TRANSITION PATHWAY INITIATIVE

MANAGEMENT QUALITY AND CARBON PERFORMANCE OF CEMENT PRODUCERS: A COMMENTARY

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EXECUTIVE SUMMARY

The Transition Pathway Initiative (TPI) is a global, asset owner-led initiative, supported by asset owners and managers with over £4/$5.2 trillion of assets under management. The initiative assesses how companies are preparing for the transition to a low-carbon economy, focusing on two elements:

1. *Management Quality*: the quality of companies' management of their greenhouse gas emissions and of the risks and opportunities related to the low-carbon transition.
2. *Carbon Performance*: how companies' carbon performance now and in the future might compare to the international targets and national pledges made as part of the Paris Agreement.

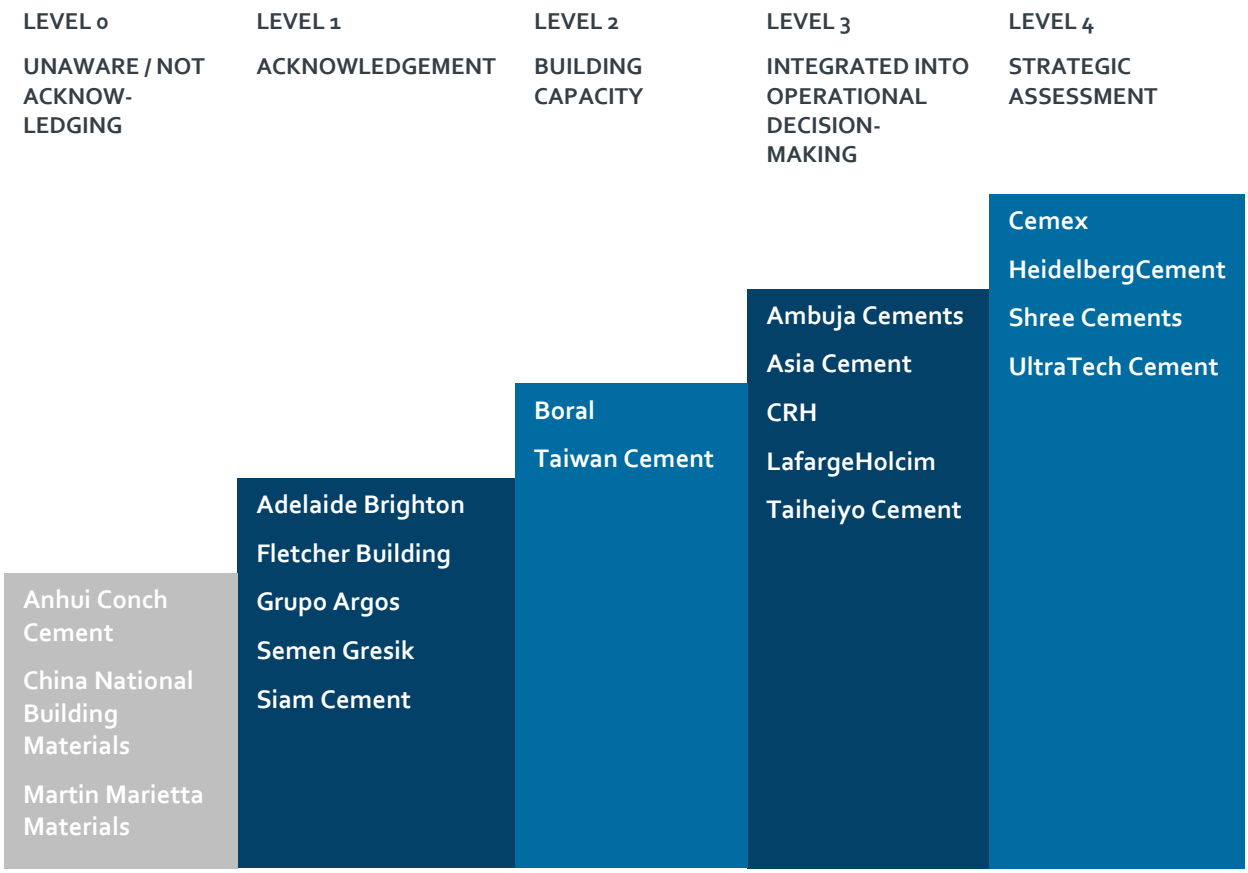
This report contains our assessment of the management quality and carbon performance of 19 of the world's largest cement producers, selected on the basis of market capitalisation.

Our management quality assessment rates companies on 14 indicators, covering such issues as 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 failure to acknowledge climate change as a business issue at the bottom (Level 0), to strategic assessment of the risks and opportunities of climate change at the top (Level 4).

Cement producers' average management quality score is 2.1 (on a scale of 0-4), which maps on to Level 2, 'Building Capacity'. This compares favourably with steel makers (average score 1.8), is on par with TPI's assessment of coal miners and oil and gas producers, and is below the 2.6 average rating for electricity utilities. However, beneath the averages, cement producers are broadly split into a low-performing cluster and a high-performing cluster: 8 companies are grouped on Levels 0 and 1, while another 9 are grouped on Levels 3 and 4. Each cluster comprises companies of diverse sizes and geographies. 'Core' members of the Cement Sustainability Initiative (CSI), which has played an important role in coordinating and establishing sector practice on climate change, are all in the high-performing cluster.

The cement companies 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. The top cement producers appear to be relatively strong on the quality of emissions disclosures and on having long-term, quantitative targets in place to reduce operational greenhouse gas emissions. Operational greenhouse gas emissions are highly material in the cement sector. However, performance is weaker on indicators such as supporting domestic and international policy efforts to mitigate climate change (in turn due to a shortage of clear positions on public policy and regulation at the level of individual companies), providing information on the business costs of climate change, and incorporating ESG issues into executive remuneration.

Figure ES1 Management quality of the world's top cement producers



This report also provides an in-depth assessment of the carbon performance of these cement producers. We translate greenhouse gas emissions targets made at the international level into appropriate benchmarks, against which the performance of individual companies can be compared, using the Sectoral Decarbonization Approach. We use modelling from the International Energy Agency to derive benchmark global carbon emissions intensity pathways for cement producers, which are consistent with:

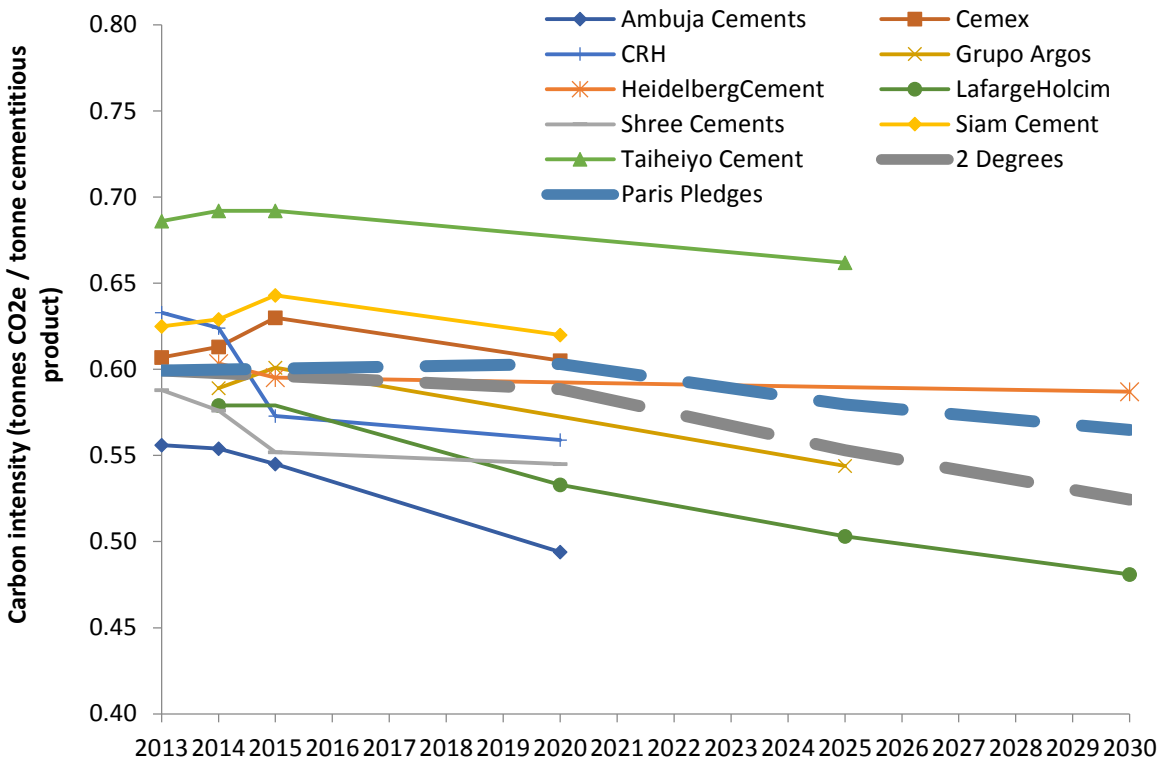
1. A *2 Degrees* scenario, commensurate with the overall aim of the Paris Agreement to limit global warming to below 2°C.
2. A *Paris Pledges* scenario, reflecting the global aggregate of emissions reductions actually pledged by countries as part of the Paris Agreement in the form of Nationally Determined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

Based on public disclosures, we are able to estimate the carbon intensity of cement production of 10 of the 19 cement producers today. The remaining 9 companies make insufficient disclosures for us to estimate carbon performance. There are particularly small differences between the most carbon-intensive and the least carbon-intensive companies in the cement sector. Companies are also distributed relatively evenly on either side of the benchmarks today: we find that 4 out of the 10 cement producers are aligned today, with a carbon intensity lower than the benchmarks. The average carbon intensity of the 10 companies today is just above the benchmarks.

We estimate cement producers' future carbon intensities on the basis of quantitative targets they have set themselves to reduce emissions. A total of 9 companies have set

targets that we can use. The benchmarks in the cement sector do not envisage large reductions in emissions intensity, compared with other sectors, such as electricity production. This reflects the technical challenges and costs of reducing emissions in the sector. The trajectories of 5 out of the 9 cement producers with quantitative emissions targets are just below – i.e. are aligned – with the 2 Degrees and Paris Pledges benchmarks in 2020. With only 4 companies setting targets extending to 2025 and only 2 companies' targets extending to 2030, little can be inferred about the position of the sector beyond 2020.

Figure ES2 Emissions intensity paths for companies with targets



1. INTRODUCTION

1.1. The Transition Pathway Initiative

The Transition Pathway Initiative (TPI) is a global, asset owner-led initiative, supported by asset owners and managers with over £4/$5.2 trillion of assets under management. The TPI aims to evaluate what the transition to a low-carbon economy looks like for companies in high-impact sectors, such as mining, oil and gas, electricity, and cement, and to assess how well-prepared companies in these sectors are for the transition to a low-carbon economy. Companies are analysed in two ways that are designed to complement each other:

1. *Management Quality*: TPI evaluates and tracks the quality of companies' governance/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.

TPI publishes the results of its analysis through an open online tool hosted by the Grantham Research Institute on Climate Change and the Environment at the London School of Economics (LSE): 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 the TPI assessment of the management quality and carbon performance of the world's largest cement producers, selected on the basis of market capitalisation.

It assesses 19 companies, set out in Table 1. Companies are listed in a diverse group of 14 countries in Asia, Australasia, Europe, Latin America and North America. There are 13 large cap companies, of which the 5 largest companies account for about 67% of the total market value of the 19 companies.[1]

[1] To provide some context, in TPI's assessment of the coal-mining sector, the 5 largest companies accounted for 85% of the total market value of the top 20 companies. The top 5 were all diversified mining companies. In the steel sector, the 5 largest companies account for 59% of the total market value of the top 20 companies covered by TPI.

Table 1 Cement producers covered in this report; further details

Company	Country	Investibility-weighted[2] market capitalisation (USD millions)
Adelaide Brighton	Australia	1,808
Ambuja Cements	India	2,823
Anhui Conch Cement	China	4,122
Asia Cement	Taiwan	2,144
Boral	Australia	4,840
Cemex	Mexico	11,461
China National Building Materials	China	1,980
CRH	United Kingdom	28,569
Fletcher Building	New Zealand	5,025
Grupo Argos	Colombia	2,173
HeidelbergCement	Germany	14,113
LafargeHolcim	Switzerland	27,092
Martin Marietta Materials	United States	14,623
Semen Gresik	Indonesia	2,172
Shree Cements	India	2,005
Siam Cement	Thailand	4,484
Taiheiyo Cement	Japan	4,366
Taiwan Cement	Taiwan	3,953
UltraTech Cement	India	4,627

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 FTSE Russell free-float methodology, as of 14 February 2017.

2. AN OVERVIEW OF THE METHODOLOGY

2.1. Management quality[3]

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 five 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 Scope 1 and 2 greenhouse gas emissions? (Yes/No)
Question 8	Does the company report on Scope 3 emissions? (Yes/No)
Question 9	Has the company had its 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 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 Scope 1 and 2 greenhouse gas emissions? (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 performance[5]

TPI's carbon performance assessment is based on the Sectoral Decarbonization Approach (SDA),[1] which is also being used by the Science-Based Targets Initiative, for example. The SDA translates greenhouse gas emissions targets made at the international level (e.g. under the Paris Agreement) into appropriate benchmarks, against which the performance of individual companies can be compared.

As the name suggests, 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:

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

  Assumptions about sectoral activity need to be consistent with the emissions modelled and are therefore taken from the same economy-energy modelling.
- 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).[6] Together these establish emissions intensity paths for companies. The length of these paths will vary

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

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

depending on how much information companies provide on their recent and current emissions intensity, as well as the time horizon for their emissions targets, if indeed they have set and disclosed any targets.

- 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 cement sector, the particular measure of emissions intensity that we use is **specific "net" CO_2 emissions per unit of cementitious product**, in units of (metric) tonnes of CO_2 per (metric) tonne of cementitious product. This is one of the main metrics developed by the Cement Sustainability Initiative (CSI). The vast majority of cement producers considered by TPI, who report any information whatsoever on their emissions intensity, use CSI metrics in their reporting. Specific net emissions intensity is also the metric chosen by companies to express their targets, again following the framework put forward by the CSI.

Net emissions are direct (i.e. Scope 1) emissions from cement production, including from burning fossil fuels to heat kilns, from the calcination process and from on-site use of the company's vehicles, but excluding CO_2 emissions from on-site power generation, emissions from alternative fuels and raw materials, and emissions from off-site use of the company's vehicles. Cement producers' Scope 2 emissions from heat and power purchases are therefore also excluded.

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.

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.[7] The underlying data used in the management quality assessment are also subject to quality assurance by the provider, FTSE Russell.

Twenty companies in the cement sector were contacted by TPI on 10th August 2017 with a draft of their assessment, and given until 13th September 2017 to respond. In total, 5 out of 20 companies responded, as a result of which the assessments of 2 companies changed. One of these companies requested to be excluded on the grounds that it was not engaged in cement production *per se*, leaving 19 companies in the final assessment.

[7] 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

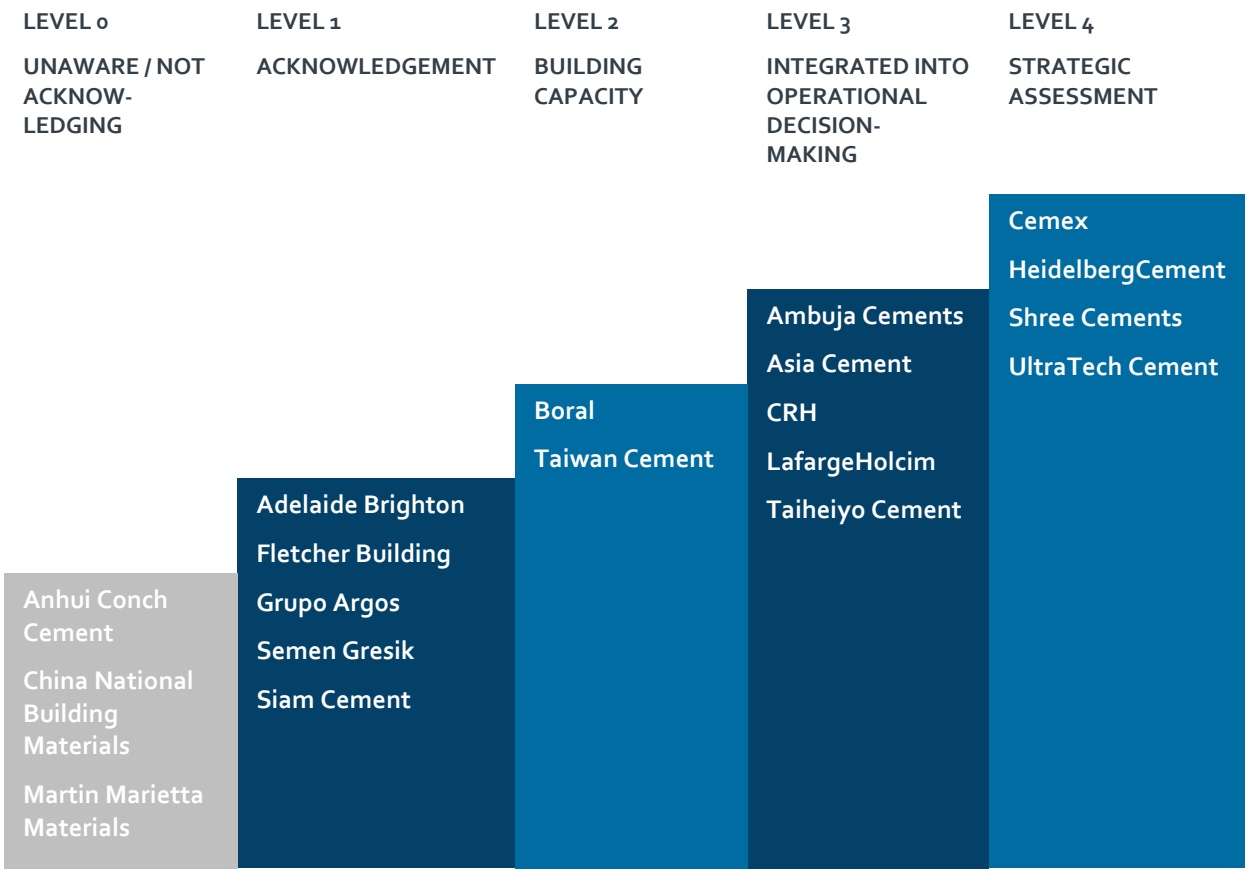
3.1.1. Overview

Figure 1 shows where the 19 companies sit on the TPI management quality framework. Appendix 2 provides a question-by-question assessment of each company.

Three companies are assessed as being "Unaware of (or not Acknowledging) Climate Change as a Business Issue" (Level 0): Anhui Conch Cement, China National Building Materials and Martin Marietta Materials. 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 the world's top cement producers



Five companies are assessed as "Acknowledging Climate Change as a Business Issue" (Level 1): Adelaide Brighton, Fletcher Building, Grupo Argos, Semen Gresik and Siam Cement. The 2 questions on Level 1 are, firstly, does the company explicitly recognise climate change as a significant issue for the business and, secondly, does it have a policy or

equivalent commitment to action on climate change? These 5 companies all have a policy/commitment to act on climate change, but none is assessed as explicitly recognising climate change as a significant issue for the business.

There are **2** companies on Level 2, defined as "Building Capacity": Boral and Taiwan Cement. Neither of these companies has yet set energy efficiency or greenhouse gas emission reduction targets, though both publish information on their Scope 1 and 2 emissions.

Five companies have graduated to Level 3, where climate change has been "Integrated into Operational Decision-Making". The companies in question are Ambuja Cements, Asia Cement, CRH, LafargeHolcim and Taiheiyo Cement. According to the framework and the rules for progression, all of these companies have satisfied the Level 2 criteria of publishing information on their Scope 1 and 2 emissions, and having set time-specific targets for their energy efficiency or emissions. There is also good performance among these 5 companies on setting quantitative targets for reducing Scope 1 and 2 emissions (all companies have done so), on reporting on Scope 3 emissions (all companies except Asia Cement have done so), and on having Scope 1 and 2 emissions data verified (again, all companies except Asia Cement have done so). But at the time of assessment only 2 out of the 5 companies had assigned explicit board responsibility for oversight of the climate change policy (Ambuja Cements and CRH), and only one of the 5 is assessed as supporting domestic and international efforts to mitigate climate change (LafargeHolcim).

Four cement producers have reached the highest level in the TPI management quality framework, which is Level 4, "Strategic Assessment" of climate change. These companies are Cemex, HeidelbergCement, Shree Cements and UltraTech Cement. Reaching Level 4 implies these companies meet all the criteria on Level 3, including having assigned explicit board responsibility for oversight of the climate change policy, and supporting domestic and international efforts to mitigate climate change. In addition, all 4 companies have set long-term targets to reduce their Scope 1 and 2 emissions, and 3 out of 4 companies provide information on the business costs associated with climate change (the exception is UltraTech Cement). But only HeidelbergCement has incorporated environmental, social and governance issues into executive remuneration, and none of the 4 companies has succeeded in reducing its total Scope 1 and 2 emissions over the past 3 years.

The average level-score of all 19 cement producers is 2.1 (thus corresponding with Level 2, "Building Capacity"), with 8 out of the 19 companies on Levels 0 or 1 and 9 companies on Levels 3 or 4.

3.1.2. Scores against individual criteria

Figure 2 looks at how the 19 cement 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,[8] insofar as a majority of companies satisfy the criteria on Levels 0 to 2, particularly acknowledging climate change as a significant issue (i.e. question 1),

[8] Besides the 19 cement 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, and steel makers. These data can be viewed at http://www.lse.ac.uk/GranthamInstitute/tpi/the-toolkit/

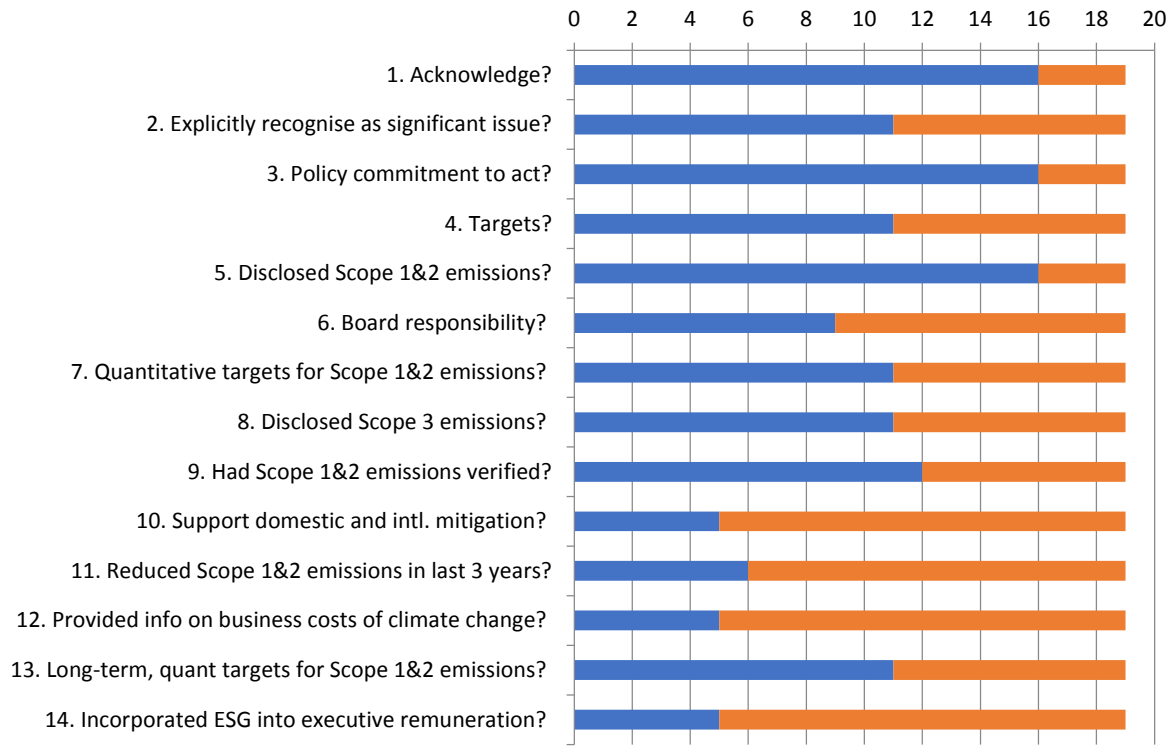
having a policy (or equivalent) commitment to action on climate change (question 3) and disclosing Scope 1 and 2 emissions (question 5).

Performance against the more demanding Level 3 and 4 criteria is weaker, as is also the case in other sectors. In particular, there are 3 questions, on which only 5 cement producers are assessed as Yes:

- *Support for domestic and international efforts to mitigate climate change*. To satisfy this criterion, companies are required to demonstrate such support both through membership of business associations that are supportive of efforts to mitigate climate change, and having a clear company position on public policy and regulation. While many of our companies are assessed as being members of supportive business associations, only 5 are also assessed as having a clear company position on public policy/regulation. The underlying assessment is carried out by FTSE Russell.
- *Providing information on the business costs associated with climate change*, for example capital investments and costs of carbon permits.
- *Incorporating environmental, social and governance issues into executive remuneration.*

On the other hand, performance is stronger on questions such as whether a company has had its Scope 1 and 2 emissions data verified (question 9). It is particularly noteworthy that 11 out of the 19 cement producers have set long-term, quantitative targets to reduce their Scope 1 and 2 emissions, which is the same share of companies as in the electricity utilities sector and is considerably higher than in other sectors TPI has looked at so 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 99 companies across five 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.
- 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 2.1.
- In the coal mining sector, the assessment of which was released in July 2017, there were 3 companies on Level 0, 7 companies on Levels 3 or 4, and the average score for the sector was again 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).
- Lastly, in the steel sector, the assessment of which is being launched at the same time as these data for cement, there are 2 companies on Level 0, 6 companies on Levels 3 or 4, and the sector's average score is 1.8.

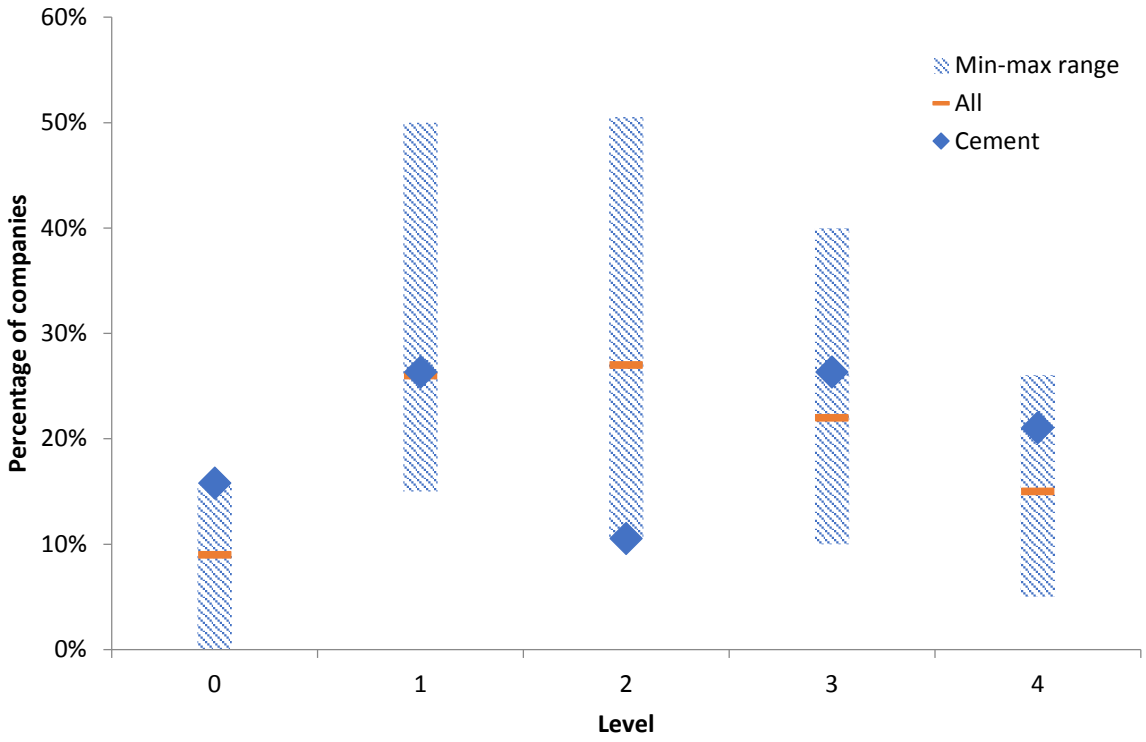
Figure 3 compares the share of cement producers on each level with the overall share of all 99 companies on each level. It also shows the range from the minimum share of companies on a level in any sector, to the maximum. Together with the coal-mining sector, the cement sector has the largest share of companies on Level 0, while it has an approximately average share of companies on Level 1. Conversely a greater-than-average share of cement producers has reached Levels 3 and 4.

The picture that emerges is therefore of a sector in which companies separate themselves into 2 distinct classes: a group of relatively low achievers on Levels 0 and 1, and a group of relatively high achievers on Levels 3 and 4. While it is beyond the scope of this report to conduct a detailed investigation into which factors determine whether a company is a low or high achiever, we can nonetheless make some initial observations based on the data we have to hand.

There is essentially no association between management quality score and company size as measured by either market value or cement production.[9] There is no obvious regional pattern in the results either. One factor, which appears to have some association with management quality score, is membership of the CSI. Of the 19 cement producers featured here, 5 are 'core' members of the CSI and these 5 companies are all on Levels 3 or 4: Cemex, CRH, HeidelbergCement, LafargeHolcim and Taiheiyo Cement. However, the performance of 'participating' members of the CSI is more variable. Of the 5 CSI participating members assessed in this report, 3 are on Levels 0 or 1 (China National Building Materials, Grupo Argos and Siam Cement), while the other 2 companies are on Level 4 (Shree Cements and UltraTech Cement).

[9] Unlike market value, disclosures of cement production data are harder to find. We were only able to find data for 11 out of 19 companies, which is an additional barrier to testing for an association between company size and management quality.

Figure 3 Comparison of management quality in cement 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	2013-15 emissions intensity data?	Quantitative emissions targets for 2020-	Type of target (absolute/intensity)
Adelaide Brighton	Australia	No	No	
Ambuja Cements	India	Yes	2020	Intensity
Anhui Conch Cement	China	No	No	
Asia Cement	Taiwan	No	No	
Boral	Australia	No	No	
Cemex	Mexico	Yes	2020	Intensity
China National Building Materials	China	No	No	
CRH	United Kingdom	Yes	2020	Intensity
Fletcher Building	New Zealand	No	No	
Grupo Argos	Colombia	2014-2015 only	2025	Intensity
HeidelbergCement	Germany	2014-2015 only	2030	Intensity
LafargeHolcim	Switzerland	2014-2015 only	2020, 2025 and 2030	Intensity
Martin Marietta Materials	United States	No	No	
Semen Gresik	Indonesia	No	No	
Shree Cements	India	Yes	2020	Intensity
Siam Cement	Thailand	Yes	2020	Intensity
Taiheiyo Cement	Japan	Yes	2025	Intensity
Taiwan Cement	Taiwan	No	No	
UltraTech Cement	India	2014-2015 only	No	

We can provide recent and current carbon performance data on **10 out of 19** companies. **Nine** of these companies have also set company-wide, quantitative targets for their future emissions, which we can use to estimate carbon performance.[10] The form taken by these targets is unusually homogeneous: all of them are intensity targets,[11] which reflects the

[10] The company without a target for *future* emissions is UltraTech Cement. It had set an emissions intensity target that expired in 2016.

[11] And all of them are in terms of the specific net emissions intensity metric mentioned in Section 2.2.

coordinating role played by the CSI in this sector. Five targets expire in 2020, a further 2 targets extend to 2025 and only 2 companies, HeidelbergCement and LafargeHolcim, have set targets that extend as far as 2030.

3.2.2. Overview of results

Table 4 summarises the cement 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 cement sector benchmarks, 2013-2030

Company	Carbon intensity (tonnes of CO2e / tonne of cementitious product)					
	2013	2014	2015	2020	2025	2030
Ambuja Cements	0.556	0.554	0.545	0.494		
Cemex	0.607	0.613	0.630	0.605		
CRH	0.633	0.624	0.573	0.559		
Grupo Argos		0.589	0.601	0.573	0.544	
HeidelbergCement		0.603	0.595	0.592	0.590	0.587
LafargeHolcim		0.579	0.579	0.533	0.503	0.481
Shree Cements	0.588	0.576	0.552	0.545		
Siam Cement	0.625	0.629	0.643	0.620		
Taiheiyo Cement	0.686	0.692	0.692	0.677	0.662	
UltraTech Cement		0.634	0.644			
2 Degrees	0.599	0.598	0.596	0.589	0.553	0.524
Paris Pledges	0.599	0.600	0.600	0.603	0.580	0.565

Between 2013 and 2015, **5 out of 10** companies had an emissions intensity[12] that was higher than either the 2 Degrees or Paris Pledges benchmarks. These companies, therefore not aligned during this period, are: Cemex, CRH, Siam Cement, Taiheiyo Cement and UltraTech Cement. Conversely **4** cement producers had an emissions intensity that was below both of the benchmarks over the period 2013 to 2015: Ambuja Cements, Grupo Argos, LafargeHolcim and Shree Cements. These companies were aligned. **One** company, HeidelbergCement, had an emissions intensity between 2013 and 2015 that places it just above the 2 Degrees benchmark, but just below the Paris Pledges benchmark. It was therefore aligned with the latter, but not the former, though the differences are very small.

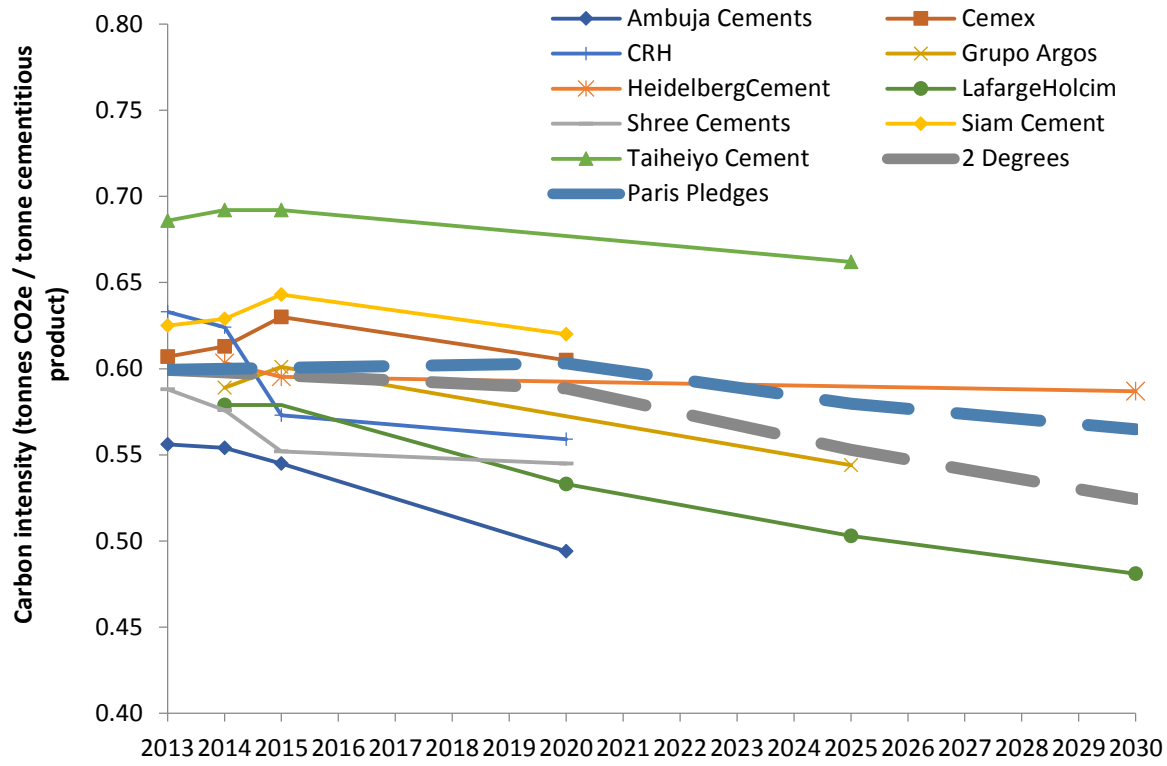
On average, the 10 cement producers included had an emissions intensity of 0.608 tonnes of CO_2e per tonne of cementitious product over the period 2013-2015,[13] which is marginally above the benchmarks (see Figure 5).

[12] Calculated as the unweighted average of each company's emissions intensity between 2013 and 2015.
[13] This is the unweighted average across the 10 companies.

What is particularly distinctive about the cement sector is the relatively low variation between companies. The range from the company disclosing the lowest emissions intensity between 2013 and 2015, Ambuja Cements at 0.563 tCO_2e / t cement, and the company with the highest emissions intensity, Taiheiyo Cement at 0.690 tCO_2e / t cement, is just 0.127 tCO_2e / t cement. To put this in context, given that different emissions intensity metrics apply in different sectors, we can calculate the coefficient of variation of companies' emissions intensity, i.e. the standard deviation of companies' emissions intensity divided by the mean. This is just 0.07 for these 10 cement producers, compared with 0.57 for 18 of the global top 20 electricity producers and 0.36 for 13 of the global top 20 steel makers.[14]

Figure 4 plots emissions intensity paths for the 9 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



The IEA modelling that underpins the benchmark pathways foresees that emissions intensity will increase between 2015 and 2020 under the Paris Pledges scenario, before falling to 6% below the 2015 level in the same scenario by 2030. Under the 2 Degrees scenario, emissions intensity falls by 1% below the 2015 level by 2020 and 12% below that level by 2030. These relatively small reductions reflect the technical challenges facing the cement sector in reducing its carbon emissions and show that integrated economy-energy

[14] Commentaries on carbon performance in the electricity and steel sectors respectively can be found on the TPI website: http://www.lse.ac.uk/GranthamInstitute/tpi/publications/.

models such as the IEA model therefore make other sectors, notably electricity generation, shoulder the burden, in order to minimise economy-wide abatement costs.[15]

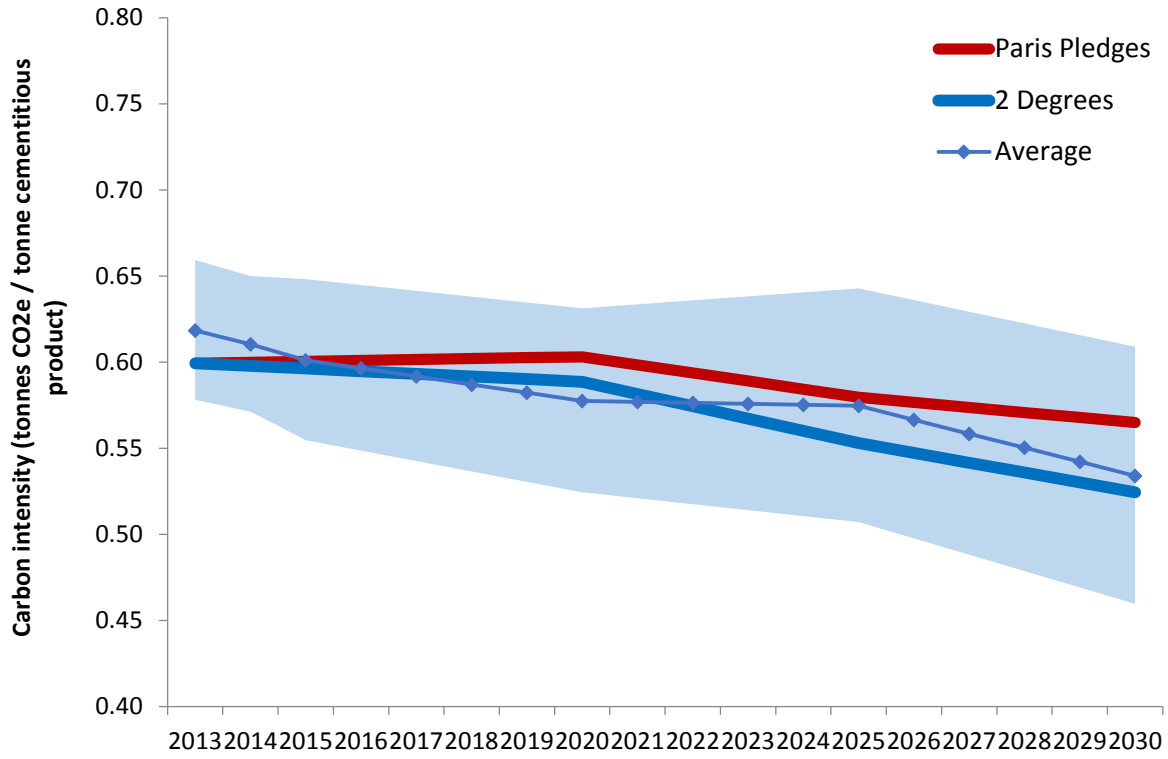
Assuming company targets are met, **5 out of 9** cement producers will be less carbon-intensive than either the 2 Degrees or the Paris Pledges benchmarks in 2020: Ambuja Cements, CRH, Grupo Argos, LafargeHolcim and Shree Cements. With the exception of CRH, these companies were also below the benchmarks during the period 2013-2015.[16]

One company, HeidelbergCement, is more carbon-intensive than the 2 Degrees benchmark, but less carbon-intensive than the Paris Pledges benchmark, while the remaining **3 out of 9** companies are above both of the benchmarks: Cemex, Siam Cement and Taiheiyo Cement. Cemex is only very marginally above the Paris Pledges benchmark in 2020.

By 2030, only **2** companies remain: HeidelbergCement and LafargeHolcim. The former has not set an emissions target ambitious enough to align it with either the 2 Degrees or Paris Pledges benchmarks in 2030. On the other hand, the latter's target is sufficient to keep it below both of the benchmarks in 2030.

[15] In the electricity utilities sector, the IEA-derived Paris Pledges benchmark emissions intensity falls by 25% below the 2015 level by 2030, while the 2 Degrees benchmark emissions intensity falls by 50% below the 2015 level by 2030.
[16] CRH's emissions intensity fell considerably between 2014 and 2015, seemingly due to the effect of acquiring new cement production capacity with a relatively low emissions intensity.

Figure 5 Average emissions intensity of companies, including range +/- 1 standard deviation (note that number of companies changes through time)



3.3. The association between management quality and carbon performance

The TPI management quality and carbon performance assessments have been designed to be complementary. Broadly speaking, the former looks at companies' efforts or *inputs* to preparing for the transition to a low-carbon economy, specifically focusing on various aspects of corporate carbon governance and management, while the latter looks at the *outputs* of this in terms of companies' emissions intensity now and in the future.

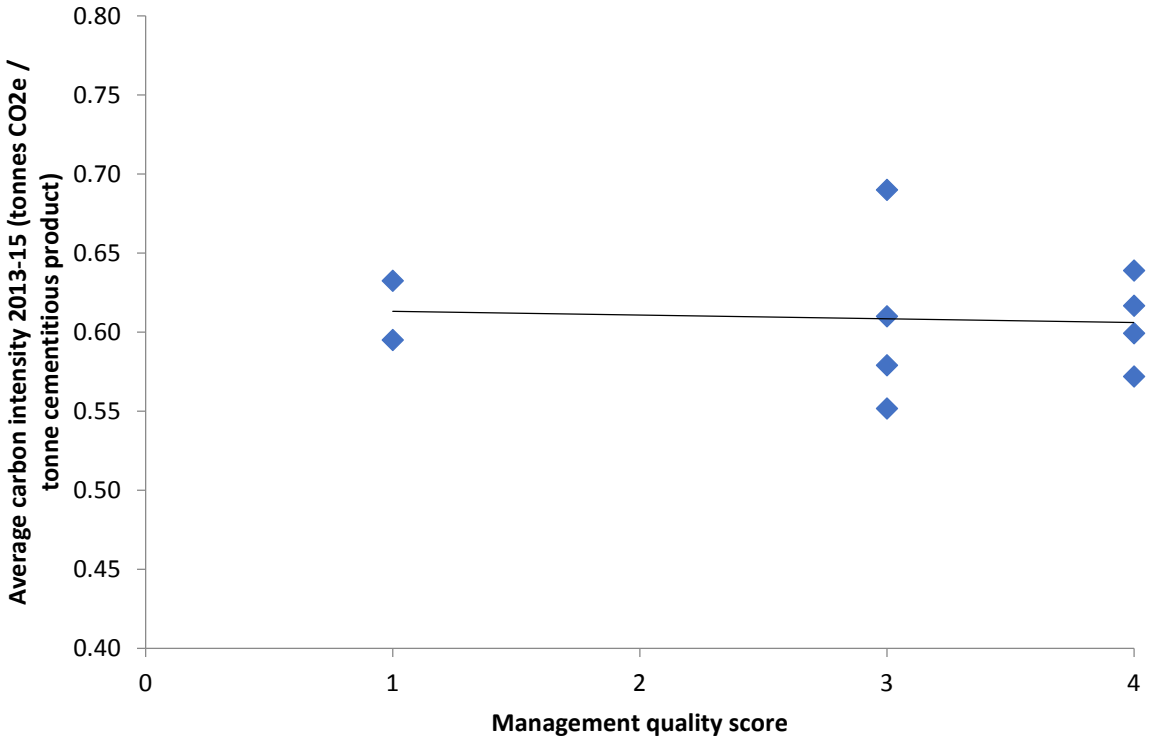
In the electricity utilities sector, we previously found no association between companies' management quality and their recent/current emissions intensity, which tends to confirm these two types of assessment are complementary.[17] It only makes sense to test the association between management quality and recent/current emissions intensity, because TPI's management quality framework is designed to reward companies with quantitative emissions targets. Therefore those cement producers with 2020 emissions targets and in turn data on their 2020 emissions intensity will have a relatively high management quality score by definition.

Figure 6 plots companies' management quality score against their average emissions intensity over the period 2013-15. It is clear that there is no association between the two measures, just as there was no association in the electricity utilities sector. It follows that in the cement sector neither the quality of a company's carbon governance/management nor

[17] Dietz, S., French, E. and Rauis, B. (2017), *Carbon Performance Assessment of Electricity Utilities: a Commentary*. 7 June 2017 (Transition Pathway Initiative, London, UK), http://www.lse.ac.uk/GranthamInstitute/tpi/wp-content/uploads/2017/06/Commentary-on-electric-utilities-results-7-June-with-disclaimer.pdf.

its *current* carbon footprint, measured in intensity terms, gives a holistic picture of the company's position vis-à-vis the low-carbon transition.

Figure 6 Association between management quality and average emissions intensity 2013-15 (black line is least squares fit)



4. SUMMARY

4.1. Summary of the results

Cement producers' average management quality score is 2.1, which maps on to Level 2, 'Building Capacity'. This compares favourably with steel makers (average score 1.8), is on par with TPI's assessment of coal miners and oil and gas producers, and is below the 2.6 average rating for electricity utilities. However, beneath the averages, cement producers are broadly split into a low-performing cluster and a high-performing cluster: 8 companies are grouped on Levels 0 and 1, while another 9 are grouped on Levels 3 and 4. Each cluster comprises companies of diverse sizes and geographies. 'Core' members of the Cement Sustainability Initiative (CSI), which has played an important role in coordinating and establishing sector practice on climate change, are all in the high-performing cluster.

The cement companies 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. The top cement producers appear to be relatively strong on the quality of emissions disclosures and on having long-term, quantitative targets in place to reduce operational greenhouse gas emissions. Operational greenhouse gas emissions are highly material in the cement sector. However, performance is weaker on indicators such as supporting domestic and international policy efforts to mitigate climate change (in turn due to a shortage of clear positions on public policy and regulation at the level of individual companies), providing information on the business costs of climate change, and incorporating ESG issues into executive remuneration.

Based on public disclosures, we are able to estimate the carbon performance – the carbon intensity of cement production – of 10 of the 19 cement producers today. The remaining 9 companies make insufficient disclosures for us to estimate carbon performance. There are particularly small differences between the most carbon-intensive and the least carbon-intensive companies in the cement sector. Companies are also distributed relatively evenly on either side of the benchmarks today: we find that 4 out of the 10 cement producers are aligned today, with a carbon intensity lower than the benchmarks. The average carbon intensity of the 10 companies today is just above the benchmarks.

We estimate cement producers' future carbon intensities on the basis of quantitative targets they have set themselves to reduce emissions. A total of 9 companies have set targets that we can use. The benchmarks in the cement sector do not envisage large reductions in emissions intensity, compared with other sectors, such as electricity production. This reflects the technical challenges and costs of reducing emissions in the sector. The trajectories of 5 out of the 9 cement producers with quantitative emissions targets are just below – i.e. are aligned – with the 2 Degrees and Paris Pledges benchmarks in 2020. With only 4 companies setting targets extending to 2025 and only 2 companies' targets extending to 2030, little can be inferred about the position of the sector beyond 2020.

Lastly we test the association between companies' management quality score and their average carbon intensity over the period 2013-15 and find none, just as in the electricity utilities sector. Investors should take care to consider a company's management quality alongside its carbon performance now and the trajectory it foresees for its carbon performance in the future.

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 next year.

TPI's carbon performance assessment is also 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 every two years 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 overshot. 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. However, fewer such assumptions tend to be required in the cement sector, because companies state their emissions targets in intensity terms. In some other sectors, such as electricity production, absolute emissions targets are more common and therefore assumptions have to be made about future activity/production.

Another limitation of the carbon performance 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.[18]

In the cement sector, the measure of carbon performance is specific net CO_2 emissions per unit of cementitious product. This is a pragmatic choice: specific net emissions are one of two CSI measures used by companies, and net rather than gross emissions are the measure of choice for CSI members in stating their emissions targets. The principal drawback of this measure is that it excludes CO_2 emissions from on-site power generation (outside the kiln

[18] Without a random sample of companies, standard statistical measures of confidence cannot be applied.

system), as well as indirect, Scope 2 emissions (typically companies will either generate their own electricity on-site or buy it in, but not both). These may amount to about 10% of the sector's overall direct and indirect emissions.

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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	Acknowledging climate change as a business issue is an important first step towards implementing a comprehensive approach to the low-carbon transition. Companies are assessed as Yes if they: • 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. Companies are assessed as No if they do not meet any of these conditions.
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	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. 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).
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	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. Companies are assessed as Yes if they have time-specific targets, covering part or all of the business, to reduce energy consumption or

	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. 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.
Question 5	Has the company published information on its operational (Scope 1 and 2) greenhouse gas emissions? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they report on their Scope 1 and 2, or their combined Scope 1, 2 and 3 emissions. Companies that only report Scope 1 emissions are assessed as No. Companies that report normalised emissions only are assessed as 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)
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 Scope 1 and 2 greenhouse gas emissions? (Yes/No)
Explanatory Notes	Companies are assessed as Yes if they have set quantified targets to reduce operational greenhouse gas emissions in relative or absolute terms. 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. 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.
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 Scope 1 and 2 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 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 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 Scope 1 and 2 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 Scope 1 and 2 GHG emissions?	14. Has the company incorporated ESG issues into executive remuneration?
Adelaide Brighton	1	Yes	No	Yes	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
Ambuja Cements	3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No
Anhui Conch Cement	0	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Asia Cement	3	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	Yes	No
Boral	2	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes	No	No	No
Cemex	4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
China National Building Materials	0	No	No	No	No	No	No	No	No	No	No	No	No	No	No
CRH	3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes
Fletcher Building	1	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No
Grupo Argos	1	Yes	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No	No	No
HeidelbergCement	4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes

LafargeHolcim	3	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Martin Marietta Materials	0	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Semen Gresik	1	Yes	No	Yes	No	Yes	No	No	No	No	No	Yes	No	No	No
Shree Cements	4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No
Siam Cement	1	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes	No
Taiheiyo Cement	3	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No
Taiwan Cement	2	Yes	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	No	No	No
UltraTech Cement	4	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No

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