1: Acknowledging Climate Change as a Business Issue	
Question 2	Does the company explicitly recognise climate change as a significant issue for the business? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they have a formal statement recognising climate change and its potential impacts as a significant or material issue for their business.
Question 3	Does the company have a policy (or equivalent) commitment to action on climate change? (Yes/No)
Explanatory Notes	<p>It is good practice for companies to formalise their approach to climate change in a policy (or equivalent document, such as a statement of guiding principles, a code of practice, or a sourcing charter). While the existence of a policy does not speak to the level of ambition or implementation, the absence of a policy is a clear sign that climate change is not on the business agenda.</p> <p>Companies are assessed as Yes if they have a published policy or commitment statement on climate change that commits them to addressing the issue or to reducing or avoiding their impact on climate change (e.g. to reduce emissions or improve their energy efficiency).</p>
Level 2: Building Capacity	
Question 4	Has the company set energy efficiency or relative or absolute greenhouse gas emission reduction targets? (Yes/No)
Explanatory Notes	<p>Objectives and targets are the point where policy commitments are translated into substantive action, and where resources and responsibilities are allocated for the delivery of these objectives and targets.</p> <p>Companies are assessed as Yes if they have time-specific targets, covering part or all of the business, to reduce energy consumption or</p>

	<p>greenhouse gas emissions. These can be process or performance targets, they can focus on energy or on greenhouse gas emissions, they can be expressed in qualitative or quantitative terms, and they can be expressed in relative or absolute terms.</p> <p>This question is intended to assess whether companies have started the target-setting process. Questions 7 and 13 ask more detailed questions about whether companies have set targets for the reduction of greenhouse gas emissions over the short and long term. Companies that are assessed as Yes on either of these questions (i.e. Questions 7 and 13) are also assessed as Yes on Question 4.</p>
Question 5	Has the company published information on its operational (Scope 1 and 2) greenhouse gas emissions? (Yes/No)
Explanatory Notes	<p>Companies are assessed as Yes if they report on their Scope 1 and 2, or their combined Scope 1, 2 and 3 emissions.</p> <p>Companies that only report Scope 1 emissions are assessed as No.</p> <p>Companies that report normalised emissions only are assessed as No.</p>
Level 3: Integrated into Operational Decision-Making	
Question 6	Has the company nominated a board member or board committee with explicit responsibility for oversight of the climate change policy? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they provide evidence of clear board or board committee oversight of climate change, or if they have a named individual/position responsible for climate change at board level.
Question 7	Has the company set quantitative relative or absolute targets for reducing its operational greenhouse gas emissions? (Yes/No)
Explanatory Notes	<p>Companies are assessed as Yes if they have set quantified targets to reduce operational (Scope 1 and/or 2) greenhouse gas emissions in relative or absolute terms.</p> <p>This question is more demanding than Question 4, as it is looking for companies to have set quantitative targets to reduce operational greenhouse gas emissions, at least in the short term (i.e. with a target year up to 5 years away). In contrast, Question 4 allows companies to set process targets (e.g. to take particular actions) and to focus these on energy or on greenhouse gas emissions.</p> <p>This question differs from Question 13, which asks whether companies have set targets for the reduction of operational greenhouse gas emissions in the long term (i.e. with a target year more than 5 years away). Companies that are assessed as Yes on Question 13 are also assessed as Yes on this question.</p>
Question 8	Does the company report on Scope 3 emissions? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they report on Scope 3 emissions separately, or if they provide a total for Scope 1, 2 and 3 emissions.
Question 9	Has the company had its operational greenhouse gas emissions data verified? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if their operational greenhouse gas emissions have been independently verified by a third party, or if they state

	the international assurance standard they have used and the level of assurance.
Question 10	Does the company support domestic and international efforts to mitigate climate change? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they demonstrate support for mitigating climate change through membership of business associations that are supportive, and if they have a clear company position on public policy and regulation.
Level 4: Strategic Assessment	
Question 11	Has the company reduced its total Scope 1 and 2 greenhouse gas emissions over the past 3 years?
Explanatory Notes	Companies are assessed as Yes if their total Scope 1 and 2 greenhouse gas emissions have reduced over the past 3 years. For companies that do not report a breakdown of Scope 1, 2 and 3 emissions, total Scope 1, 2 and 3 emissions are used in this calculation. Companies that do not report Scope 1 and 2 emissions are assessed as No, as are companies that report less than 3 years' data.
Question 12	Does the company provide information on the business costs – for example, capital investments, costs of carbon permits – associated with climate change? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they quantify the business costs associated with climate change.
Question 13	Has the company set long-term relative or absolute targets for reducing its operational greenhouse gas emissions? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they have set quantified long-term targets (i.e. with a target year more than 5 years away) to reduce operational (Scope 1 and/or 2) greenhouse emissions in relative or absolute terms. This question is more demanding than Question 7, as it looks for companies to have set long-term quantitative targets (i.e. that are more than 5 years in duration from start to end) to reduce operational greenhouse gas emissions. By contrast, Question 7 asks whether the company has set short-term targets (i.e. less than 5 years in duration).
Question 14	Has the company incorporated environmental, social and governance issues into executive remuneration? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if executive remuneration includes incorporates environmental, social and governance performance.

APPENDIX 2 DETAILED ASSESSMENT OF COMPANIES' MANAGEMENT QUALITY

Company	Level	Level 0	Level 1	Level 2	Level 3	Level 2	Level 4
		1. Does the company acknowledge climate change as a significant issue for the business?	2. Does the company explicitly recognise climate change as a significant issue for the business? 3. Does the company have a policy (or equivalent) commitment to action on climate change?	4. Has the company set energy efficiency or GHG emission reduction targets? 5. Has the company published information on its Scope 1 and 2 GHG emissions?	6. Has the company assigned explicit board responsibility for oversight of the climate change policy? 7. Has the company set quantitative targets for reducing its operational GHG emissions? 8. Does the company report on Scope 3 emissions? 9. Has the company had its Scope 1 and 2 GHG emissions data verified? 10. Does the company support domestic and international efforts to mitigate climate change?		11. Has the company reduced its total operational Scope 1 and 2 GHG emissions over the past 3 years? 12. Does the company provide information on the business costs associated with climate change? 13. Has the company set long-term targets for reducing its operational GHG emissions? 14. Has the company incorporated ESG issues into executive remuneration?
Daio Paper	1	Yes	No Yes	No Yes	No No Yes No No		No Yes No No
Domtar	1	Yes	No Yes	Yes Yes	Yes Yes Yes No Yes		Yes No Yes Yes
CMPC	3	Yes	Yes Yes	Yes Yes	Yes No No No Yes		Yes Yes No No
Ence Energia y Celulosa	2	Yes	Yes Yes	No No	No No No No No		No No No No
Fibria Celulose	2	Yes	Yes Yes	No Yes	Yes No Yes Yes Yes		Yes Yes No No
Hokuetsu Kishu Paper	1	Yes	No Yes	Yes Yes	Yes No Yes No No		Yes Yes No No
International Paper	4	Yes	Yes Yes	Yes Yes	Yes Yes Yes Yes Yes		Yes No Yes Yes
Lee & Man Paper Manufacturing	0	No	No No	No No	No No No No No		No No No No
Mondi	3	Yes	Yes Yes	Yes Yes	No Yes Yes Yes Yes		Yes Yes Yes Yes

Nine Dragons Paper Industries	0	No													
Nippon Paper Industries	3	Yes	No	No	No	Yes	Yes	No	Yes						
Oji Holdings	3	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	Yes	No
Pap Y Cart Euro	1	Yes	No	No	No	Yes	No								
Sappi	4	Yes	No												
Shandong Chenming Paper	1	Yes	No	Yes	No										
Stora Enso	4	Yes													
Suzano Papel e Celulose	2	Yes	Yes	Yes	No	Yes	No	No	Yes	No	No	No	No	No	Yes
UPM-Kymmene	3	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No
YFY	1	Yes	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No

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