



Directional Survey Data Object

The PPDM Association

March 2022



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The PPDM Association Data Objects project considers this question. What if we could design a method for defining clear baselines that allow data to be properly managed

What if we could design a method for defining clear baselines that allow data to be properly managed and audited, independent of the technology in which it has been deployed, and data professionals had appropriate competency and capability?

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Abstract

Various standards might be leveraged, but often data professionals are unaware that they exist.



The Professional Petroleum Data Management Association

The Member Driven
Global Society for Data and Data Professionals

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ABOUT US

The PPDM Association is the global, not-for-profit society within the petroleum industry that provides leadership for the professionalization of petroleum data management through the development and dissemination of best practices and standards, education programs, certification programs and professional development opportunities.

30⁺

Years of
experience

18,500⁺

Community
supporters

130⁺

Countries are
part of PPDM's
global reach

1,000S

PPDM volunteers
have built
products and
services that
benefit industry



SUMMARY

Formed by Industry

October 1991

Governance

Volunteer Board of Directors elected by members

Status

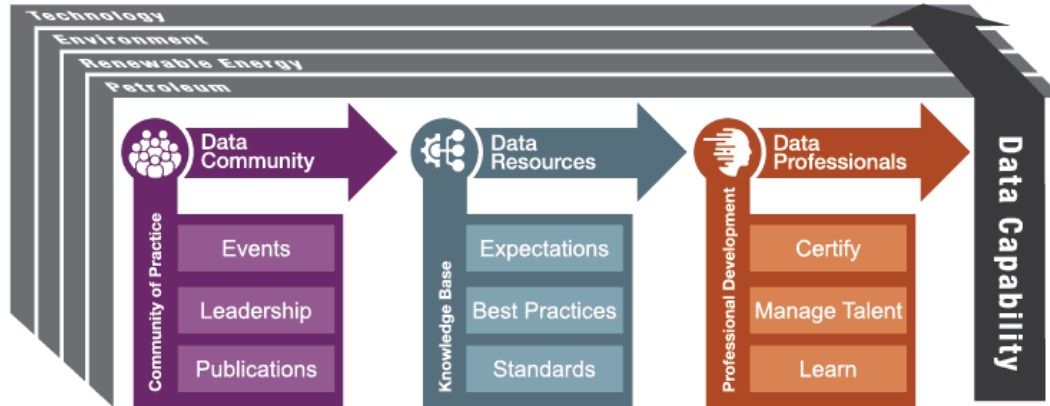
Registered Not for Profit

Locations

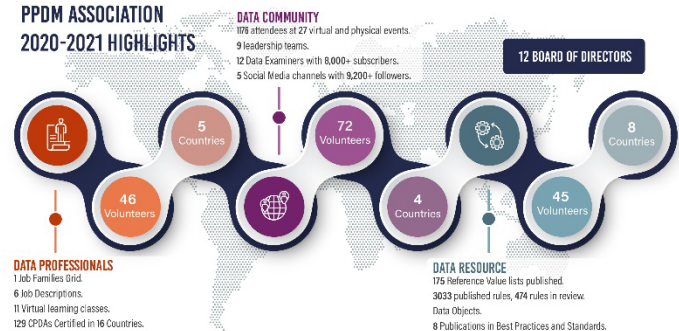
HQ Canada

Members Global

The PPDM Strategy



Member collaboration is
the heart of PPDM.



The Challenge *(For All Data Types)*

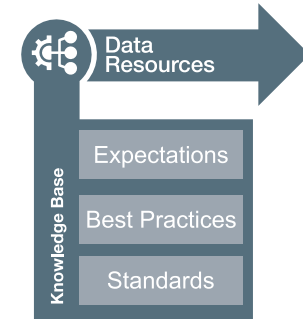
Data struggles to achieve full usefulness because:

We all have a different idea of what “good” is

- What makes a good well log, section, directional survey ...
- What vocabulary (mine, my vendor’s, service company...)
 - But we are not very good about defining our terms
- We “adjust” the data to fit our expectations

Data disciplines often considered tactical (not strategic)

- Limited to the needs of the part of business they are in
 - Data transcends business boundaries
 - Many global data managers are “part time”
- Discipline awareness often poor
- Suitable professional development not available

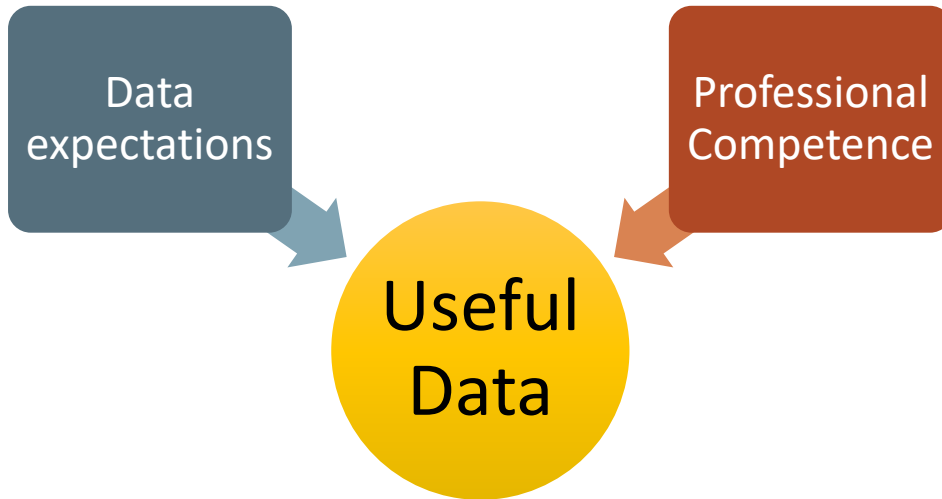


The Opportunity

Can we create a baseline for what “good” data looks like?

Instead of fixing data again and again, can we get it right and keep it right?

Can we help data professionals master the core competencies and capabilities to steward data through all users and business processes?



Measurable expectations
must be established



Competency &
Capability

Trained, credentialed professionals maintain the strategic data asset to support the needs of all users.

Communication
Protocols

Communication protocols ensure data is used and transported between systems without attenuation.

Container
Structures

Technical containers (databases, ML, spreadsheets), keep contents organized and accessible by SW.



**Data
Contents**

Object
Contents

Object contents describe how each object should behave. Consistency drives interoperability.

Data
Contents

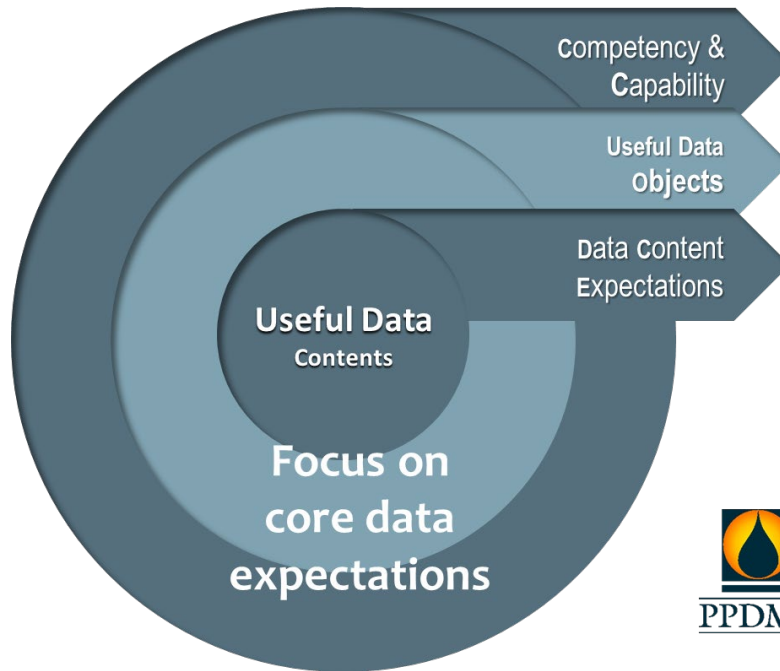
Data contents support shared vocabularies and other information needed to drive trust and usefulness.



PPDM™

Data Ecosystems

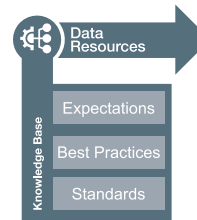
Data Objects



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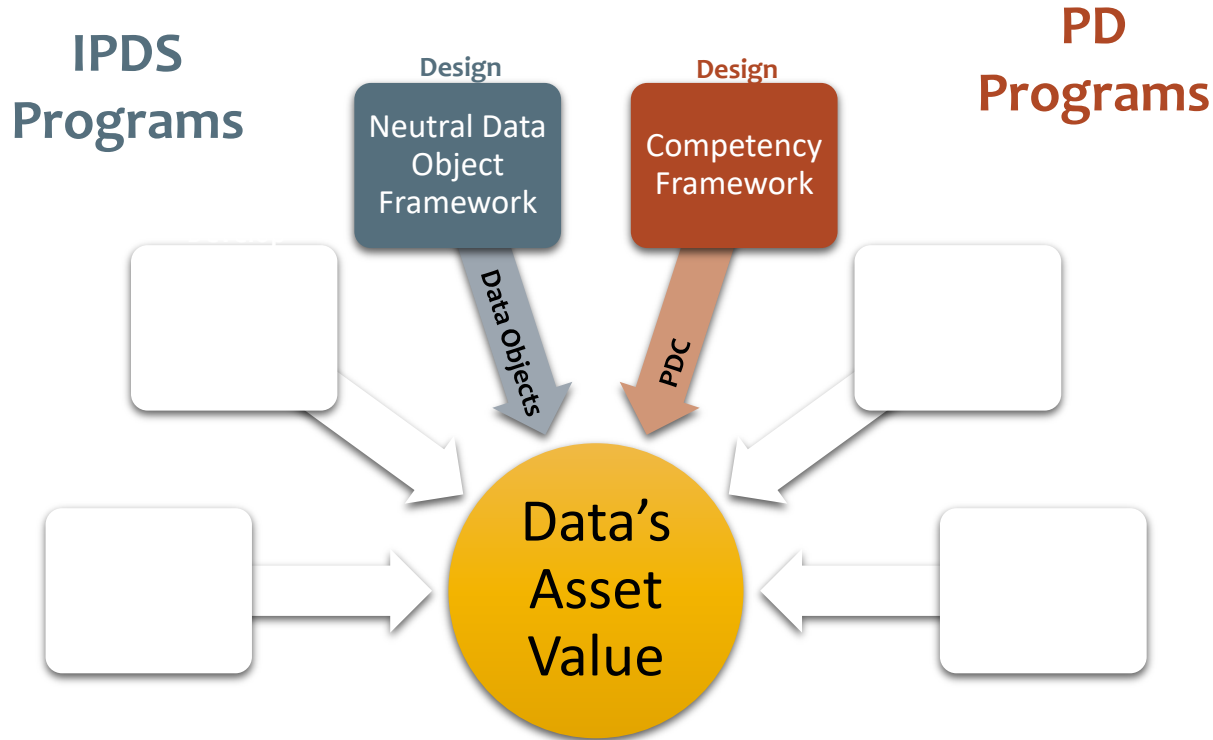


Data
Auditability

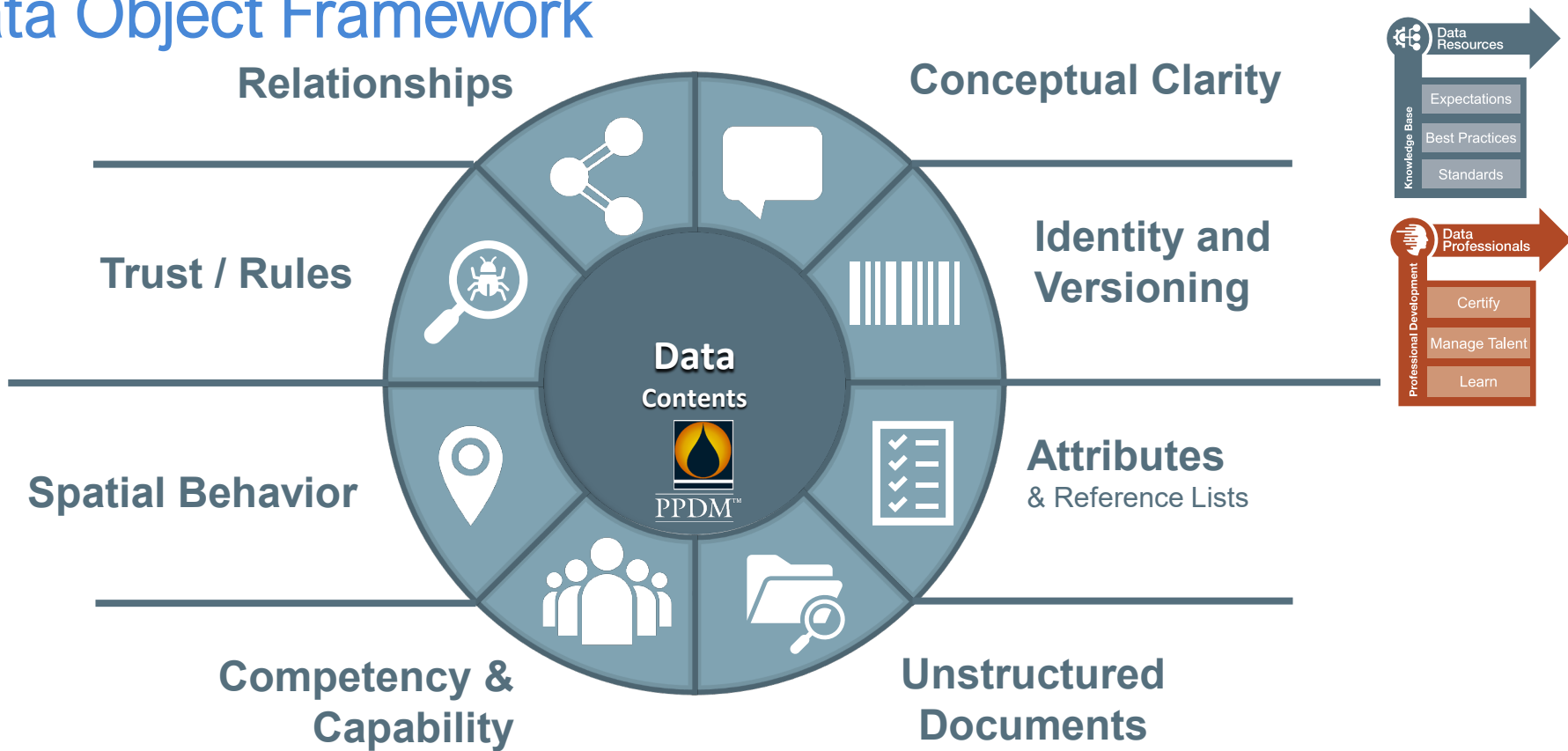


Professional
Accountability

Data and Capability



Data Object Framework



Relationships

Relationships and cardinality describe real world relationships between objects. Knowledge of these relationships ensures that data represents the business, rather than a specific process.

Rules

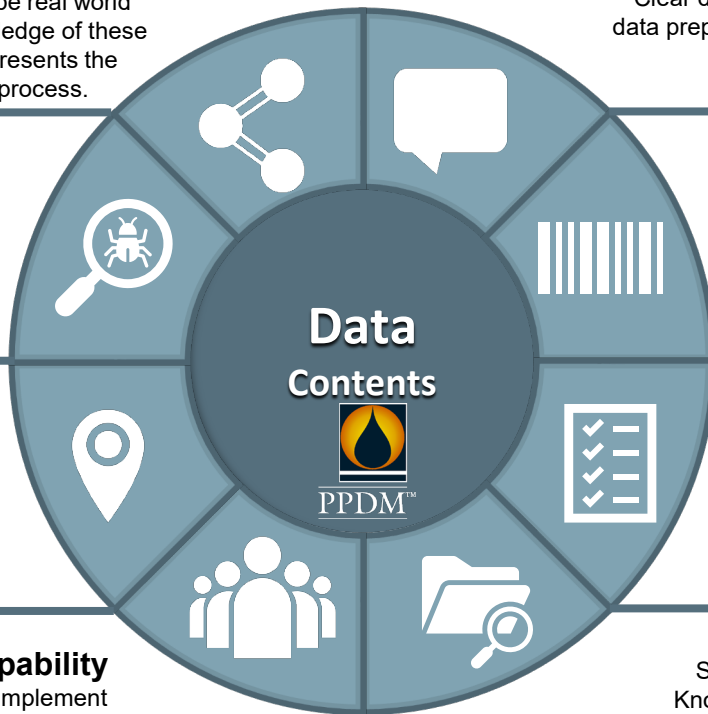
Atomic, measurable, specific and testable expressions that describe “well formed” data, prevent content and contextual attenuation. May include specifications for when and how terms are to be used.

Spatial Behavior

Most objects can be located on the surface or subsurface. They are subject to change, versioning and interpretation.

Competency and Capability

Data resources develop and implement strategies to ensure that the needs of stakeholders are addressed while supporting the strategic value of data.



Conceptual Clarity

Clear descriptions and definitions ensure that integration and data preparation focus on business concepts, and don't get hung up on proprietary terminology.

Identity and Versioning

Criteria for establishing the data difference between “new” objects and “versions” of the same object must be clearly understood.

Attributes

The unique and clear identification of a data object is defined by the presence of specific attributes.

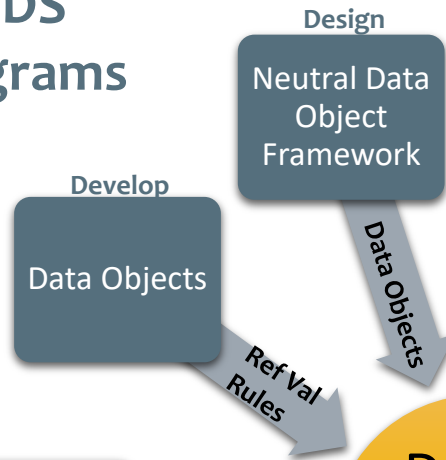
Reference lists support interoperability.

Unstructured Documents

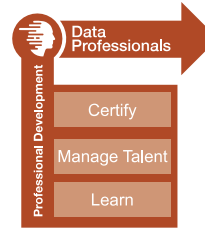
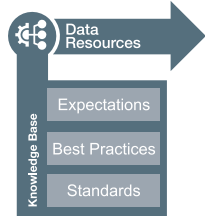
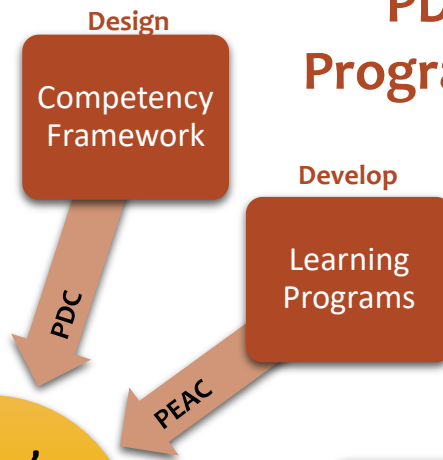
Supporting Documents and Information. Knowledge of what unstructured information needs to be associated with this object (and how it might be created, changed and managed).

Data and Capability

IPDS Programs



PD Programs

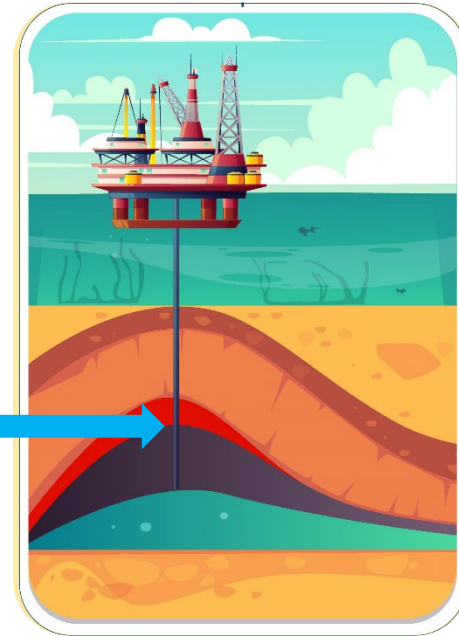


Walk Through Using an Example

Directional Surveys

Most wellbores are not entirely straight (intentionally or not)

A collection of surveyed points that measure the path of a wellbore in three dimensions.



Data Managers Consider These Framework Elements



Wellbore Positioning Technical Section

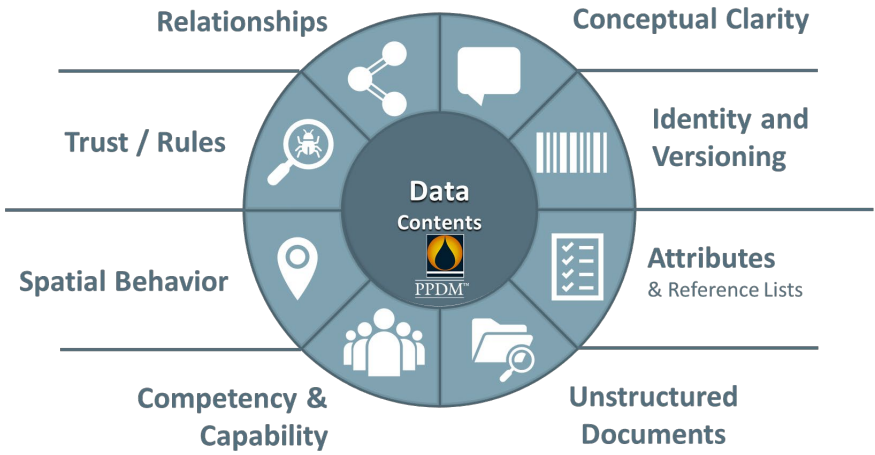
The Industry Steering
Wellbore Survey Acc...

Data Resources

- Expectations
- Best Practices
- Standards

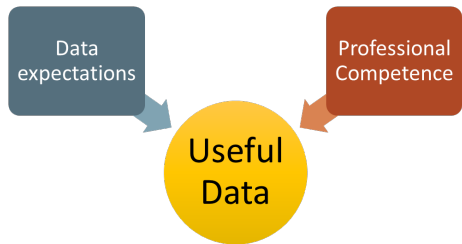
Data Professionals

- Certify
- Manage Talent
- Learn

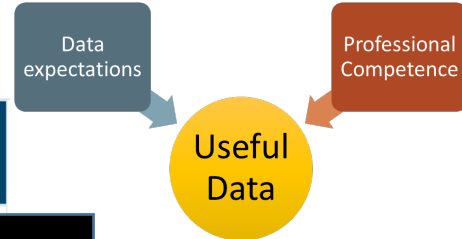


What should “good” data look like?

What should data professionals know?



Each Directional Survey Must Have Attributes



Sub-object	Attribute	Attribute Family	Define or Describe	Reference List	Definition	Data Type
Directional Survey Composite	TVD Reference Elevation UOM					
Directional Survey Station	Accuracy Problem Indicator		Describe			
Directional Survey Station	Accuracy Problem Reason		Describe	Directional Survey Accuracy Reason	reason there is a problem if	Validated Text
					Value for the measurement in angle degrees of the clockwise departure from a reference north to the survey point in the wellbore.	Number
Directional Survey Station	Azimuth UOM		Describe	Units of Measure	Original units of measure for the Azimuth value.	Validated Text
					Pythagorean Theorem from this survey station X and Y Offsets	Number

The attribute name is human readable.

Upgrading to whether mandatory, recommended or optional.

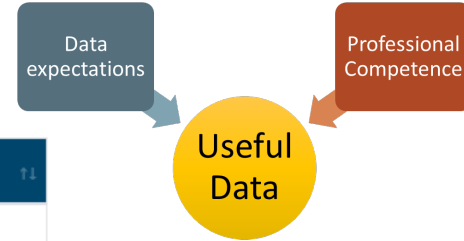
Link to list of values where applicable

Clear, complete definitions.
Can include advice or suggestions.

The kind of data to expect, not container specific.
Considering scale and precision.



Behaviors can be described

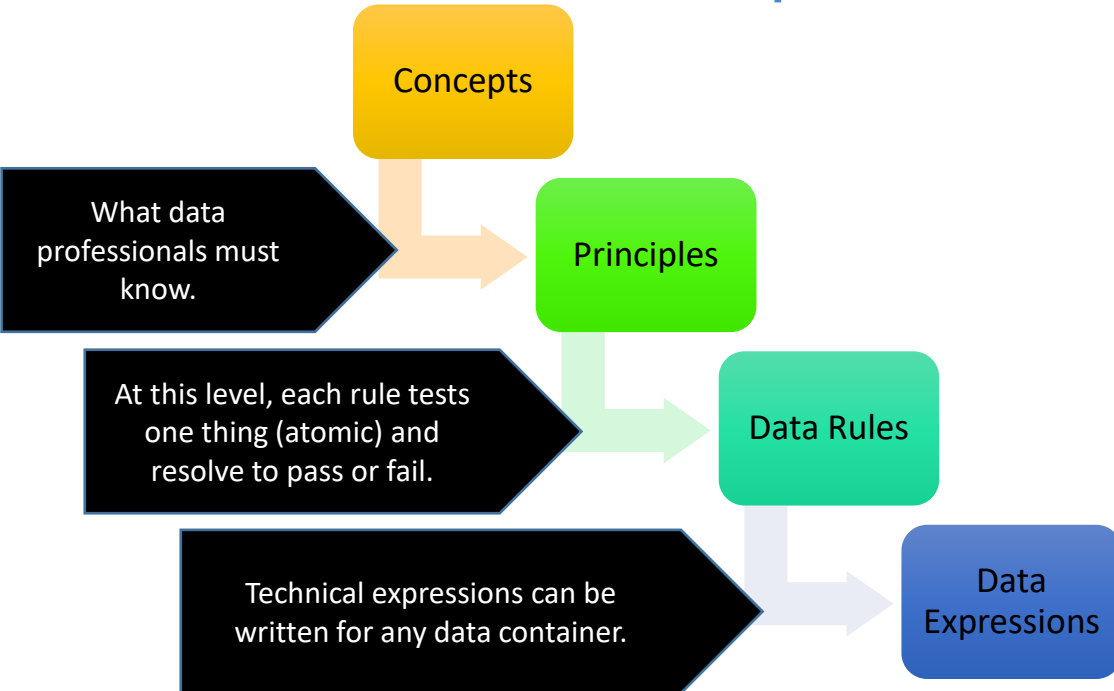


Description Type	Description
Spatial Physical	Errors in the north reference type can result in substantial positioning errors.
Spatial Planning	These starting behaviors need to be expanded. composite survey less
Description Type	What do data professionals need to know? What will drive interoperability? What will enhance data's usefulness?
Identity Management	
Version Management	Versions of directional surveys are only allowed when different calculation methods are applied to the same raw

Behavioral information is intended to support competence and encourage appropriate implementation in data systems.

Description Type	Description
Business	Directional surveys should be attached to wellbores.

Data Rules Can Be Captured

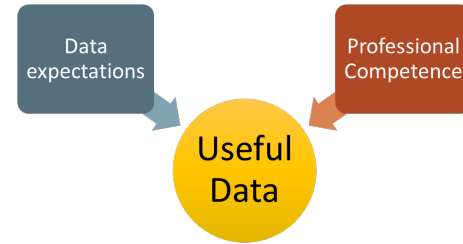


Professional Accountability Programs

- Data Governance
- Data Mastering
- Data Management

Data Auditability Programs

- Human testing
- Machine testing



Data
expectations

Professional
Competence

Useful
Data

Data Rules Can Be Captured

Concepts

Coordinates are provided as a triplet of values: latitude, longitude and coordinate reference system.

Principles

When used in data systems, all three attributes are normally expected. If the CRS is missing, investigate and resolve. Each CRS is valid in specific areas ...

Data Rules

If Latitude is present, Longitude must also be present...
If Latitude is present, CRS must be present ...
If CRS is present, it must exist in a list of valid values ...

Data Expressions

Manual inspection
SQL, Macro
Coding language...



Wellbore Positioning Technical Section



The Industry Steering Committee on
Wellbore Survey Accuracy (ISCWSA)

Rule ID	Statement	Description
172	Directional survey date	Rule # 248 - The directional survey depth datum must be the same as the permanent dep...
240	Well directional survey	
241	Directional survey base wellbore depth at the	
243	For a well directional system value must not	
248	The directional survey as the permanent dep	
256	Well directional survey release date	
258	The file for a wellbore header information ab	

Data expectations

Professional Competence

Useful Data

Rule # 248 - The directional survey depth datum must be the same as the permanent dep...

Print Close

Definitions Comments Metadata

Rule Details

Statement
The directional survey depth datum must be the same as the permanent depth datum for the well.

Description
All depth measurements in a wellbore are referenced to a surface point (elevation reference datum) in order to convert to elevation. The directional survey should use the same datum as the other depth measurements (logs, drilling, etc.)

Coding Example
WELL_DIR_SRVY.REPORT_LOG_DATUM should equal WELLDEPTH_DATUM

Diagnostic Advice
Not available

Exceptions
Not available

Tolerances
Not available

Business Impact
Elevations are critically important for subsurface interpretation

Data Impact
Not available

Resolution
Not available

Classifications

- Subject Area**
 - Well
- Rule Type**
 - Data Rule
- Quality Dimension**
 - Consistency

Close

3.4 Recommended resolution

The following resolution is recommended for wellbore positioning

Container design

- Geodetic parameters (common header)
 - Where possible use the same unit and precision as in the EPSG Dataset. Maintain better than 1 millimetre precision if the unit or representation needs to be converted (e.g., use 8 decimal places for radians or arcseconds converted to decimal degree).
 - 5 decimal places for combined scale factor
- Raw sensor data (M7 and G7)
 - 0 decimal place for inclination
 - 6 decimal places for azimuth
 - 4 decimal places for magnetic declination
 - 0 decimal places for magnetic variation
- MDINCAZ (P7, M7 and G7)
 - 2 decimal places for magnetic declination
 - 3 decimal places for magnetic variation
 - 3 decimal places for magnetic variation (e.g., magnetic variation)
- Local coordinates (P7, M7 and G7)
 - 2 decimal places for Easting
 - 2 decimal places for Northing
 - 3 decimal places for Elevation
- Geodetic/projected coordinates
 - 2 decimal places for Easting
 - 2 decimal places for Northing
 - 7 decimal places for Elevation (corresponds to approx 1 cm-level precision for coordinates)

Table 11: Zero-depth Point (ZDP) TYPEID Codes and their abbreviations

ZDPTYPEID	ZDP Type	Description
1	Rig Bracing	The point where the wellbore meets the rig bracing.
2	Crown Valve	Also known as a swab valve. This is the uppermost on the vertical bore of the christmas tree above the outlet, sometimes used as a reference point for measurements.
3	Derrick Floor	The point where the wellbore intersects the platform usually 10 feet or more above the ground, or the floor which drilling operations are carried on. Also called the Derrick Floor.
4	Ground Level	Onshore. The earth's surface where the drillstring meets the ground. This reference point is not appropriate for offshore wells.
5	Kelly Bushing	The point in a wellbore where the wellbore intersects the top of the Kelly bushing.
6	Lowest Astronomic Tide	Depth Datum - The lowest predicted level of the sea under normal meteorological conditions.
7	Mean Lower Low Water	Depth Datum - Mean of observed lowest water level over a certain period. Used as Chart Datum on US nautical charts.
8	Mean Sea Level	Depth Datum - The average level of the surface of the sea over all stages of tide and seasonal variations.
9	Pipe Top	The top of the wellbore pipe.
10	Sea Floor	Offshore. The point where the wellbore intersects the sea floor. This is sometimes used as a reference point for wellbore measurements.
11	Top Bottom Flange	The top point of the bottom flange.
12	Top Cellar	Onshore, "hard" point generally close to Ground Level.
13	Top Wellhead Housing	May be used offshore to reference the top of the wellhead housing.
14	Unknown	The type of reference point is unknown.
100 onwards	[User Defined]	[User to define ZDP Type and abbreviation.

Notes:

Note that degree-minute-second notation (if it would be, then 3 decimal places) is not used for coordinates. 1 cm-level precision for coordinates

Wellbore Positioning Technical Section

H7,1,2,0: Well Definition

This record is mandatory. It defines the well horizontal Reference Point (WRP). The wellbore trajectory is considered to start at the WRP. The horizontal error starts to propagate at the WRP.

Additional detail of the WRP can be provided using H7,1,2,0 Position Object Attributes.

Field	Description	Data Type	Reference Code
5	"Well Definition"	Description	
6	Well Reference Number	Integer	WELLREF
7	Structure Reference Number	Integer	STRUCTUREREFER
8	Well Reference Point Abbreviation	Text	
9	Well Reference Point Reference Number	Integer	WOBJREF
10	Primary UWI	Text	
11	Primary Well Name	Text	
12	Primary Authority Name	Text	
13	Alternate UWI(s)	Text List	
14	Alternate Well Name(s)	Text List	
15	Alternate Authority Name(s)	Text List	
16	Well Status	Text	"Unknown", "Proposed", "Permitted", or "As-built"
17	Licence/Lease/Section Name	Text	At surface location
18	Spud Date	Date	YYYY-MM-DD Leave blank if unknown Planned date if proposed or permitted

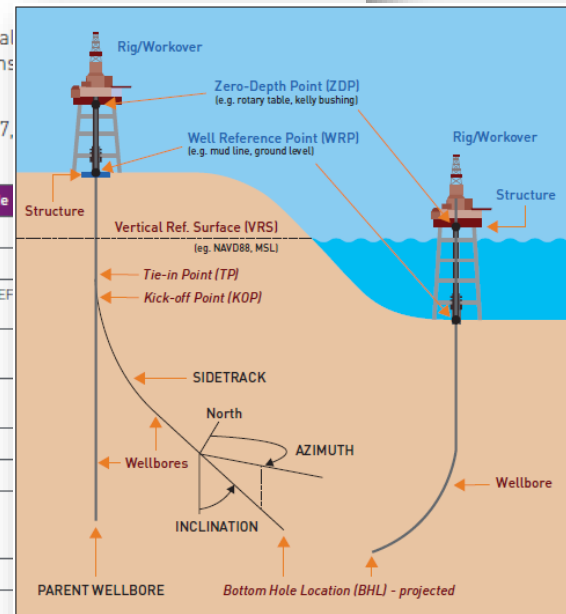


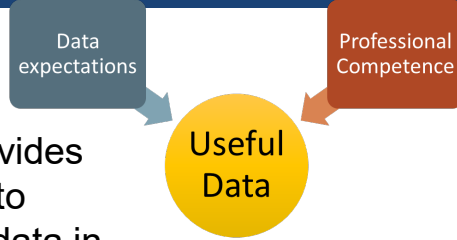
Figure 1: Deviated wellbore terminology.

List of Values

Use Rule

Wellbore Positioning Technical Section

Relationships



Directional survey provides useful spatial context to activities or technical data in the wellbore but it isn't mandatory.

The service job that creates the directional survey is important to some user groups.

The Wellbore that the directional survey describes is critical – this relationship is mandatory. Some business processes attenuate this relationship.



What is this?

What do the numbers mean?

How do I know if the numbers are right?

What should I look for?

What should I do if it's wrong or missing something?

Unstructured Data and Examples

It is very helpful for learners and designers to have access to examples.

It's also very useful to provide examples of BAD data, provided some explanation is provided about what went wrong and what to do about it.

DIRECTIONAL SURVEY												
(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)		(9)		
SUBSEA DEPTH FEET	TRIAS DEPTH FEET	TRUE VERTICAL DEPTH FEET	DRIFT ANGLE D H	DRIFT DIRECTION	VERTICAL SECTION FEET	RECTANGULAR	CLOSURES	DOG LEG SEVERITY				
						FEET	FEET	DISTANCE FEET	DIRECT	DES/100FT		
5299.88	5700	5390.88	31 30	N 37	0 E	1490.00	1390.73 N	538.16 E	1491.22	N 21 9 E	1.04	
5285.14	5800	5416.14	31 30	N 32	0 E	1541.27	1433.77 N	567.75 E	1542.09	N 21 36 E	2.41	
5479.52	5900	5501.52	31 15	N 25	0 E	1593.10	1479.50 N	592.57 E	1593.76	N 21 50 E	3.45	
5556.01	6000	5587.01	31 15	N 20	0 E	1644.95	1527.41 N	612.42 E	1645.61	N 21 51 E	2.59	
5641.95	6100	5672.95	30 15	N 14	0 E	1695.73	1576.28 N	627.36 E	1696.54	N 21 42 E	3.23	
5728.23	6200	5759.23	30 30	N 10	0 E	1745.28	1625.73 N	637.87 E	1746.29	N 21 23 E	2.04	
5814.50	6300	5845.50	30 15	N 8	0 E	1794.24	1675.47 N	645.78 E	1795.31	N 21 5 E	1.04	
5900.88	6400	5931.88	30 15	N 8	0 E	1842.19	1725.56 N	652.79 E	1844.91	N 20 43 E	0.00	
5987.59	6500	6018.59	29 30	N 10	0 E	1891.02	1774.76 N	660.59 E	1893.71	N 20 25 E	1.25	
6075.26	6600	6106.26	28 0	N 12	0 E	1937.98	1821.97 N	668.76 E	1941.17	N 20 11 E	1.78	
6164.16	6700	6195.16	26 30	N 12	0 E	1982.85	1866.75 N	679.28 E	1986.50	N 19 40 E	1.30	
6254.23	6800	6285.23	25 0	N 13	0 E	2025.50	1909.17 N	688.48 E	2029.58	N 19 50 E	1.56	
6344.86	6900	6375.86	25 0	N 16	0 E	2067.24	1950.05 N	699.26 E	2071.66	N 19 44 E	1.27	
6435.40	7000	6466.40	25 15	N 18	0 E	2109.43	1990.68 N	711.48 E	2114.07	N 19 40 E	0.89	
6525.75	7100	6556.75	25 30	N 20	0 E	2152.15	2031.20 N	725.63 E	2156.92	N 19 40 E	0.89	
6616.10	7200	6647.10	25 15	N 20	0 E	2194.92	2071.47 N	740.29 E	2199.77	N 19 40 E	0.25	
6706.73	7300	6737.73	24 45	N 20	0 E	2237.11	2111.18 N	754.74 E	2242.03	N 19 40 E	0.50	
6797.82	7400	6828.82	24 0	N 20	0 E	2278.30	2149.96 N	768.86 E	2283.30	N 19 41 E	0.75	
6889.17	7500	6920.17	24 0	N 20	0 E	2318.90	2188.18 N	782.77 E	2323.98	N 19 41 E	0.00	
6980.53	7600	7011.53	24 0	N 20	0 E	2359.50	2226.40 N	796.48 E	2364.65	N 19 41 E	0.00	



Directional Survey - Learning[?]

Introduction to wellbore positioning

This industry standard publication on directional drilling (accepted by the ISCWSA board) is published through the UHI Research Office, the full eBook is available to view or download below. This publication is constantly updated as techniques change or newer technology is employed, please check this page regularly if it is important to you to have the latest version of the publication. Version information is at the bottom of this page.

 Read More

Useful Links:

https://www.wellboreintegrity.com/wp-content/uploads/2021/05/DRILCO_Drilling-Assembly-Hndbk_WIS-BR-MKT-021_r2_ELEC.pdf

<https://www.iscwsa.net/articles/api-rp-78-overview-recommended-practices-for-wellbore-positioning/>

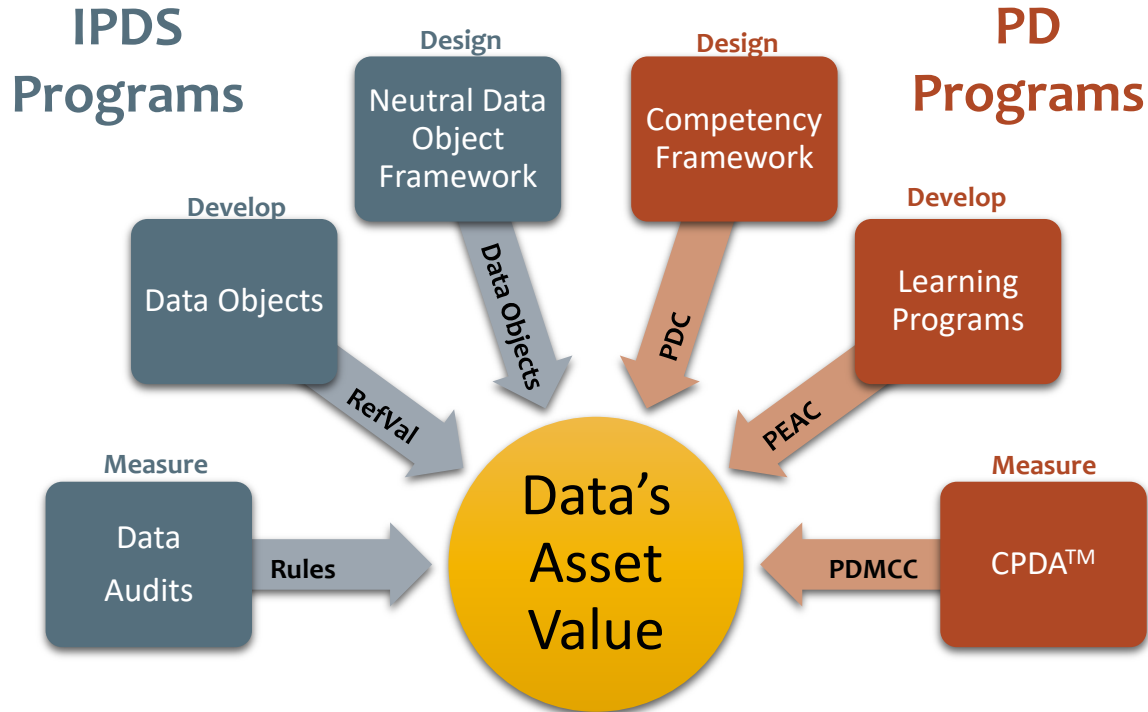
https://www.uhi.ac.uk/en/t4-media/one-web/university/research/eBook_V9_10_2017-redux.pdf

<https://www.iogp.org/bookstore/product/p7-17-wellbore-positioning-data-exchange-format/>

We need links to useful articles, illustrations etc., prepared by experts.

What data centric training is available?

Data and Capability





The Industry Steering Committee on
Wellbore Survey Accuracy (ISCWSA)

Wellbore Positioning Technical Section

Professional Competence

The Professional Petroleum Data Management (PPDM) Association

Data Analyst Professional Competency Framework

Version 1.0.0.2

The PPDM Association exists to create a global professional community of practice for those who manage all pet geo data and information as an essential asset using a collectively developed body of knowledge.

In collaboration with the members, the PPDM Association delivers events, publications, professional development programs, and standards that support interoperability of people, processes, and data.

Functional Competency	Document and Content Management (DCM)				
	Assessment	Basic	Intermediate	Advanced	Expert
Definition					
Description					

Roles
The graphic illustration below identifies multiple roles under the data management umbrella. Those highlighted in dark blue represent the six roles the PDC job families group focused on (Job Description Appendix). They include Data Analyst, Data Manager, Chief Data Manager, Petrotechnical Business Analyst, Data Steward and Petrotechnical Data Scientist.

Outside of the three (3) Core Roles, 11 Other Disciplines and Science Disciplines (roles) are identified. The group recognizes that this is not a comprehensive list of roles that may be prominent across the industry.

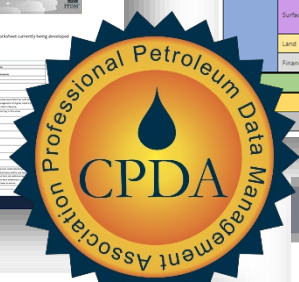


Appendix K: Competency Mapping Worksheet

Sample Competency Mapping Worksheet

The following table is a sample of the National and Behavioral Competency Mapping Worksheet currently being developed by the International Data Management Association (IDMA).

Professional and Functional Skills	Geoscientist	Reservoir/Petroleum Eng.	Data Scientist	Data Steward	Chief Data Manager	Data Manager	Data Analyst	Petrotechnical Business Analyst	Data Engineer	IT Business Analyst
...										



Job Families	Level 1 (L1)	Level 2 (L2)	Level 3 (L3)	Level 4 (L4)	Sample Job Titles
Corporate / IT	Upstream	Strategy / Governance	Standards / Policy	Digital Transformation	Chief Information Officer, Architect Data Analyst, Chief Data Manager Petrotechnical Business Analyst, Project Manager Petrotechnical Data Scientist, Data Engineer
		Midstream / Downstream	Phase 3		
Upstream	Data Scientist	Geoscience	Seismic	Well (DAG)	Data Manager: Geoscience Technician, Data Analyst Data Manager, Data Specialist, Data Steward
		Engineering	Reservoir	Production	Data Manager: Engineering Technician, Data Specialist, Data Steward Reservoir Engineering Data Manager, Reserves Data Specialist, Data Steward
		Geospatial			Data Manager: GIS Data Manager, Spatial Data Specialist, Data Steward
		Surface	Facilities Engineering	Engineering	Geospatial
	Land	Phase 2	Phase 2	Phase 3	Phase 3 and beyond

Data Professionals

Professional Development

Certify

Manage Talent

Learn

Appendix E (Continued): Job Description – Data Analyst

Job Title: Data Analyst Continued

- Major Duties / Responsibilities**
- Single Point of Contact (SPOC) responsible for all data needs of the assigned asset team or functional group.
 - Works with team members to ensure that newly acquired data are quality controlled through corporate and project data stores and distributed properly, following EIP data management guidelines.
 - Assists in identifying and resolving data quality issues, work with appropriate team to resolve issues.
 - Ensures during data loading, data adheres to approved standards. This role is responsible for transactions activities such as consolidating, converting, re-projecting, re-merging, re-linking, and interpolating existing data (e.g., Well logs, coring/borehole depths, etc.).
 - Runs quality assurance metrics.
 - Works with vendors and other external entities to ensure that all qualified data are received in industry standard formats.
 - Identifies and resolve data issues in raw original format data as well as in corporate and project data stores, help determine the root cause of issues.
 - Provides regular and user requested data cleaning according to quality assessment and approved business rules.
 - Assists team members at end of projects with data archival, knowledge capture, deletions, and transfers to corporate repositories, as appropriate.
 - Performs data consolidation of project databases.
 - Retrieves data from either physical or electronic data stores.

- Qualifications / Prerequisites**
- Mandatory:**
- Bachelor's Degree in Computer Science, Mathematics, Geology, Geophysics, Physics, Engineering, or Business Information Systems, or equivalent combination of education and experience.
 - A minimum of 3-years experience and expertise in data administration, processes and standards, relational database management systems (e.g., SQL, Tervey), integration and data quality applications work with multiple data types and data models.
 - Experience with industry applications regarding subsurface data modeling, reservoir models, geological interpretations, etc.
- Preferred:**
- Certified Petroleum Data Analyst (CPDA).



Training Courses

Search Courses by Course Code / Title / Option / Description

Developing Leadership Capability & Thinking Strategically
Industry Discipline: Non-Technical
Option: Classroom or Online
The challenge of 50+ year-olds and all companies is that they are often better suited to the traditional modes of leadership in the 19th century than in the 21st century.

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Geospatial Data Management for Non-Geophysicists (Classroom)
Industry Discipline: Non-Technical
Option: Classroom
Geospatial Data Management (GDM) is the foundation of good technical data and the key to successful operational success. Reservoirs and operations focus on maximizing the value of their data.

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Leadership 4.0: The Rise of the Industry Executive Non-Technical
Option: Classroom
We are in the midst of what is being referred to as the Fourth Industrial Revolution. We are observing incredible change in the way we live, work, and relate to one another as individuals and organizations.

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Streamlining Business Through Big Data Analytics
Industry Discipline: Non-Technical

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The International Project Manager
Industry Discipline: Non-Technical
Option: Classroom

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CEMDS Series: Seismic Data Processing
Industry Discipline: Non-Technical

[View Details](#)



Data Inspection / Auditability

Once a baseline is developed we can set up measurable expectations for data stores that are technology neutral.

Does verification that a dataset has been inspected / audited add business value?

Who would see the most value?

Regulators?

Operators?



Thanks for listening.

We look forward to
your feedback

projects@ppdm.org