The 7th Greenhouse Gas Inventory System Training Workshop

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Addressing Data Gaps and Uncertainties in BTRs

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Addressing Data Gaps and Uncertainties in BTRs: Methodologies and Approaches

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- **What are Data Gaps?** Data gaps refer to missing or unavailable data points required for comprehensive reporting in BTRs. This can include anything from incomplete historical datasets to a lack of disaggregated data for specific sectors or themes.

- **What are Data Uncertainties?** Data uncertainties relate to the reliability, accuracy, and precision of the collected data. These can arise from measurement errors, estimation methodologies, or inconsistencies in data collection practices over time.

- **Why are they critical in BTRs?** The foundational principles of Transparency, Accuracy, Consistency, Comparability, and Completeness (TACCC) are paramount for all reported data in BTRs. Data gaps and uncertainties directly undermine these principles, affecting the credibility of reports and hindering effective technical review processes.

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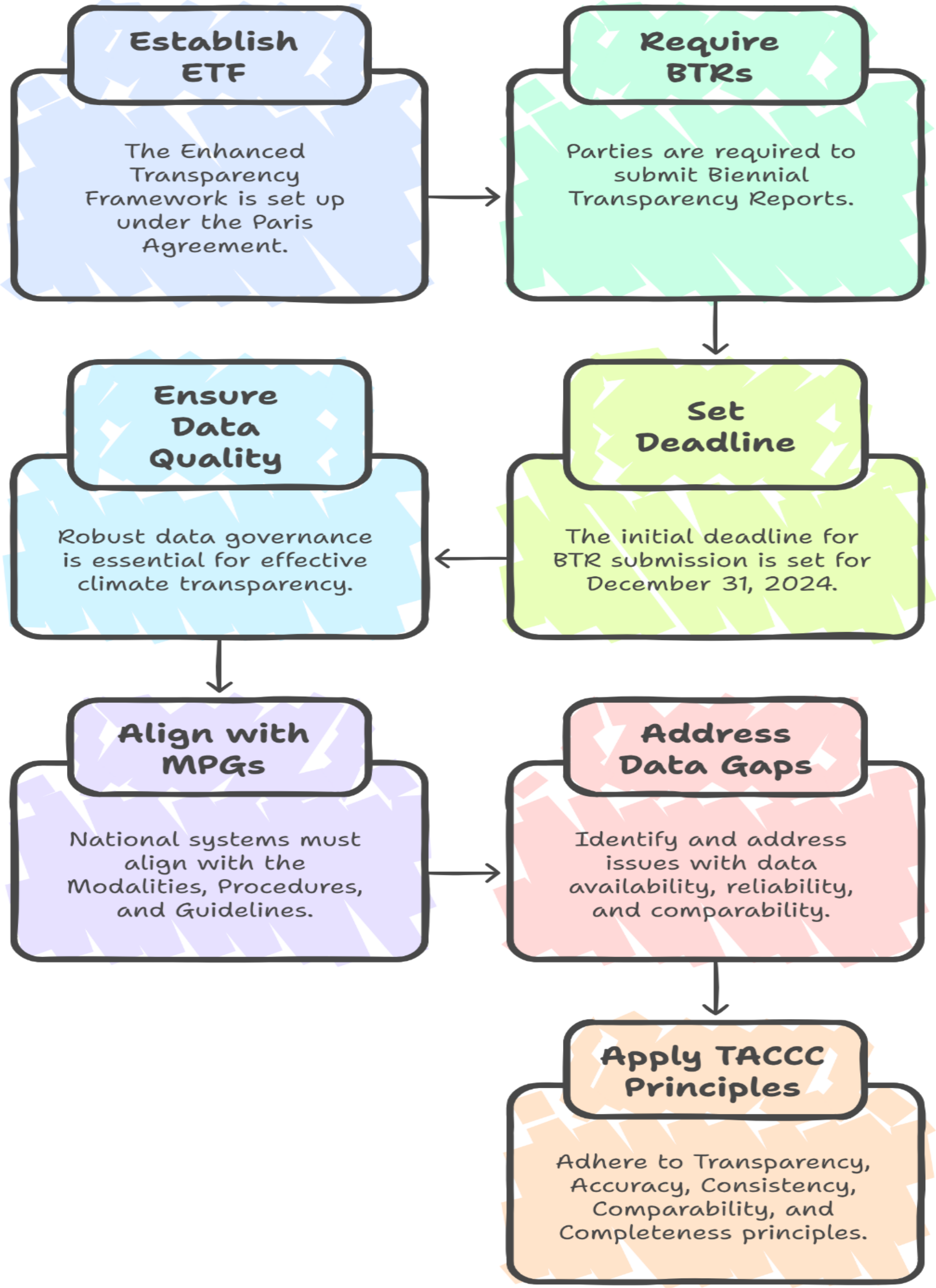
Addressing Data Gaps and Uncertainties in BTRs: Methodologies and Approaches

Data gaps in climate-related reporting encompass several dimensions:

- **Availability:** Issues with coverage, granularity, and accessibility of data
- **Reliability:** Concerns about quality, auditability, and transparency
- **Comparability:** Challenges in comparing or ensuring consistency between available data sources



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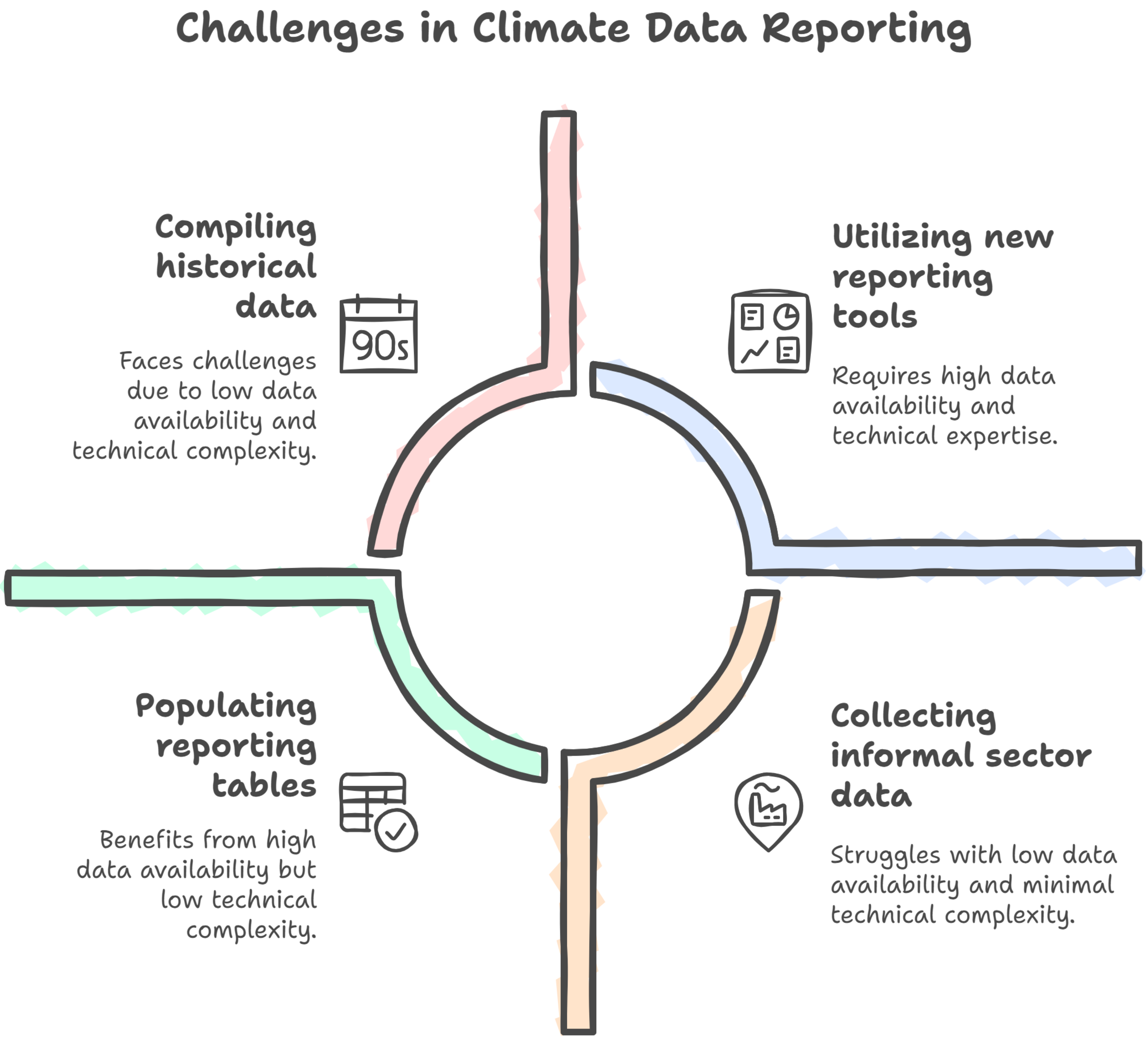
Data Availability and Collection Challenges



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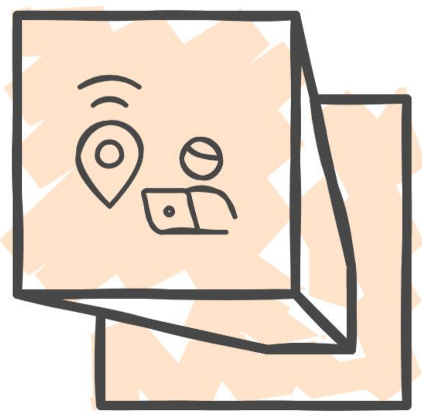
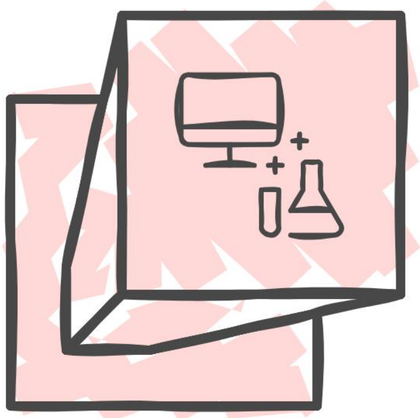
Methodological and Technical Complexities

Proxy Data Usage

Proxy data usage conserves resources but increases data uncertainty.



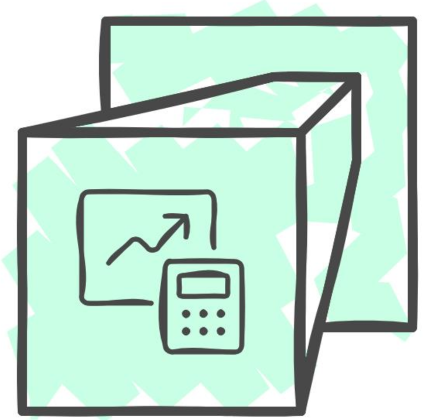
Advanced Methodologies



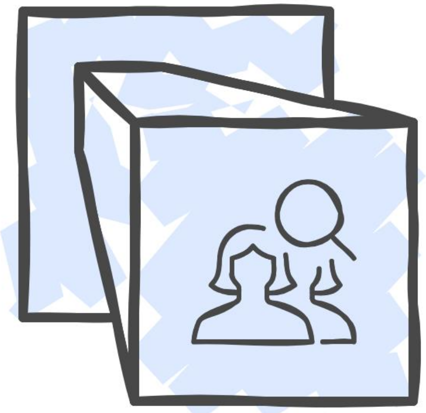
Advanced methodologies require significant resources but face high data uncertainty.

Basic Methodologies

Basic methodologies are resource-efficient with low data uncertainty.



Comprehensive Data Collection



Comprehensive data collection demands high resources but reduces data uncertainty.

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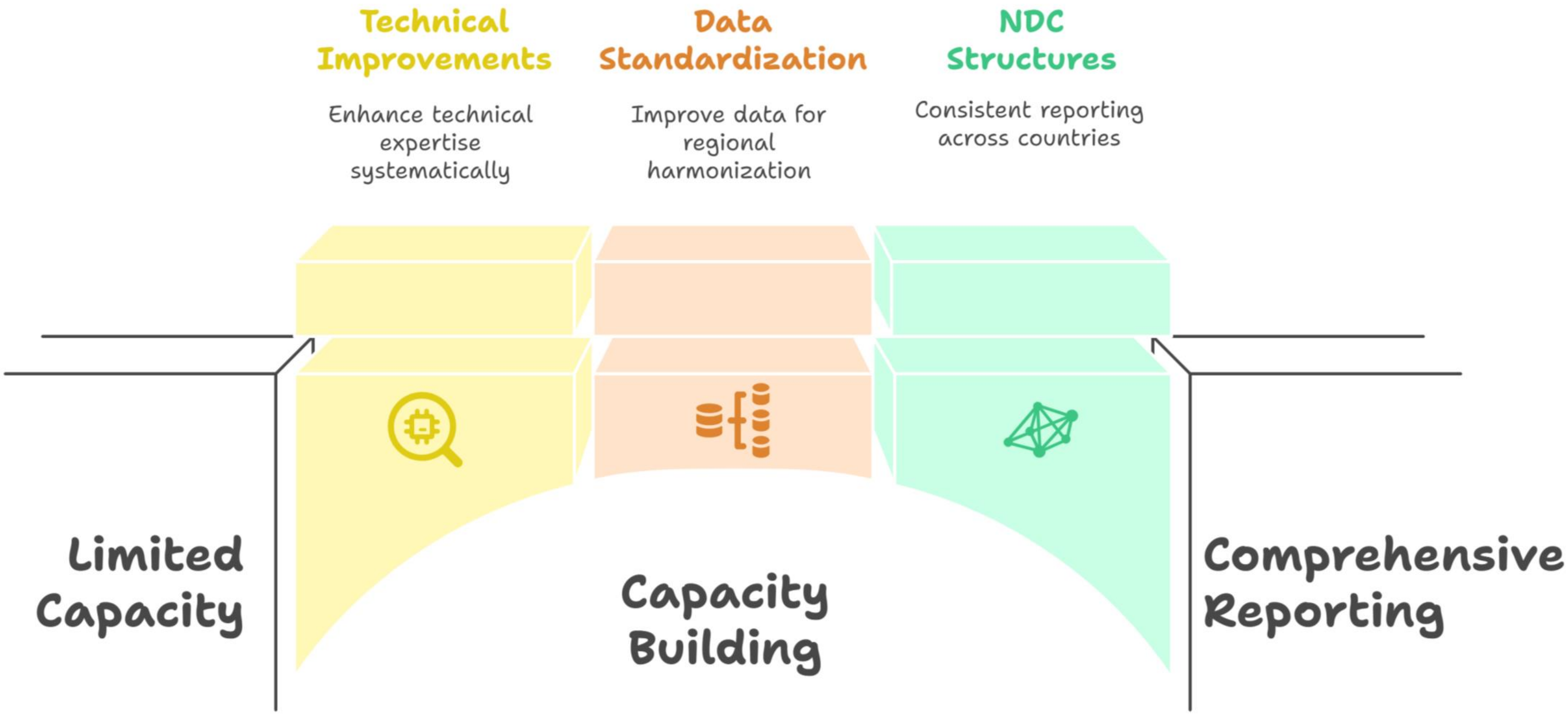
Institutional and Capacity Constraints



Methodologies for Bridging Gaps

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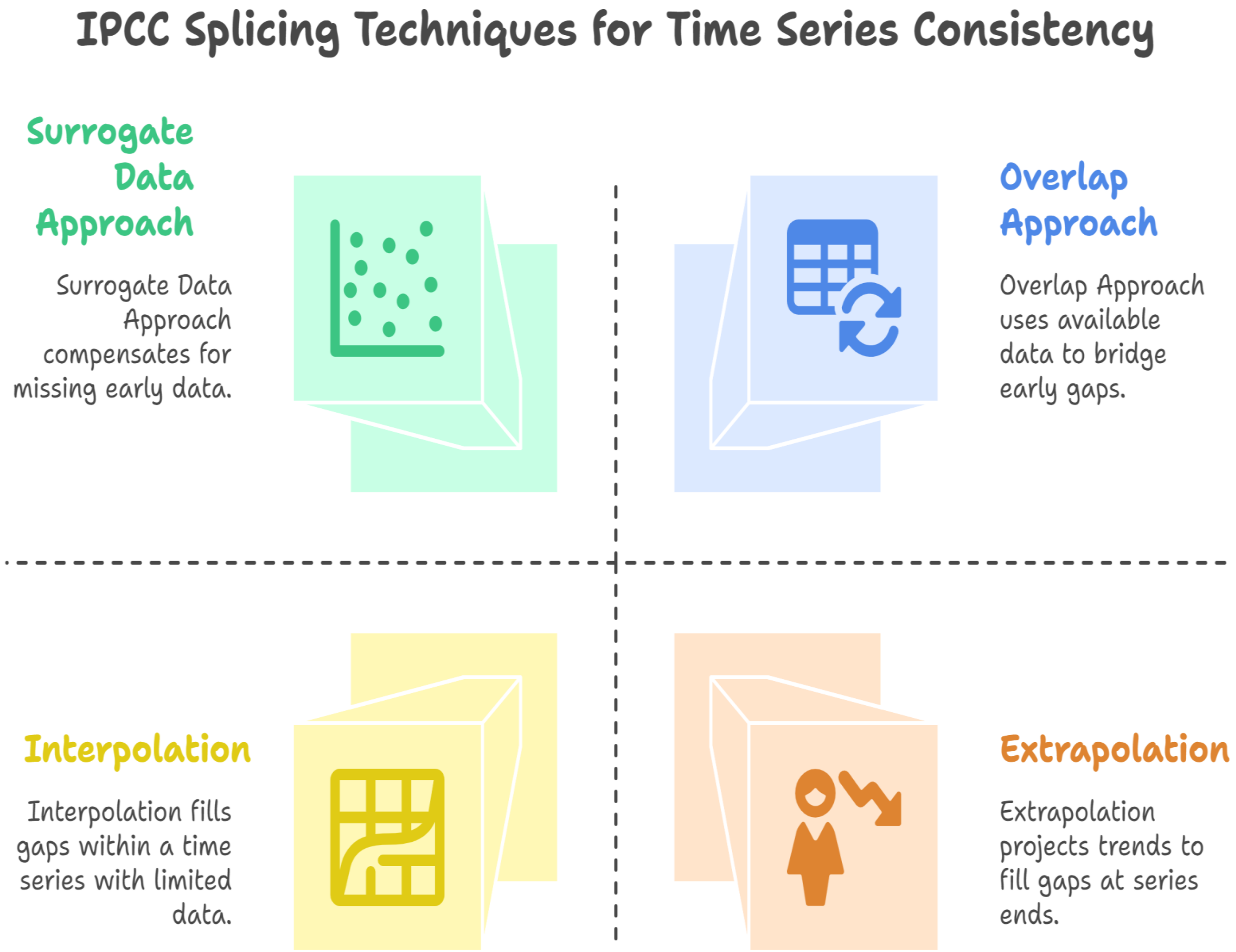
Expert Judgment and Proxy Data:

- **Expert Elicitation:** Consulting with national experts to provide informed estimates based on their knowledge and experience when direct data is unavailable.
- **Proxy Indicators:** Utilizing readily available data that can serve as a reasonable substitute for missing direct measurements (e.g., population growth as a proxy for certain energy consumption trends if specific data is absent).



Methodologies for Bridging Gaps

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- The IPCC Guidelines provide a suite of "splicing techniques" to **ensure time-series consistency** and fill data gaps, which include overlap, surrogate data, interpolation, and trend extrapolation. The selection of the most appropriate technique is not prescriptive but depends on factors such as data availability, the nature of the methodological modification, and expert judgment.

- In situations where standard alternatives like overlap, surrogate data, interpolation, or extrapolation are not valid, particularly when technical conditions are changing throughout the time series (e.g., due to the introduction of mitigation technology), a customized approach may be necessary. This involves carefully considering the trends in all factors known to influence emissions or removals over the period. When such customized approaches are used, they must be thoroughly documented, with special consideration given to how the resultant emission estimates compare to those that would be developed using more standard alternatives.

Interpolation

- **Interpolation** is a gap-filling method used when detailed statistics or data are collected intermittently, meaning data for intermediate years in a time series are missing. Estimates for these intermediate years are developed by inferring values between the available detailed estimates.

  - This method is suitable when the overall trend appears stable and significant fluctuations are unlikely. For example, if a national forest inventory is conducted every 5 years, interpolation can be used to estimate tree growth for the years between surveys.
  - A critical consideration for interpolation is its limitation in cases of large annual fluctuations in emission trends. If information on general trends or underlying parameters is available, the surrogate method is generally preferable. The uncertainty associated with interpolated estimates increases with the length of the interpolation period, necessitating careful application.

Trend Extrapolation

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- **Trend extrapolation** is conceptually similar to interpolation but is applied when detailed estimates are unavailable for the base year or the most recent year in the inventory. It assumes that the observed trend in emissions or removals during the period with available detailed estimates remains constant over the extrapolation period.
- Extrapolation can be conducted both forward (to estimate more recent emissions or removals) and backward (to estimate base year data). For example, if the last forest inventory measurement was in 2020, estimates for tree growth in 2025 could be made by linearly extrapolating the trend observed between 2015 and 2020.
- This method is most reliable when the trend over time is constant. It should be avoided if the trend is changing or for long periods without detailed checks to confirm the trend's validity, as the uncertainty of extrapolated estimates increases significantly with the length of the extrapolation period.
- Backward extrapolation for base year data, particularly during periods of significant administrative or economic transitions, should ideally be combined with other splicing techniques like surrogate data and overlap.

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Surrogate Method

- The **surrogate method** involves relating emissions or removals to underlying activity data or other indicative data that are more readily available and well-known. Changes in these surrogate data are then used to simulate the trend in emissions or removals. This approach is applicable when emission factors, activity data, or other estimation parameters used in the new method are strongly correlated with the chosen indicative data.
- For instance, when direct methane emission measurements from underground coal mining were unavailable in the United States due to industry restructuring, total underground coal production was used as a surrogate dataset to estimate emissions for those years.
- This method should not be applied for very long periods, and it requires careful selection and testing of multiple indicative data sets to determine the most strongly correlated ones.

Overlap Method

- **Overlap Method:** This technique is frequently employed when a new methodological approach is introduced, but historical data are unavailable to apply this new method to earlier years in the time series (e.g., when transitioning to a higher-tier methodology).
- The time series is constructed by establishing a consistent relationship between the results of the previously used method and the new method during an "overlap" period where both can be applied.
- Estimates for years where the new method cannot be directly used are then proportionally adjusted based on this observed relationship.
- The overlap method is most reliable when a consistent relationship between the two sets of annual estimates can be clearly assessed. It requires data to apply both the previously used and new methods for at least one year, preferably more. However, it is not considered good practice if the trends observed using the two methods are inconsistent.

Data Harmonization Process Framework

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Establish Objectives

Define business goals and requirements

Acquire Data Sources

Gather relevant data from various sources

Create Single Schema

Develop a unified data structure

Ingest and Clean Data

Process and refine the data

Data Capturing

Inventory regulatory requirements

Defining

Establish clear data element definitions

Analyzing

Gather and understand similar data elements

Reconciling

Agree on common data standards

Uncertainty Assessment and Quantification Methods

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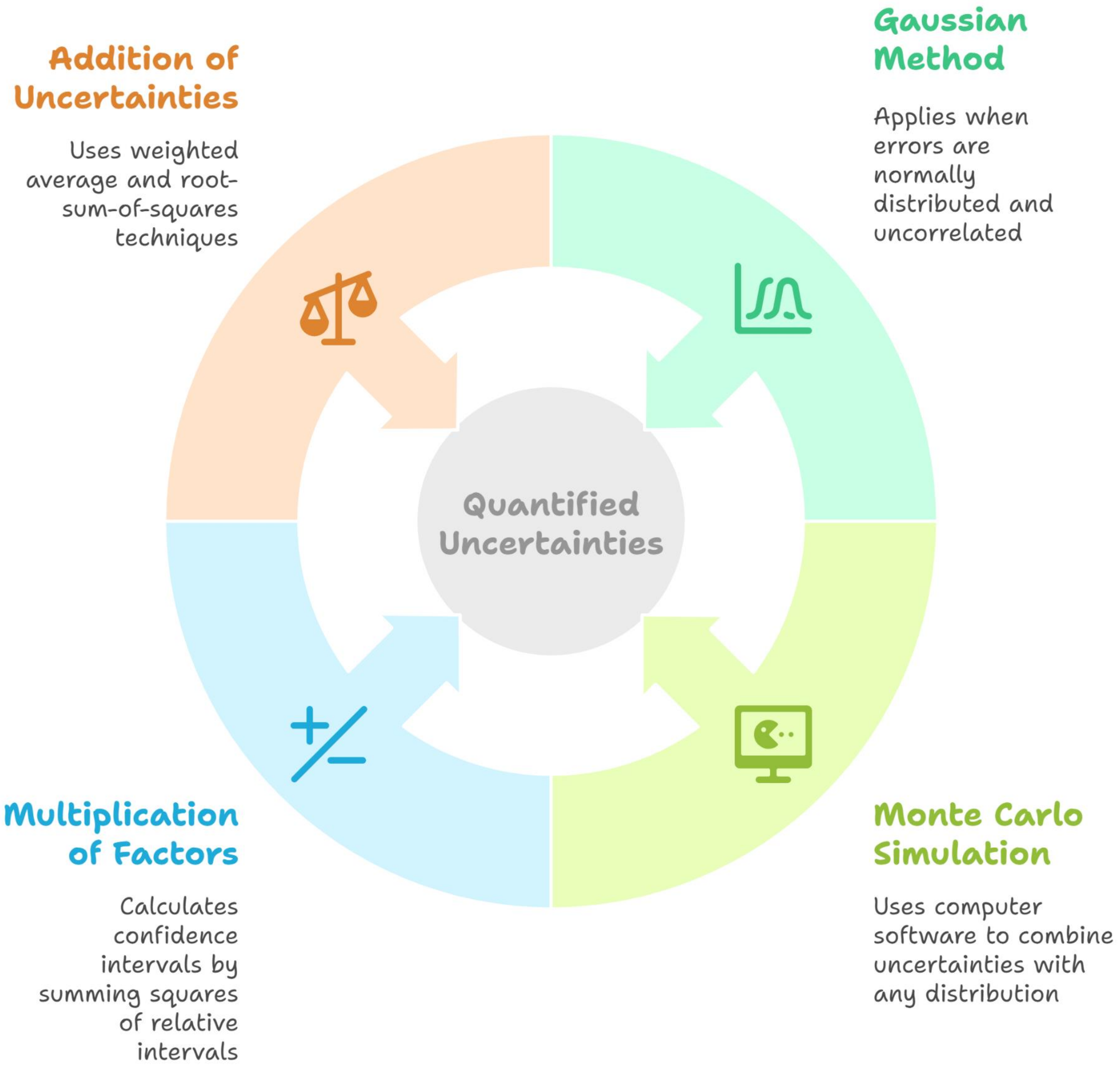
Two main approaches exist for quantifying and combining uncertainties in GHG inventories:

1.First Order Error Propagation Method (Gaussian Method): This approach should only be applied if:

1. Errors in each parameter are normally distributed
2. There are no biases in the estimator function
3. Estimated parameters are uncorrelated
4. Individual uncertainties in each parameter are less than 60% of the mean

2.Monte Carlo Simulation: This technique allows uncertainties with any probability distribution, range, and correlation structure to be combined, provided they have been suitably quantified. While enormously flexible, computer software is required for its use.



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Case Study 1: Bridging Historical Data Gaps in GHG Inventories

- *Challenge:* A country struggled to compile consistent GHG inventory data back to 1990 due to data unavailability and changes in statistical methodologies over time.
- *Solution:* Implementation of a combination of expert judgment, proxy data (e.g., energy consumption statistics from international sources in early years), and interpolation techniques. Collaboration with academic institutions for historical data reconstruction.
- *Outcome:* Achieved a more complete and consistent time series for GHG emissions, improving the accuracy of trend analysis.

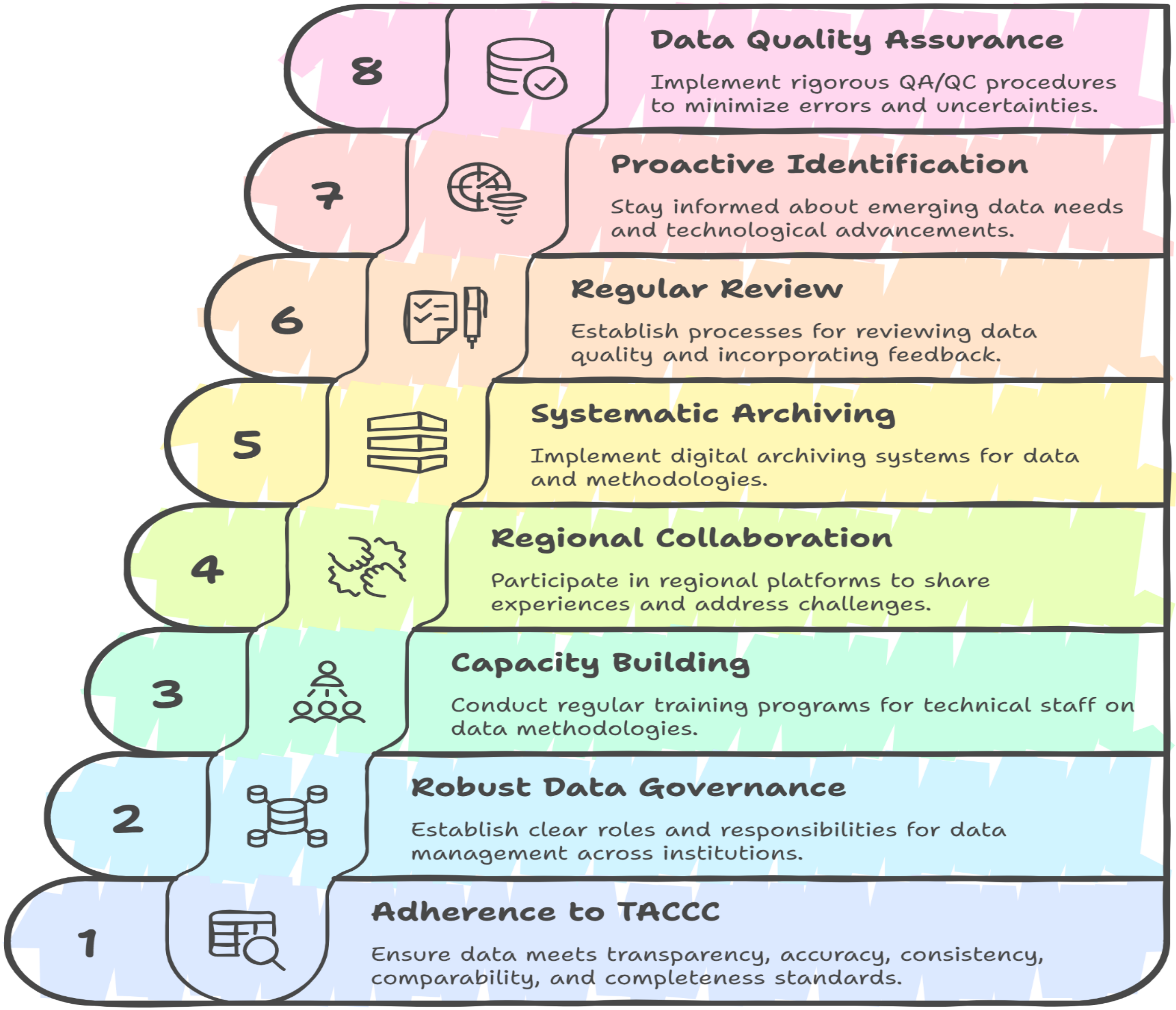
Case Study 2: Improving Data for NDC Tracking

- *Challenge:* Inconsistencies in sectoral data for tracking progress towards specific NDC targets, particularly in the agriculture sector.
- *Solution:* Development of a national working group involving agricultural ministries and statistical offices to standardize data collection methodologies and establish regular data sharing protocols. Implementation of disaggregated data collection pilots.
- *Outcome:* Enhanced granularity and comparability of data for NDC progress reporting in the agriculture sector.

Case Study 3: Addressing Data Deficiencies in Cross-Cutting Themes

- *Challenge:* Limited and aggregated data for reporting on gender inclusion in climate action.
- *Solution:* Introduction of gender-disaggregated indicators in relevant national surveys and project monitoring frameworks. Training for data collectors on gender-sensitive data collection.
- *Outcome:* Improved ability to report on the gender dimensions of climate actions, leading to more inclusive policy development.

Best Practices for Continuous Improvement



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Thank you for your attention !

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Please reach out to us for any question, comments or suggestions!

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