Data Governance and Data Quality Q&A Guide

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1.What is Data Governance?

Answer: Data Governance refers to the overall management of data within an organization. It includes the processes, policies, standards, and rules for ensuring data is accurate, secure, consistent, and used responsibly. Data governance ensures that data is properly handled throughout its lifecycle from collection to storage to deletion. It also includes establishing clear roles and responsibilities for managing and protecting data.

Example: A company might create a policy to ensure that customer emails are regularly updated and validated so that they are never used for marketing without consent. The company might assign specific people to check and update these email addresses every month.

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2. What are the key principles of Data Governance?

Answer: The key principles of Data Governance include:

- **Accountability:** Individuals or teams are responsible for the data they manage, and they ensure data is used properly.
- **Transparency:** All processes related to data handling, policies, and decision-making are clearly communicated across the organization.
- **Integrity:** Data should be reliable, accurate, and consistent.
- **Standardization:** Data should follow agreed formats and definitions to make it easy to use across different systems.

- **Compliance:** Data should meet legal requirements such as GDPR, HIPAA, or CCPA, ensuring that personal or sensitive data is protected.

Example:

Principles	**What It Means**
Accountability	Clear responsibility for data management
Transparency	Transparent data handling and policies
Integrity	Ensuring data accuracy and consistency
Standardization	Using consistent formats and definitions
Compliance	Following legal requirements

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3. Who are the key roles in a data governance team?

Answer: A data governance team typically includes several important roles:

- **Data Owner:** This person is accountable for specific datasets and is responsible for ensuring the quality and proper use of that data.
- **Data Steward:** They are responsible for maintaining the data's quality and ensuring it is used correctly according to the governance policies. They are also responsible for cleaning and validating the data.
- **Data Custodian:** This role handles the technical aspects of storing, securing, and backing up data.
- **Governance Council:** This group sets the strategic direction, policies, and guidelines for data management in the organization. They define the rules that data must follow.

Example: In a large retail chain, the **Data Owner** may be in charge of the product inventory database, while the **Data Steward** ensures that the product descriptions are correct and up-to-date, and the **Data Custodian** manages the backup and security of the database.

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4. Why is data governance important in organizations?

Answer: Data governance is critical because it helps organizations ensure that their data is accurate, accessible, and protected. Proper governance minimizes errors, ensures compliance with laws, enhances decision-making, and prevents misuse of data. By following data governance practices, an organization can trust its data, reduce risks, and improve operational efficiency.

Example: In healthcare, data governance is crucial for maintaining patient privacy. Hospitals must ensure that sensitive data, like medical records, is protected and only accessible to authorized personnel, complying with laws such as HIPAA.

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5. What is the difference between data governance and data management?

Answer:

- **Data Governance** refers to the rules, policies, and roles that define how data is handled, secured, and used. It sets the overall strategy for data.
- **Data Management** involves the day-to-day tasks of storing, organizing, and processing data. It's about implementing the rules defined by data governance.

Example: Think of **data governance** as creating a rulebook for a game, while **data management** is actually playing the game and following the rules during the game.

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6. What are data policies and why are they needed?

Answer: Data policies are documented rules that define how data should be collected, accessed, and protected within an organization. These policies ensure that data is handled consistently, securely, and in a way that complies with relevant laws and regulations. Without policies, data could be misused or lost, leading to errors, breaches, and legal issues.

Python Example:

```python
# Example of a policy to check who can access certain data
def access_data(user_role):
    if user_role not in ['admin', 'data_owner']:
        raise PermissionError("You do not have permission to access this data")
    return "Data Access Granted"
```

In this example, only certain roles (like admins) are allowed to access sensitive data, which follows the policy of restricting access.

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7. What are data standards and how do they relate to governance?

Answer: Data standards define the rules for how data should be formatted, named, and organized across the organization. For example, the standard might state that all dates should be written as *YYYY-MM-DD*. These standards help ensure consistency and prevent errors when sharing or processing data across different teams or systems.

Example: An organization might adopt a data standard that all addresses are written with the country first, followed by the city and street name, ensuring all addresses are in the same format for easy analysis and reporting.

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8. How does a Data Governance Framework work?

Answer: A Data Governance Framework provides a structured approach to managing data. It outlines the roles, responsibilities, policies, and processes needed to manage data effectively. The framework helps organizations make sure that their data is used properly and consistently.

Example:

Framework Part	What It Means
Policy	Guidelines on how data should be handled
Roles	Individuals responsible for managing and securing data
Processes	The steps for collecting, validating, and storing data
Tools	Software tools used to support data governance (e.g., data catalog tools)

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9. What is a data stewardship program?

Answer: A data stewardship program assigns specific individuals (data stewards) to manage and maintain the quality of data. These stewards are responsible for making sure the data is accurate, clean, and follows the rules set by the organization. They play a key role in data governance by ensuring data integrity and making sure the data is being used appropriately.

Example: In a bank, a **Data Steward** may ensure that account numbers are correctly formatted and that there are no duplicate entries for customers.

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10. How do you measure the effectiveness of data governance?

Answer: The effectiveness of data governance can be measured by tracking key metrics such as:

- **Data Accuracy:** The percentage of data that is correct and free of errors.
- **Compliance Rate:** How well the organization is adhering to data privacy laws like GDPR.

- **Data Accessibility:** How easily data can be accessed by authorized personnel.
- **Issue Resolution Time:** How quickly data-related issues are resolved.

R Code Example:

```r
# Calculate % of missing data in a dataset
missing_rate <- function(df) {
  sum(is.na(df)) / prod(dim(df)) * 100
}
```

This R code calculates the percentage of missing data, which is an important metric to track when evaluating data quality.

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11. What is Data Quality?

Answer: Data Quality refers to how accurate, complete, reliable, and relevant the data is for its intended use. High-quality data helps organizations make better decisions, while poor data can lead to errors and lost opportunities.

Key Dimensions of Data Quality:

- **Accuracy:** Data matches the real-world values.
- **Completeness:** No missing or incomplete fields.
- **Consistency:** Data is the same across systems.
- **Timeliness:** Data is up to date.
- **Validity:** Data follows the required format or rules.

Example Table:

Customer ID	Name	Email	Age
001	John Doe	john.doe@example.com	29
002		jane@example.com	(Missing Name → Low Quality)
003	Sam Lee	samlee[at]email.com	23 (Invalid Email Format)

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12. Why is data quality important?

Answer: Data quality is crucial because it impacts the reliability of business decisions. Poor-quality data can lead to wrong conclusions, financial losses, and damage to reputation. Good data quality improves customer experience, operational efficiency, and regulatory compliance.

Example: If a bank sends credit card offers to the wrong people due to incorrect addresses, they waste money and might face legal consequences for data mishandling.

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13. What are common causes of poor data quality?

Answer:

- **Manual Data Entry Errors:** Typos or wrong values during input.
- **Data Duplication:** Same records entered multiple times.
- **Missing Data:** Some fields are left blank.
- **Inconsistent Formats:** Dates in different formats (*DD-MM-YYYY* vs *MM/DD/YYYY*).
- **Outdated Information:** Old contact details or pricing.

Python Example:

```python
import pandas as pd

df = pd.DataFrame({
    'Date': ['01-01-2023', '2023/01/02', '03/01/2023']
})

# Convert inconsistent date formats to standard format
df['Date'] = pd.to_datetime(df['Date'], errors='coerce')
print(df)
```

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14. How do you assess data quality?

Answer: Data quality can be assessed using techniques such as:

- **Profiling:** Analyzing data to understand its structure and content.
- **Validation Rules:** Checking data against set rules (e.g., age must be > 0).
- **Completeness Checks:** Identifying missing values.
- **Duplicate Checks:** Finding and removing repeated records.

R Code Example:

```r
# Check for duplicate rows
sum(duplicated(my_data))
```

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15. What are data quality rules?

Answer: Data quality rules are conditions that data must meet to be considered correct. They define acceptable formats, value ranges, and relationships.

Examples of rules:

- Phone numbers must be 10 digits.
- Email addresses must contain "@".
- Age must be between 0 and 120.

Python Example:

```python
df['Valid_Age'] = df['Age'].apply(lambda x: 0 <= x <= 120)
```

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16. How do you clean data to improve its quality?

Answer: Common data cleaning methods include:

- Removing Duplicates
- Filling or Dropping Missing Values
- Correcting Typos
- Standardizing Formats
- Validating Against Rules

Python Example:

```
df.drop_duplicates(inplace=True)
df['Email'] = df['Email'].str.lower()
df['Age'] = df['Age'].fillna(df['Age'].mean())
```

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17. What tools can help maintain data quality?

Answer: Some common tools include:

- **OpenRefine:** Cleans and transforms messy data.
- **Talend Data Quality:** Identifies errors and ensures integrity.
- **Trifacta / Alteryx:** For wrangling and profiling data.
- **Pandas (Python) / dplyr (R):** For programmatic data cleaning.

Example Tool Use in Python (Pandas):

```
# Checking for missing values
df.isnull().sum()
```

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18. What is the role of a data steward in ensuring data quality?

Answer: A data steward is responsible for monitoring, managing, and improving the quality of data in an organization. They enforce rules, clean data, and work with teams to ensure the data stays useful and accurate.

Example:
If customer data from different departments shows conflicting email addresses, the

steward investigates and corrects the errors based on trusted sources.

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19. How can you prevent poor data quality at the source?

Answer:

- **Use Data Validation at Input:** E.g., form fields checking formats.
- **Train Staff:** So they enter data accurately.
- **Automate Data Collection:** Reduces human errors.
- **Enforce Standards:** Use consistent formats and naming.

Example: In online forms, ensure the phone number field only accepts numbers and the email field checks for @domain.com.

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20. How does master data management (MDM) help with data quality?

Answer: MDM creates a single, consistent view of key business entities like customers, products, or employees. It pulls together data from different systems and eliminates inconsistencies.

Example: If "John Smith" is listed with two different emails in two systems, MDM helps merge them into one trusted profile.

Example table:

System A	System B	MDM Output
John Smith	Johnathan Smith	John Smith (Email: latest)
john@gmail.com	jsmith@gmail.com	jsmith@gmail.com

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21. What is GDPR and why is it important?

Answer: The **General Data Protection Regulation (GDPR)** is a European Union law that governs how organizations collect, store, and process personal data. It's important because it gives individuals more control over their personal information and forces organizations to protect user privacy.

Key Rights under GDPR:

- Right to access data
- Right to be forgotten
- Right to data portability
- Right to rectification

Example: A user can ask a company to delete their personal data completely from the system.

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22. What is CCPA and how does it differ from GDPR?

Answer: The **California Consumer Privacy Act (CCPA)** is a U.S. law that provides California residents rights over their personal data. It's similar to GDPR but more focused on giving people transparency and control over data selling.

Key Differences:

- **CCPA** allows users to *opt out* of data sales.
- **GDPR** requires users to *opt in* for data collection.
- **GDPR** applies globally if you process EU data; **CCPA** applies to businesses in/serving California.

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23. What is personally identifiable information (PII)?

Answer: PII refers to any data that can identify a person directly or indirectly. This includes:

- Names
- Phone numbers
- Email addresses
- Social Security Numbers
- IP addresses

Example: "john.doe@example.com" is PII because it identifies a person directly.

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24. How do companies ensure compliance with data privacy laws?

Answer: They follow steps such as:

- Collecting minimal required data
- Encrypting sensitive data
- Creating privacy policies
- Allowing users to delete/export data
- Conducting regular audits

Python Example (Pseudocode):

```
# Hashing sensitive data for privacy
import hashlib

def hash_email(email):
    return hashlib.sha256(email.encode()).hexdigest()

user_email = 'john.doe@example.com'
hashed_email = hash_email(user_email)
print(hashed_email)
```

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25. What are data subject rights?

Answer: Data subject rights are rights given to individuals over their personal data under laws like GDPR and CCPA.

Common Rights Include:

- Right to know what data is collected
- Right to request deletion
- Right to opt-out of data sale
- Right to correct inaccurate data

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26. What is data anonymization and how does it help compliance?

Answer: **Anonymization** is the process of removing or masking identifiable information from a dataset so individuals can't be traced.

Python Example (Simple Anonymization):

```
df['User_ID'] = df['User_ID'].apply(lambda x: hashlib.sha256(str(x).encode()).hexdigest())
```

Why it helps: Once data is anonymized, many privacy laws (like GDPR) may no longer apply, reducing legal risk.

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27. What is a Data Protection Officer (DPO)?

Answer: A DPO is responsible for overseeing an organization's data protection strategy and ensuring compliance with privacy laws.

Responsibilities:

- Monitor compliance
- Conduct audits
- Train employees
- Be the contact point for data subjects and regulators

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28. What is a Data Breach, and how should it be handled?

Answer: A **data breach** occurs when sensitive data is accessed or disclosed without authorization. It could be due to hacking, leaks, or internal errors.

Handling a Breach:

- Detect and stop the breach
- Inform affected users (within 72 hrs for GDPR)
- Investigate and fix root causes
- Report to regulators

Example: If someone steals customer data from a database, the company must notify all affected users quickly.

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29. What are privacy policies, and why are they needed?

Answer: A **privacy policy** explains how an organization collects, uses, stores, and protects user data. It's legally required in many regions (GDPR, CCPA) and builds trust with users.

Typical Contents:

- What data is collected
- How it’s used
- Who it’s shared with
- User rights and how to contact the company

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30. What is the role of encryption in data privacy?

Answer: Encryption converts data into unreadable code that can only be accessed with a key. It protects sensitive data from unauthorized access.

Python Example (Simple Encryption using Fernet):

```python
from cryptography.fernet import Fernet

key = Fernet.generate_key()
cipher = Fernet(key)

message = b"Sensitive Info"
encrypted = cipher.encrypt(message)
decrypted = cipher.decrypt(encrypted)

print("Encrypted:", encrypted)
print("Decrypted:", decrypted)
```

Why it matters: Even if data is stolen, it's useless without the decryption key.

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31. What is metadata and why is it important in data governance?

Answer: Metadata is "data about data." It describes the content, structure, and context of data, like file type, creation date, author, data source, or column meanings.

Importance:

- Improves data understanding
- Supports data discovery
- Tracks data lineage
- Helps in audits and compliance

Example: In a dataset with a column named DOB, metadata might tell you it stands for "Date of Birth," is in *YYYY-MM-DD* format, and comes from a user registration form.

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32. What are the types of metadata?

Answer:

1. **Technical Metadata:** Schema, data types, column names.
2. **Business Metadata:** Definitions, rules, business usage.

3. **Operational Metadata:** When and how data was created/modified.
4. **Process Metadata:** Info about ETL or data pipeline steps.

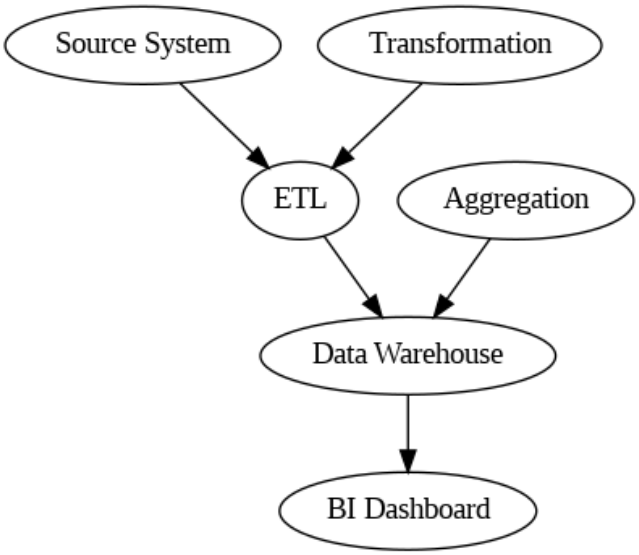
33. What is data lineage and why does it matter?

Answer:
Data lineage shows the path data takes — from its source through transformations to its final form. It helps track where data comes from, how it's changed, and where it's used.

Why it matters:

- Ensures trust in data
- Helps troubleshoot issues
- Aids in impact analysis

Example Chart:



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34. What is ETL (Extract, Transform, Load)?

Answer: ETL is the process of:

- **Extracting** data from sources
- **Transforming** it into the correct format
- **Loading** it into a target system (like a database or warehouse)

Python Example (using pandas):

```python
import pandas as pd

# Extract
data = pd.read_csv('sales_data.csv')

# Transform
data['Date'] = pd.to_datetime(data['Date'])

# Load
data.to_csv('cleaned_sales.csv', index=False)
```

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35. How does ETL relate to data governance?

Answer: ETL ensures the **controlled movement** and **standardization** of data. When properly managed:

- Data quality rules are enforced
- Data lineage is captured
- Metadata is updated

A well-governed ETL process ensures that only trusted, clean data reaches users.

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36. What is data cataloging?

Answer: A **data catalog** is an organized inventory of data assets that includes metadata, usage info, and access controls.

Benefits:

- Easy search and discovery
- Clear understanding of data
- Enforced data policies

Example Tool: Alation, Collibra, or even a custom catalog built using Python and metadata tables.

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37. What are some best practices for maintaining high data quality in ETL?

Answer:

- Validate inputs at every step
- Handle nulls and errors smartly
- Log and monitor processes
- Document transformations
- Run data profiling after load

Python Snippet:

```
# Validate no nulls in critical fields
assert data['CustomerID'].notnull().all(), "Missing CustomerID"
```

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38. What is the role of audit trails in data governance?

Answer: Audit trails are logs that record who accessed or changed data, when, and how.

Why it matters:

- Detect unauthorized access
- Ensure accountability
- Simplify compliance audits

Example:

User: analyst_01 | Action: Deleted Row | Timestamp: 2025-04-21 10:23:17

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39. What is data validation and how is it done?

Answer: Data validation checks if data is correct, complete, and meets specific rules before it's used or stored.

Validation Checks:

- Type: Is age an integer?
- Range: Is salary between 10k and 100k?
- Format: Is email valid?

Python Example:

```
def is_valid_email(email):
    return '@' in email and '.' in email

df['valid_email'] = df['email'].apply(is_valid_email)
```

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40. What are some common data governance frameworks?

Answer:

- **DAMA-DMBOK:** Covers data management knowledge areas.
- **COBIT:** Focuses on IT governance.
- **DCAM:** Data management maturity model.

Key Components:

- Roles & responsibilities
- Data policies & standards
- Metadata & lineage
- Quality controls
- Compliance checks

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41. What are some real-world use cases of data governance?

Answer:

- **Healthcare:** Ensuring patient data privacy and accurate medical records
- **Finance:** Regulatory reporting and fraud detection
- **E-commerce:** Maintaining customer data integrity and personalized marketing

- **Education:** Managing student records and exam results with audit trails

Example: A bank uses data governance to ensure all customer information is accurate before approving a loan.

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42. What are the biggest challenges in implementing data governance?

Answer:

- Lack of executive support
- Poor data literacy across teams
- Resistance to change
- Complex data environments
- Lack of clear ownership

Solution Tip: Start with small governance initiatives and expand after early success.

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43. What is a data steward and what do they do?

Answer: A **data steward** is responsible for managing data quality and enforcing data policies within an organization.

Responsibilities:

- Monitor data accuracy
- Ensure data is properly labeled and used
- Act as a bridge between technical and business teams

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44. How can machine learning help with data quality?

Answer: ML models can:

- Detect outliers and inconsistencies
- Auto-correct based on patterns
- Predict missing values
- Classify and tag data automatically

Python Example:

```
from sklearn.ensemble import IsolationForest

model = IsolationForest()
data['outlier'] = model.fit_predict(data[['value_column']])
```

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45. What tools are commonly used for data governance?

Answer:

- **Collibra** – Data catalog and governance
- **Alation** – Metadata management
- **Informatica** – Data integration and governance
- **Apache Atlas** – Open-source metadata and lineage

For code-based governance, Python with tools like **Great Expectations** or **pandas profiling** can help.

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46. How does data profiling support data governance?

Answer: Data profiling involves analyzing a dataset to understand its structure, content, and quality.

Why it matters:

- Identifies data types, missing values, anomalies
- Helps with metadata creation
- Ensures consistency

Python Tool Example:

```
from pandas_profiling import ProfileReport
profile = ProfileReport(df)
profile.to_file("data_profile.html")
```

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47. What is master data management (MDM)?

Answer: **MDM** ensures a single, consistent view of key business entities like customers, products, or employees across systems.

Goals:

- Avoid duplication
- Ensure accuracy
- Provide trusted data for reporting

Example: A customer's info is stored consistently across CRM, billing, and support systems.

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48. How does data retention policy impact data governance?

Answer: A **data retention policy** defines how long data is kept and when it's deleted. It ensures compliance with laws and reduces storage costs.

Example Policy: Keep customer data for 7 years, then delete it securely unless legally required to retain it longer.

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49. What is the difference between structured and unstructured data in governance?

Answer:

- **Structured Data:** Easily stored in tables (e.g., SQL databases)
- **Unstructured Data:** Includes documents, images, videos, logs

Governance Implications:

- Structured: Easier to manage with traditional tools
- Unstructured: Requires metadata tagging and specialized tools (e.g., NLP for documents)

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50. Why is a data governance strategy important for data-driven organizations?

Answer: A clear **data governance strategy** helps an organization:

- Build trust in data
- Ensure compliance
- Improve data quality
- Enable better decision-making
- Support scalability of analytics initiatives

Without governance, even the best data tools and models can lead to poor outcomes due to inconsistent or low-quality data.
