ICE Database Insights:
An Introduction to Data Quality Scoring

10th April 2025

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circularecology.com

Today's Webinar

- Introduction

- Definition of data quality

- Landscape of standards in carbon data quality

- Common themes in data quality analyses

- The importance of data quality

- ICE Database data quality framework

- Case study comparison

- Q&A

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Your Presenters Today

Jon Burrow
Head of Carbon Accounting
- Over a decade's experience in carbon footprints
- Expertise in developing Carbon Reduction Strategies for organisations
- Oversight for the development and launch of ICE V4.0

Charlie Zhu
Senior Sustainability Analyst
- Experience in wide range of carbon consultancy work in manufacturing, construction, and design sectors
- Delivery of data assets to support carbon accounting and life cycle assessments using data science and machine learning skills
- Category Lead on ICE Database

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Background & Introduction

Circular Ecology – Introduction

Environmental consultancy, founded in 2013

Offer a range environmental services:

- Whole-Life Embodied Carbon Assessments for Construction Projects
- Organisational Carbon Footprints, Scope 1, 2 & 3
- Product Carbon Footprints
- Life Cycle Assessments (LCA)
- Carbon Footprint Verification & Assurance
- Net Zero Carbon Strategy
- Carbon Footprint Database (library) Development
- Online E-Learning Training Courses
- Carbon Offsetting and Tree Planting

Hosts the Inventory of Carbon & Energy (ICE) database

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Scaling Carbon Reduction Initiative (SCRI)

Launch of our **Scaling Carbon Reductions Initiative (SCRI)**

Key to our purpose **to release impactful work, to enable scalable carbon reductions**

We will be diverting a specified amount from some of our sales into the SCRI

Funds will be used to **develop free carbon footprint data, tools and resources**
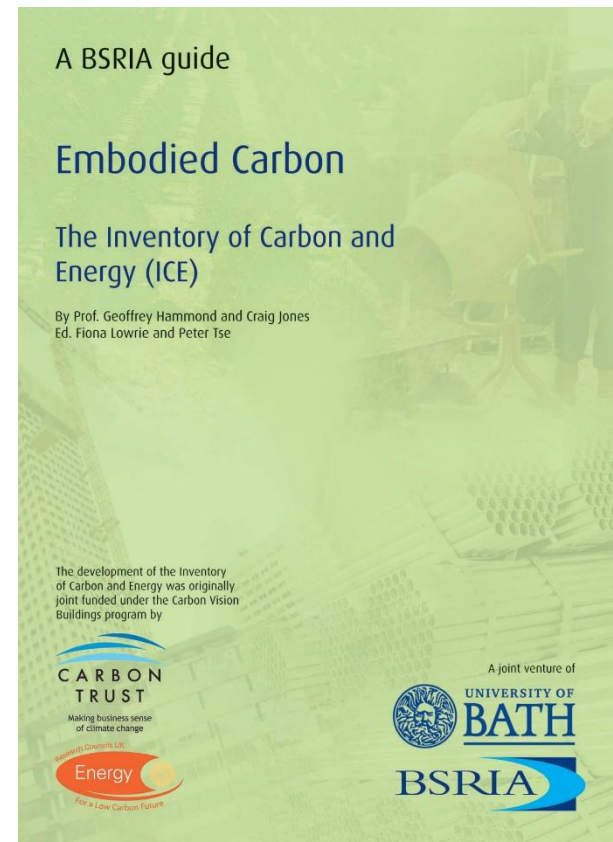
Publication of an annual impact report disclosing the amount raised and use of funds

https://circularecology.com/scaling-carbon-reductions-initiative.html

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The Inventory of Carbon & Energy (ICE)

- An **embodied energy and carbon database** for building materials

  o First version (2005) released by Dr Craig Jones and Professor Geoff Hammond, University of Bath

- Carbon Data for over 200 materials

  o Primarily for Construction Materials

- Over 50,000 worldwide users

- Updated in 2011 (v2.0), and 2019 (v3.0)

- The latest version (ICE v4.0, Nov 2024) is free to download as an excel file from - www.circularecology.com/ice-database.html

- Further ICE updates hopefully to come

A BSRIA guide

Embodied Carbon

The Inventory of Carbon and Energy (ICE)

By Prof. Geoffrey Hammond and Craig Jones
Ed. Fiona Lowrie and Peter Tse

The development of the Inventory of Carbon and Energy was originally joint funded under the Carbon Vision Buildings program by

CARBON TRUST
Making business sense of climate change

Energy
For a Low Carbon Future

A joint venture of
UNIVERSITY OF BATH

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Data Quality in the Context of Carbon Data

Data Quality – Definition

Data Quality =

Measurement of how well data serves its intended purpose
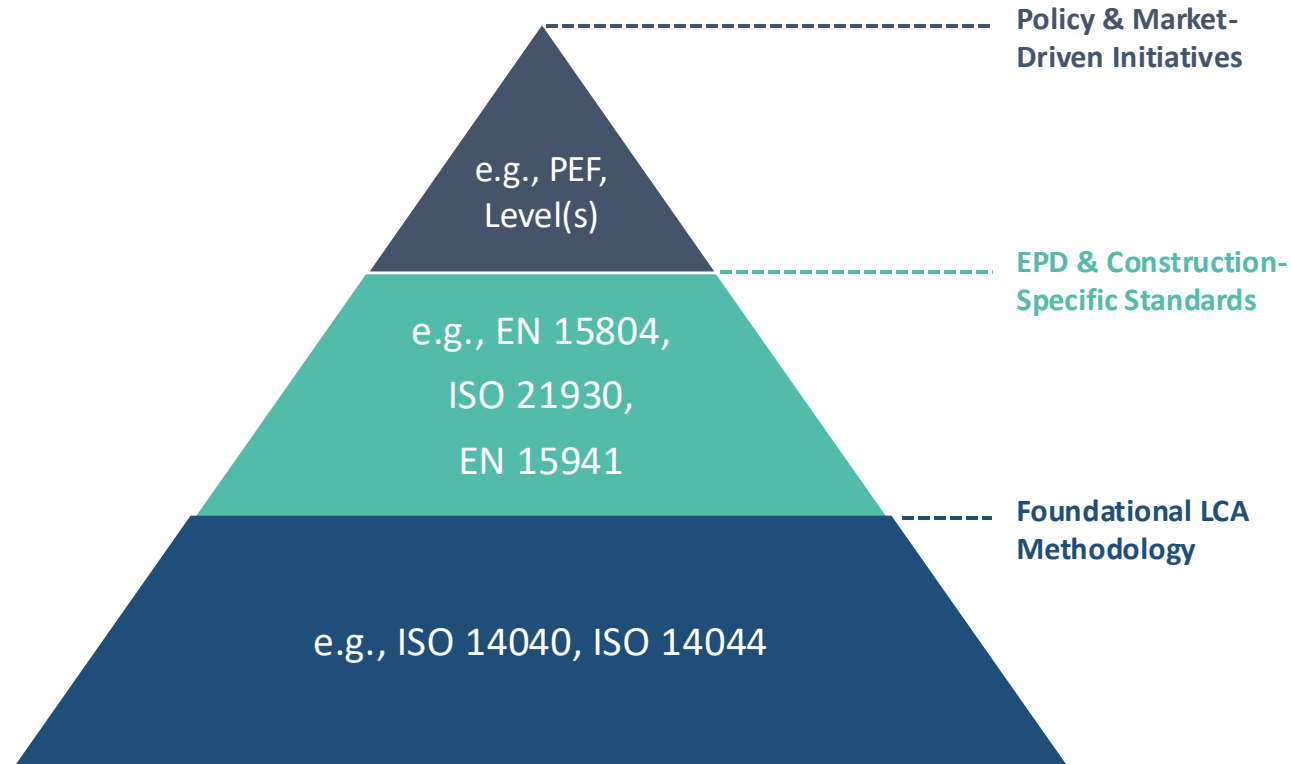
- **Not all data** is created equal

- Higher quality data leads to **better decisions, stronger insights, and more trustworthy results**

- Data quality is also a tool for **managing the uncertainties inherent** in carbon assessments

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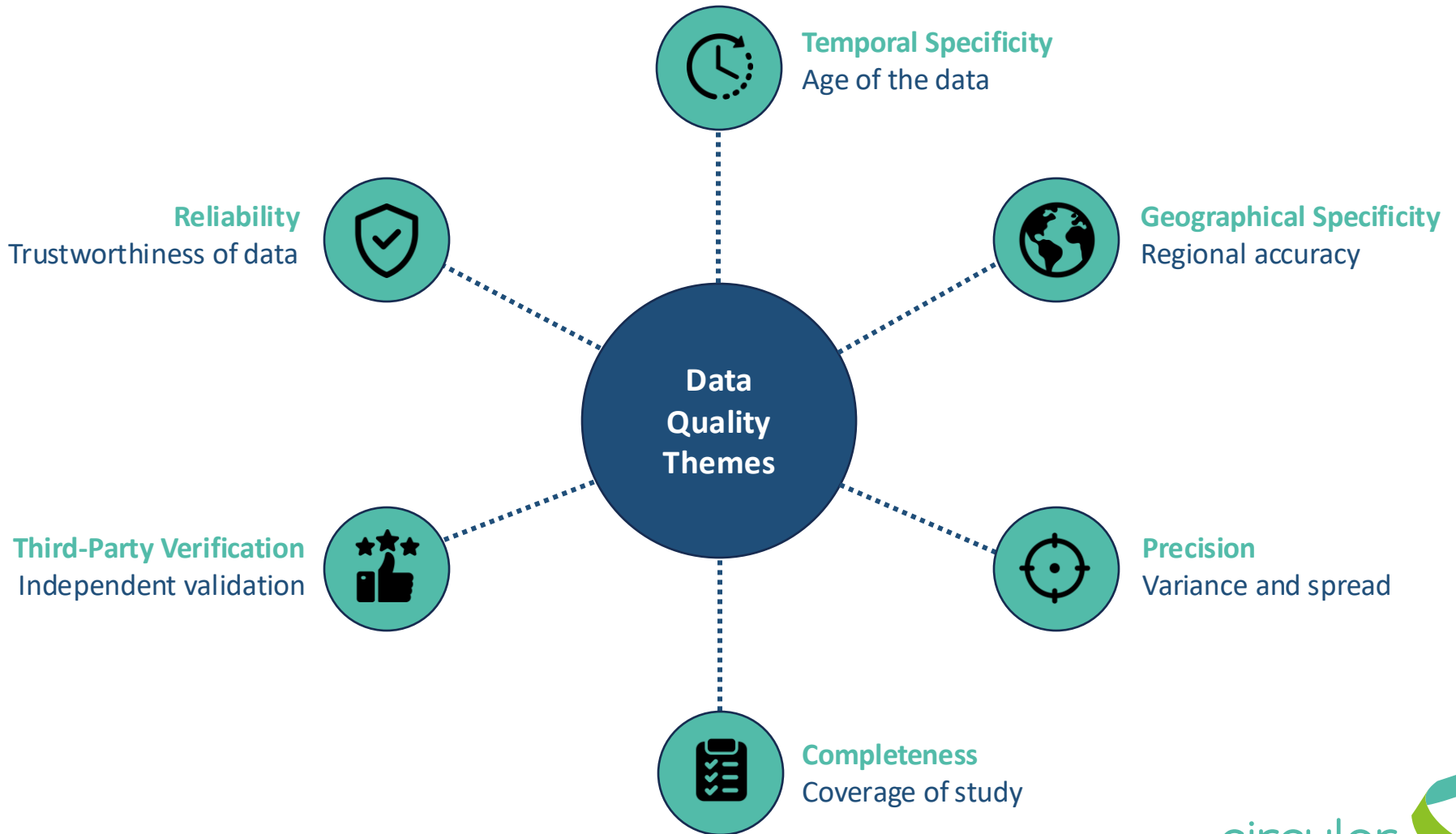
Data Quality – Standards

Role of Standards:

- Creates a **common language** for reporting carbon data quality

- Helps to identify high-quality, verifiable data – by ensuring **consistency, transparency and comparability**

Policy & Market-Driven Initiatives

e.g., PEF, Level(s)

EPD & Construction-Specific Standards

e.g., EN 15804,
ISO 21930,
EN 15941

Foundational LCA Methodology

e.g., ISO 14040, ISO 14044

Hierarchy of Standards

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Data Quality – Common Themes

Temporal Specificity
Age of the data

Geographical Specificity
Regional accuracy

Reliability
Trustworthiness of data

Precision
Variance and spread

Third-Party Verification
Independent validation

Completeness
Coverage of study

Data Quality Themes

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Data Quality – Benefits

- **Reliable Comparisons**
  - Ensures results are consistent and comparable, laying the foundation for informed decision making

- **Validation of Carbon Assessments**
  - Ensures results are credible and verifiable, important for external communications

- **Avoiding Misguided Sustainability Decisions**
  - Focusses sustainability efforts on relevant aspects

- **Identifying Improvement Opportunities**
  - Helps to pinpoint gaps or inconsistencies in data

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ICE v4.0
Data Quality Framework

ICE v4.0 – Context

ORIGINAL
Data Quality Framework

Applies to ICE v3.0 data

- Aggregates
- Aluminium
- Asphalt
- Bitumen
- Clay
- Glass
- Timber
- Etc...

UPDATED
Data Quality Framework

Applies to ICE v4.0 updated categories only

- Concrete
- Cement
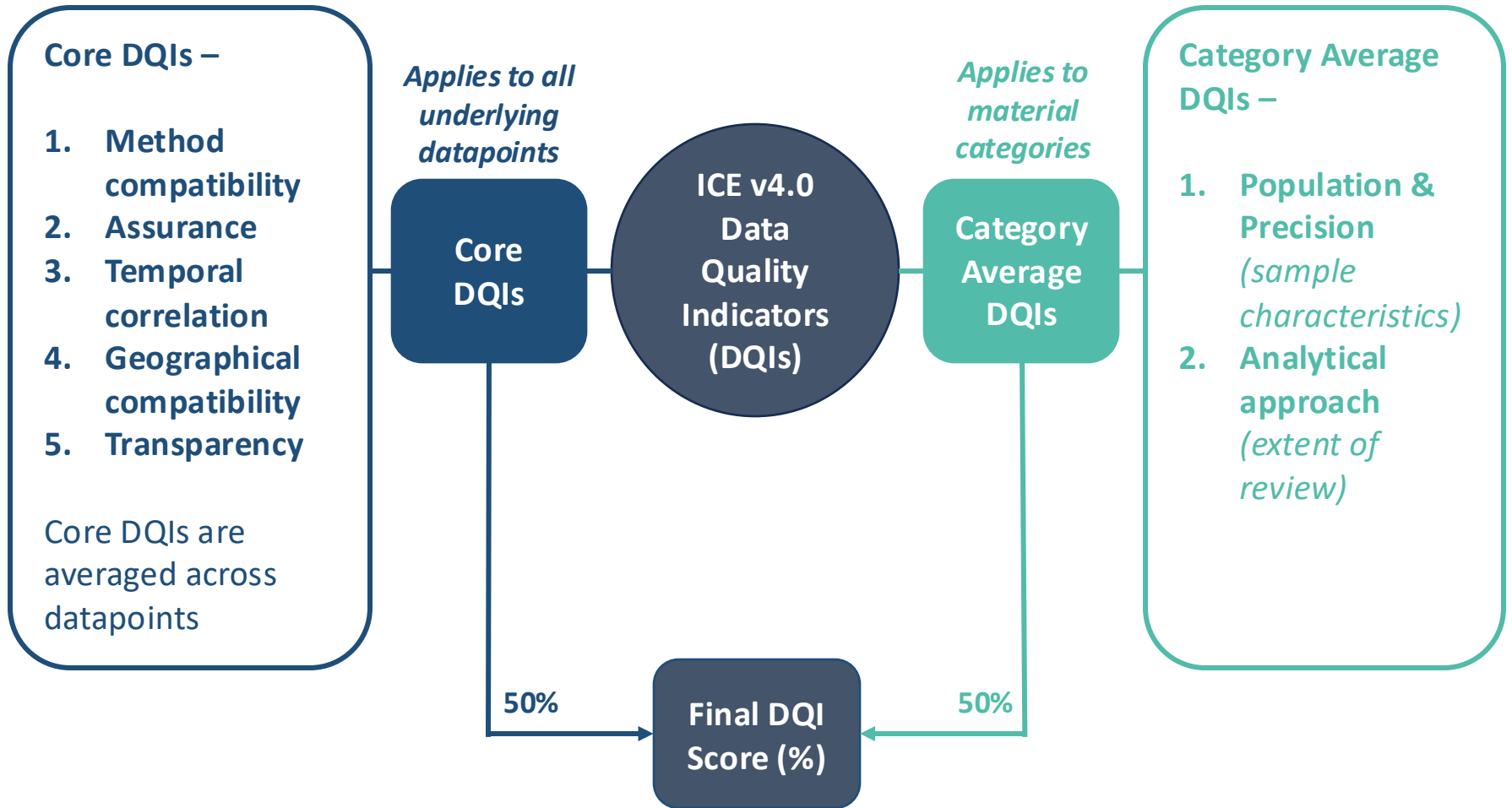- Insulation
- Paint
- Plaster
- Rubber
- Vinyl
- Etc...

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ICE v4.0 – Generic Data

The ICE Database is made up of generic data

Generic data = Average carbon impacts for a material category

- Advantages **– accessible, easy-to-use** emission factor (useful at **early stages** of assessment or design)

- Best practice involves **replacing generic data with specific data** once it is feasible to do so (e.g., product-specific EPDs)

- ICE Database generic emission factors are typically made up of a **mix of underlying datapoints that are aggregated** (LCAs, EPDs, academic literature etc.)

- Data quality is **particularly important for generic data**

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ICE v4.0 – Framework Overview

Core DQIs –

1. **Method compatibility**
2. **Assurance**
3. **Temporal correlation**
4. **Geographical compatibility**
5. **Transparency**

Core DQIs are averaged across datapoints

Applies to all underlying datapoints

Core DQIs

ICE v4.0 Data Quality Indicators (DQIs)

Applies to material categories

Category Average DQIs

Category Average DQIs –

1. **Population & Precision** *(sample characteristics)*
2. **Analytical approach** *(extent of review)*

50%

50%

Final DQI Score (%)

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ICE v4.0 – Core DQIs

| Indicators	5 (Best)	4	3	2	1 (Worst)
1. Method Compatibility	Industry-specific prescriptive standards (e.g. EN 15804, ISO 21930)	Industry non-specific prescriptive standards (e.g. ISO 14067, PAS 2050, GHGP Product) - EPDs without stated methods will be awarded this score by default.	Other standardised method	Recognised method, but not standardised (e.g. ISO 14040/44 only)	No declared method (e.g. missing data or research paper without defined method)
2. Assurance	External panel review (e.g. ISO 14040 panel review with 3 or more people)	2 External reviewers (e.g. academic papers)	1 External reviewer (EPDs score this by default)	Internal review	No declared review process
3. Temporal Correlation	<= 3 years old	4 - 6 years old	7 - 9 years old	>= 10 years old	No declared year
4. Geographical Compatibility	UK	European data or World Average	North American	All other countries and regions, or no declared geography	-
5. Transparency	Full calculation model and detailed report available (very rare)	Detailed report (e.g. full LCA report, documenting assumptions in detail), but no calculation model. Or transparent calculation model, but not detailed report.	Summary report covering an overview of method incl. key data (EPDs will be awarded this score)	-	Limited details on method, or key information missing

Notes

- The Core DQIs **formed the basis of the** original ICE data quality framework

- Maximum score of **25 points** for each datapoint

- Database is **currently UK-centric**

- Key consideration of **handling diverse forms** of underlying data

- Core DQIs are applied to **every underlying datapoint** in the database

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ICE v4.0 – Category Average DQIs (1)

1. Population & Precision DQI (Max 5 Points)

Sample Size / MAPD	>40%	40% ≥ x > 30%	30% ≥ x > 20%	20% ≥ x >10%	≤10%
1 - 10	0.5	1	1.5	2	2
11 - 25	1	1.5	2	2.5	3
26 - 50	1.5	2	2.5	3	3.5
51 - 100	2	2.5	3	3.5	4.5
101+	2	3	3.5	4	5
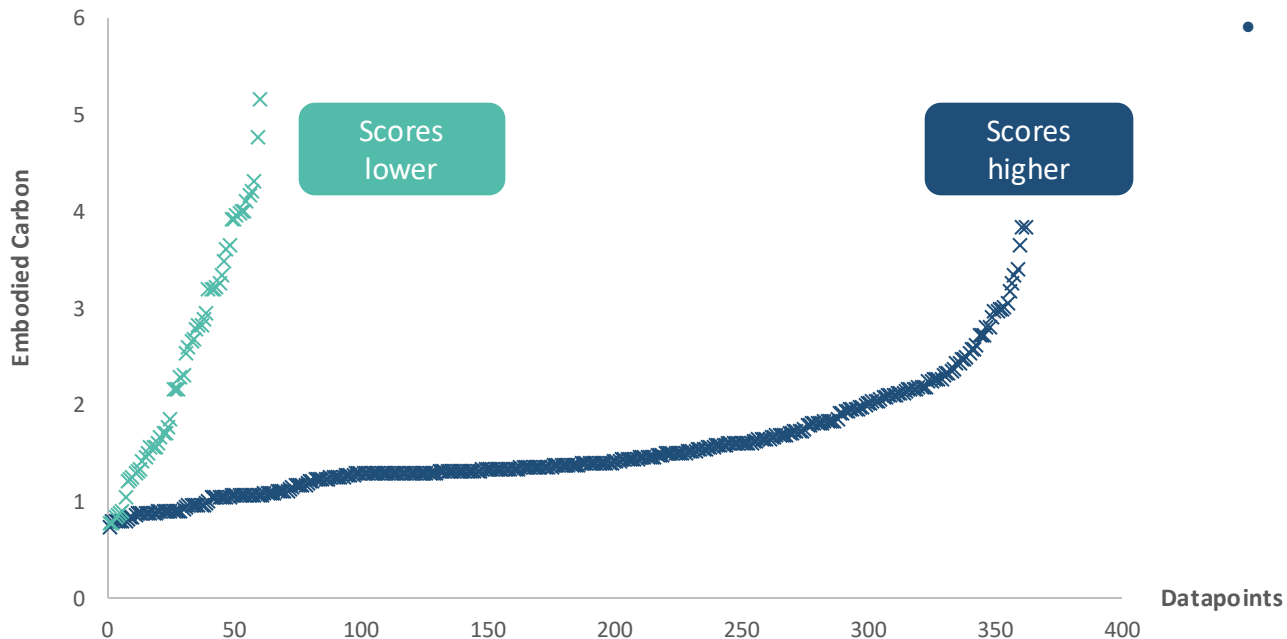
Notes

- This is an assessment of **sample size and sample variance**

- Mean Absolute Percentage Deviation (MAPD) is a **measure of variance/precision,** expressed as a percentage

- Matrix format to allow for **flexibility to handle the connected nature of these two characteristics**

ICE v4.0 – Category Average DQIs (2)

2. Analytical Approach DQI (Max 5 Points)

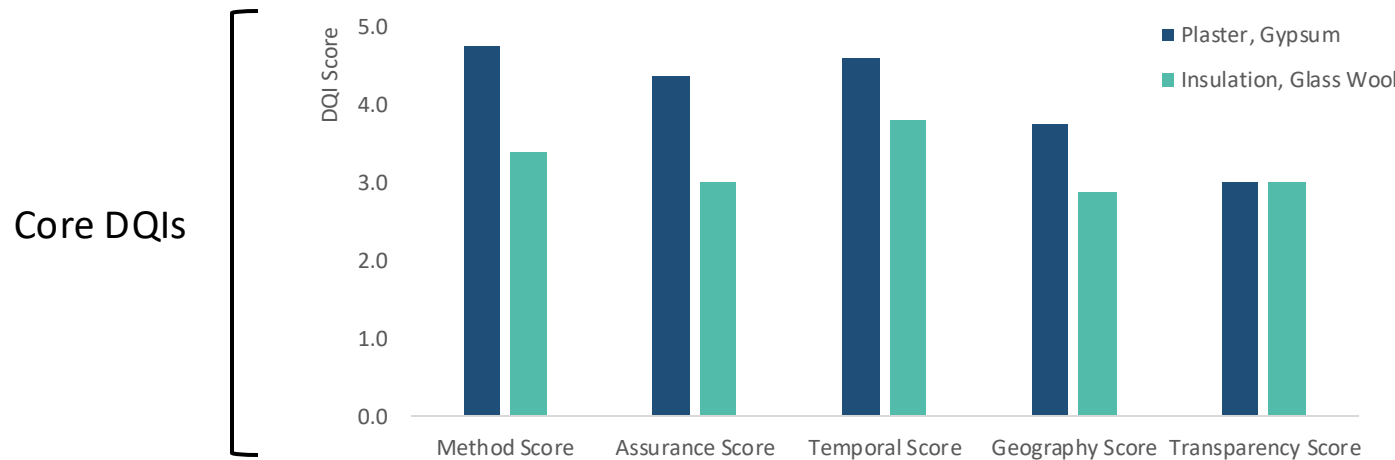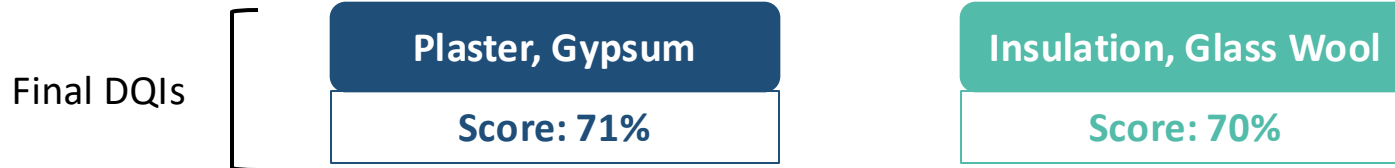| Description	Score
Every datapoint in this category has been checked, and all targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily	5
Targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily, with minor or no concerns noted	4
Targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily, with moderate concerns noted	3
Targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been closed out satisfactorily, with larger concerns noted	2
Data has been categorised, automatic capping applied, but no analysis or review of individual datapoints has taken place; or targeted analysis (e.g. via statistical methods, reference values, visual inspection) has been attempted but major concerns are noted	1

Notes

- Categories undergo **extensive internal review and manual intervention**

- **Future webinar** to explore this process in more detail

- It is a means of **transparently documenting our internal review**

- Identifies **areas for improvement** in analytical review

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ICE v4.0 – Uncertainty in Generic Data

- The data quality assessments **serve a crucial function for handling the mostly generic nature** of ICE emission factors

- Aggregation of datasets **introduces uncertainties**

- Data quality assessments help to **reveal these associated uncertainties** in a transparent manner

- Data quality can act as a risk management tool to help **make more informed decisions** in the face of uncertainty

- **Full profiles can be found** in the ICE material profile pages

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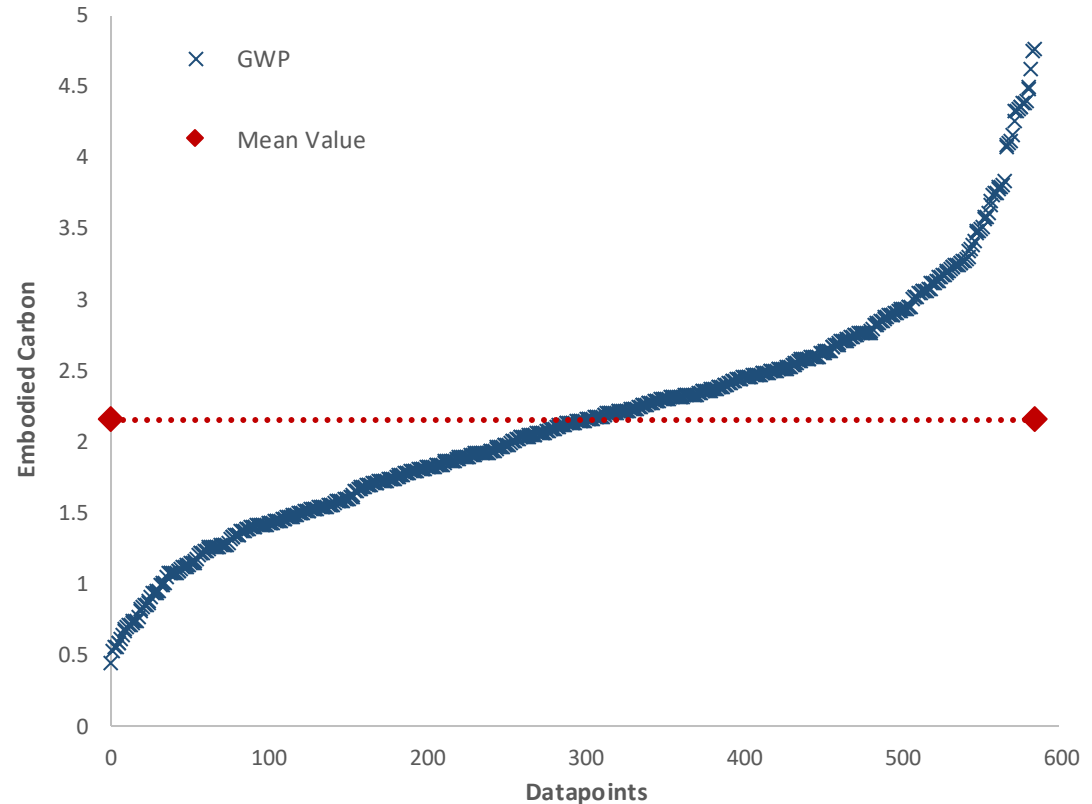
ICE v4.0 – Data Quality Scoring Comparison

Final DQIs

Plaster, Gypsum	Insulation, Glass Wool
Score: 71%	**Score: 70%**

Core DQIs

DQI Score

Legend:
- Plaster, Gypsum
- Insulation, Glass Wool

X-axis: Method Score, Assurance Score, Temporal Score, Geography Score, Transparency Score

Category Average DQIs

	Plaster, Gypsum	Insulation, Glass Wool
Sample Size	*107*	*362*
Variance (MAPD)	*38.3%*	*26.1%*
Population DQI	**3.0**	**3.5**
Analytical DQI	**3**	**4**

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ICE v4.0 – Future DQI Improvements

- **Three Point Uncertainty**
  - Preserving more of the distribution present in categories, rather than reducing it to one datapoint (e.g., *'plausible minimum', 'most-likely', 'plausible maximum'* scenarios)
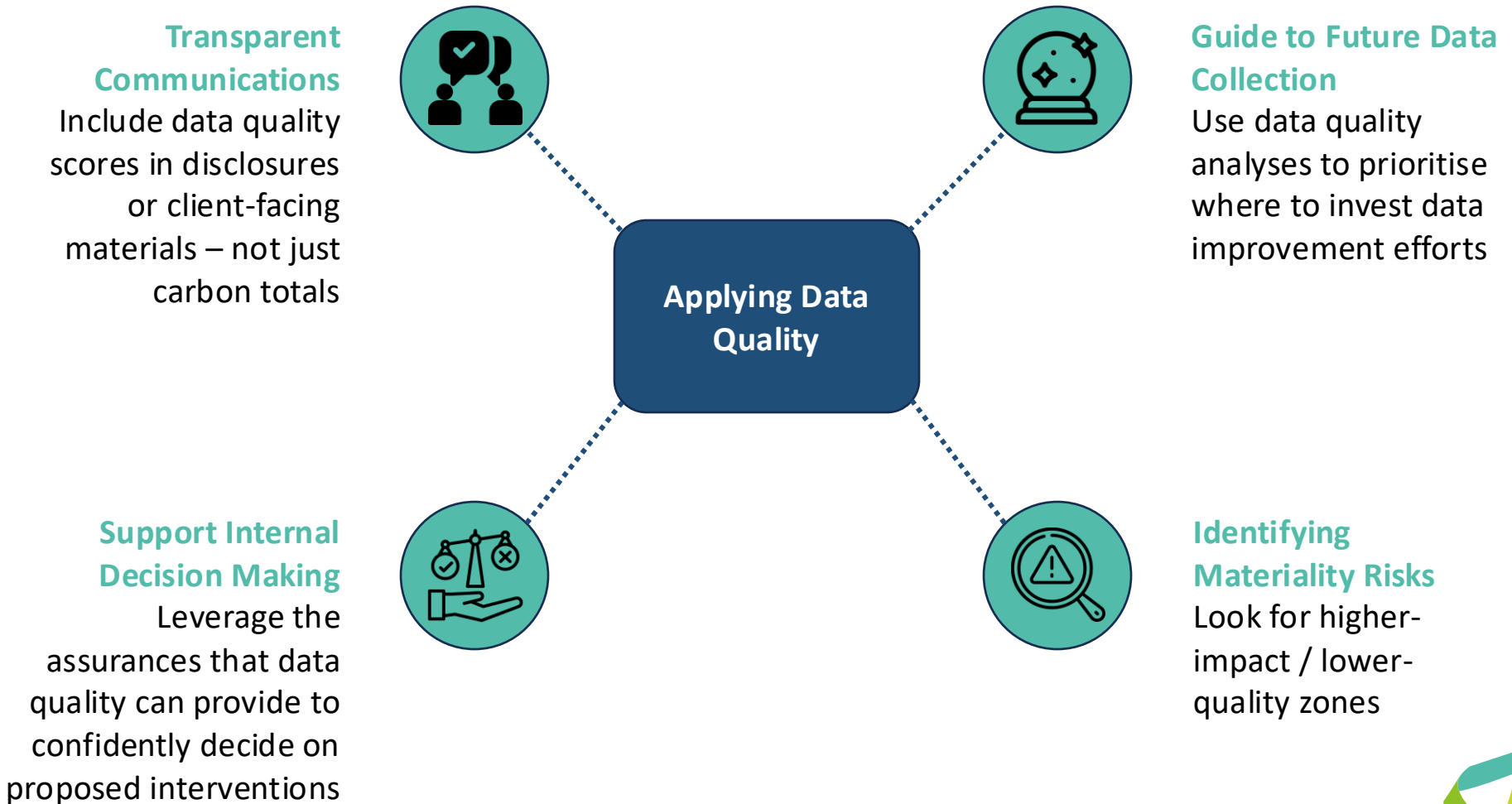
- **Better Accounting of Industry Average EPDs/LCAs**
  - Implementing processes and metrics to better incorporate the quality of industry-average or sector-average data

- **Ongoing Improvements to Existing Framework**
  - New data brings new nuances
  - Evolution of standards as they relate to background databases
  - Option to change user geography
  - User feedback

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Practical Applications of Data Quality

Transparent Communications
Include data quality scores in disclosures or client-facing materials – not just carbon totals

Guide to Future Data Collection
Use data quality analyses to prioritise where to invest data improvement efforts

Applying Data Quality

Support Internal Decision Making
Leverage the assurances that data quality can provide to confidently decide on proposed interventions

Identifying Materiality Risks
Look for higher-impact / lower-quality zones

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Summary

Today's Webinar - Recap

✓ Definition of Data Quality

✓ Landscape of standards in carbon data quality

✓ Common themes in data quality analyses

✓ The importance of data quality

✓ ICE Database data quality framework

✓ Case study comparison

✓ Future improvements

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How You Can Support ICE

Share with your networks **how you use the ICE Database** in projects, tools and research

Contribute to our **Scaling Carbon Reductions Initiative (SCRI)** by choosing some of the Circular Ecology products which diverts revenue from sales towards ICE and other free data and tools

Donate directly to the ICE Database and be recognised as an ICE Supporter or Contributor

Invite us to collaborate on research grant funding applications (Innovate UK, Horizon...etc), part funded research can be an important part of updating the ICE Database

https://circularecology.com/how-to-support-ice.html

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Next Webinars

We are planning multiple **webinar series across 2025**

Continuing **ICE Database Insights** series -

1. **ICE Analytical Review Processes** - Weds 30th April

2. **Are All EPDs Created Equal?** - Thurs 22nd May

3. **Methodological Challenges Behind the Scenes** – 12th June

4. **Appropriate Use of Generic Data** - Weds 16th July

Read more and sign up at circularecology.com/news/new-webinar-series-the-ice-database

Keep an eye on our networks for more information

- Website - circularecology.com

- LinkedIn - linkedin.com/company/circular-ecology

Q&A

Please use the Q&A interface to ask your questions

Thank you for watching

Sign up for more information on ICE and for future updates

https://circularecology.com/newsletter.html