



# FEDERAL CHIEF DATA OFFICERS (CDO) COUNCIL

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An Approach to Measuring  
Chief Data Officer  
Value and Impact

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## **Executive Summary**

Chief Data Officers (CDOs) are relatively new to organizations, and often need help communicating the value of their efforts. The relative novelty of the function means measurement approaches and metrics for data programs are not mature. In addition, the CDO's function and responsibilities vary across organizations, exacerbating the measurement problem. In general, this means:

- There is little to no agreement on the metrics CDOs should be applying in their work.
- There is no way to benchmark CDOs or their initiatives.

This paper seeks to overcome these challenges by applying lessons from non-data domains like asset management, inventory management, manufacturing, and customer experience. These domains face key questions that are like those facing CDOs. The difference is those domains have clear metrics to use.

This paper proposes several ways CDOs can measure the impact and value of their initiatives, including enterprise analytics programs, and proposes adopting a product management mentality in addition to an asset management mentality to help ensure the alignment of data programs and initiatives to business and mission outcomes.

## **Introduction**

The Chief Data Officer (CDO) function is relatively new, and the roles and responsibilities are comparatively diverse. The Federal Data Strategy (<https://strategy.data.gov/overview/>) sets forth principles and practices for federal agencies, outlining practices such as:

- Assess maturity
- Recognize the value of data assets

In support of these key practices, the 2020 and 2021 Federal Data Strategy Action Plans contained actions focused on assessing agencies' data and related infrastructure maturity. Agencies chose a wide range of maturity assessments, tailoring them to their own requirements. While maturity assessments have been completed, it is not possible to benchmark or compare agency maturity. This issue is not limited to the public sector. According to Gartner®, only 29% of respondents to their 2022 Chief Data Officer Agenda Survey (<https://www.gartner.com/document/4013119>) met the objective of delivering measurable return on investment from their data and analytics investments.

Other functions, such as Chief Human Capital Officers, Chief Financial Officers, and Chief Information Officers have a relatively consistent core set of roles and expectations supported by metrics that communicate value and facilitate benchmarking. To help Federal CDOs overcome these challenges, this paper explores ways CDOs can be more data-driven in measuring their value and impact.

### **How to Use This Paper**

This paper focuses on the questions CDOs face and helps them build the data they need to communicate value and impact. Using this approach, CDOs can:

- Propose and prioritize key questions most relevant to their programs.
- Inspire and coordinate approaches to measuring the value and impact of their programs.
- Connect results and decisions to CDO programs and priorities.

### **The Federal CDOs Council's Playbook**

([https://resources.data.gov/assets/documents/CDO\\_Playbook\\_2021.pdf](https://resources.data.gov/assets/documents/CDO_Playbook_2021.pdf)) emphasizes assessing and measuring mission and business value and outcomes (specifically, Play 2.9 or 3.12). The Playbook also recommends measuring progress on data strategies or action plans (Plays 4.19 and 4.20). Some CDOs are also responsible for enterprise analytics programs and are seeking ways to communicate the impact of those programs. However, there are not many resources available to assist Federal CDOs in selecting appropriate metrics for these plays or the related initiatives that support those plays.

The questions in this paper provide agency CDOs with a roadmap on how to measure their data programs and promote the use of human-centered design to enhance customer experience with data services. This document also aims to help agencies understand the needs of their data customers by providing recommended questions to measure and continually improve federal government data services. This paper provides a series of recommendations but is not a

specification for CDOs and is not a comprehensive list of potential metrics for CDOs. It is intended to help CDOs understand the motivations behind different measurement approaches that enable them to select the most appropriate metrics for their individual programs.

**A Note About the Paperwork Reduction Act and This Paper**

Many qualitative metrics proposed in this paper focus on receiving feedback about service delivery or quality. These kinds of surveys are permitted under federal law and often can leverage a fast-track clearance process if your agency takes the necessary steps to set it up. Read more at: <https://pra.digital.gov/clearance-types/#generic-clearance>.

**How Do We Measure Assets?**

**Background**

The Federal Data Strategy is about leveraging data as a strategic asset. We can study how businesses account for their assets to guide our measurement approach to using data as a strategic asset. Let’s consider the types of assets a business may have:

- Fixed assets, which are not consumed in the business’s operations
- Operating assets, which do get consumed in the business’s operations

With fixed assets, asset management programs are usually primarily concerned with the reliability and utilization of the asset. There are metrics associated with these:

Sample Question	Sample Metric
What does it take to keep the asset in good condition?	Mean time to repair
Which assets are being well maintained?	Mean time between failure Mean time to failure Annualized failure rate On-time delivery rate
How much are assets being utilized?	Average occupancy rate Uptime
How productive is the asset?	Overall equipment effectiveness (availability x performance x quality)

Likewise, with operational assets, inventory management programs are concerned with value, efficiency, and utilization. There are metrics associated with these:

Sample Question	Sample Metric
How much of what kind of thing do we have?	Inventory
How much does it cost us to acquire our inventory?	Cost of ordering and processing the inventory at a plant or warehouse
How much is our inventory worth?	Inventory cost
How much space is our inventory using?	Space utilization
Where is our inventory kept?	Warehouse locations, with specificity to the bin level
How much is it costing us to keep our inventory?	Inventory carrying cost Obsolescence rate
How much revenue are we losing due to inventory issues?	Spill and spoilage rates

**Applications to Data**

Data assets refer to the raw data and information an organization collects and stores. These assets come from various sources, including customer data, financial data, market data, and more. These assets are often stored in databases, data warehouses, or other data management systems and can be used for various purposes, such as business intelligence and data analytics. Data assets are a valuable resource for organizations. It is important organizations have a clear understanding of their data assets, including what data they have, where it is stored, and how it can be accessed. Achieving that understanding requires robust data management practices along with Federal Data Strategy principles, such as data governance, data quality management, data security, and building a culture that values data and its leveraging power.

Good data management at the outset reduces the need to fix systems later due to inconsistency in data standards or definitions. We can translate the general questions and metrics from asset management over to the data domain and pose the following questions:

Sample Question	Sample Metric
<p>What are the costs to acquire and maintain our data?</p>	<p>Direct information technology costs, such as applications, computing, and storage, as well as any direct personnel costs. May include direct purchasing costs.</p> <p>Activity-based costing to determine how much time is spent on basic maintenance versus repairs. Cost avoidance from the reduced need to perform repairs or maintenance to data.</p> <p>Information collection costs, such as the burden and reporting frequency imposed on respondents to agency information collections</p>
<p>How are our raw data sources being used? How frequently?</p>	<p>Data flow, lineage, or provenance to describe the value chain, instrumented to measure the cost of the data movement as well as the uses and audiences for the finished products</p>
<p>How long is the wait to access the data?</p>	<p>Calculate availability or a service level</p>
<p>How long is the wait for new data or new functionality in current data?</p>	<p>Calculate lead times and manage roadmaps</p>
<p>What are all our data sources? How would we segment or classify them?</p>	<p>Inventory completeness or accuracy</p>
<p>What is the value of our data?</p>	<p>Apply costs as a starter metric, place value around the business processes supported, use economic models.</p>
<p>Do we experience data outages? If so, how frequently?</p>	<p>Any failure rate metric or operational efficiency metric</p>
<p>What is the condition of our data?</p>	<p>Data quality measures: completeness, accuracy, consistency, uniformity, validity, relevance, timeliness, integrity</p>

<p>How long does it take to set up the data once access is granted?</p>	<p>Direct personnel costs of people working with the data, and the time it takes them from access to complete exploratory data analysis.</p> <p>Indirect personnel support costs for the people working with the data, and the time it takes to support data use. Costs and time should decrease as self-service enablement increases.</p>
<p>How much storage is our data consuming? What does it cost?</p>	<p>Direct measurement of disk utilization</p>

These types of metrics can be applied directly to enterprise analytics programs. CDOs can compare and contrast these metrics for data assets that are under the purview of an enterprise analytics program and those that are not. An important feature of any asset management program is the need to classify or segment assets to tailor maintenance and management activities based on their relative priority of value to the organization. These tailoring activities can help organizations allocate finite resources and attention for their overall governance and prioritize the most important assets to the enterprise.

Furthermore, these metrics can be applied whether the organizations’ data infrastructure is centralized or not. In a federated system, it can be difficult to compare the metrics from different component agencies and offices that may have their own dedicated data systems and technologies. By establishing consistent metrics with consistent calculation methods, it should be possible to aggregate, compare, and contrast across the organization.

## **How Do We Measure Manufacturing?**

### **Background**

Leveraging data involves the consumption of data from a source through intermediate steps ultimately to a target. The process of taking raw materials and turning them into finished goods is manufacturing, and this is also a field that is well studied in domains such as operations research and industrial engineering.



All the prior discussions around asset management and inventory management are applicable to manufacturing settings; these are maintenance metrics. Beyond these, we can study the following key manufacturing questions and the metrics:

Sample Question	Sample Metric
How much did we make?	Yield, throughput
How long does it take us to make a product?	Lead time to customer
How can we shorten lead times?	Setup time, dwell time, run time
Which inventory do we need to make product?	Bill of material Inventory forecast
What is the quality of our product?	Supplier defect rate, waste, rejection rates (in factory and at customer)

**Applications to Data**

Data products refer to the products and services an organization creates using its data assets. Agencies usually have many programs creating data products, and CDOs are sometimes responsible for data products through enterprise analytics programs. Data products can include curated datasets, intermediate datasets, reports, dashboards, visualizations, predictive models, machine learning algorithms, etc. Data products are designed to facilitate or provide insights and information to users within an organization, as well as to external customers and stakeholders. However, to be effective, data products need to be designed with the end user in mind, meaning they should be easy to use, intuitive, and provide relative insights that help drive internal and external business outcomes.

When we measure concepts like yield from manufacturing processes, it’s important to hold those concepts in the overall business or mission context. For example, it is possible to manufacture too much product, creating an overstock condition. It is possible to manufacture too much of the wrong product because of a misalignment between demand and production. In data, as with all digital experiences, we must ensure our productivity is also aligned with our customer needs. It may not be best to optimize for yield; instead, it may be best to optimize for use or utilization. Metrics such as these can work in tandem to help align demand with supply. We can translate the following general questions and metrics from manufacturing to data products:

Sample Question	Sample Metric
How is our data being used?	<p>End-user segmentation (internal, external, etc.)</p> <p>Number of end-user data products created</p> <p>Value of end-user data products</p> <p>Use or utilization by end users (time to activation, engagement, number of users, citations, secondary uses)</p>
How much time did we spend creating the data product?	Direct time and cost of personnel involved in the data project
How can we shorten lead times?	Measuring setup time (how long from access to the end of exploratory data analysis), dwell time (time spent with documentation), run time (time spent conducting analysis)
What is the quality of the source data?	Direct measure of data quality, as in asset condition
What is the quality of our data product?	<p>Use and utilization of intermediate data products (curations, fact tables, etc.) and associated quality measures</p> <p>Defect rate and customer rejection rate (rework)</p> <p>For an analytics product, measures of model performance or model drift and other similar metrics</p> <p>Customer assistance request volume</p>

In data, we have concepts like lineage and provenance, which describe data origins, transformations, movements, and finished products. We use these concepts to trace errors and issues back to the root cause in the data origin. Lineage and provenance can be used for more than traceability purposes. For instance, it should be possible to attribute end-user metrics from finished data products to the originating datasets using lineage.

CDOs may also be interested in how data are being used beyond their own agency, especially in open data contexts. That is why the metrics above also focus on external customers and customer segmentation. Tracking downstream lineage, partnerships, and so on may help more fully characterize the value of an agency's data products.

An example of this is how NOAA created an entire secondary market for their open data, which has evolved into the NOAA Open Data Dissemination (NODD) Program.  
<https://www.noaa.gov/information-technology/open-data-dissemination>

These types of metrics can be applied directly to enterprise analytics programs. CDOs can directly apply these metrics for data assets that are under the purview of an enterprise analytics program. The technologies and processes that support an enterprise analytics program generate data that can be used to automatically generate some of these metrics. Put more simply, enterprise analytics programs enable CDOs to create dashboards about their dashboards. These measurement approaches can help organizations communicate the value and impact of their enterprise analytics programs.

## **How Do We Measure Experiences?**

### **Background**

Thus far, this paper has discussed quantitative approaches to measuring data. It is also possible to gather qualitative data about the human experiences with data and data products. For this, we seek to learn from customer experience with measures of perception and satisfaction. Areas for measuring the federal customer experience (<https://www.performance.gov/cx/data/>) include:

- Satisfaction
- Trust
- Quality
- Ease
- Efficiency
- Transparency
- Helpfulness

### **Applications to Data**

We can measure experiences for many aspects of a data program—data governance, data management, data analysis, data quality, enterprise analytics programs and so on. Here are some sample questions:

Sample Question	Sample Metric
<p>How well do people trust our program and our data? (reputation)</p> <p><i>This interaction increased my trust in &lt;thing&gt;.</i></p> <p><i>I trust &lt;agency/office&gt; to fulfill our commitment to &lt;relevant population or goal&gt;.</i></p> <p><i>I feel informed and consulted with on a regular basis.</i></p>	<p>This overall trust score can be measured on a Likert scale (preferring a 5-point scale).</p> <p>It can be asked of any customer—internal or external—and can be asked at the point of interaction with the service or product.</p> <p>It is also possible to ask these kinds of questions about your data program, your data governance board, and your data products and services.</p>
<p>How satisfied are people using our data or data products?</p> <p><i>Please rate your experience &lt;5-star option&gt;.</i></p> <p><i>I am satisfied with the service I received from &lt;dataset/data product name&gt;.</i></p>	<p>This overall satisfaction score can also be measured on a Likert scale.</p>
<p>What are peoples’ perceptions about our data and data products?</p> <p><i>My need was addressed.</i></p> <p><i>My issue was resolved.</i></p> <p><i>I found what I needed.</i></p> <p><i>My question was answered.</i></p> <p><i>My feedback was heard and acted upon.</i></p>	<p>These perceptions of service quality can be measured as simply agree or disagree and can be used as proxies for quality of the data asset or product as well as the kind of support the agency is providing users.</p>
<p>How easy is it to use our data assets or data products?</p> <p><i>It was easy to complete what I needed to do.</i></p> <p><i>It was easy to find what I needed.</i></p>	<p>These perceptions of findability and utility can help us measure ease of use or simplicity.</p>

<p>How easy is it to understand and work with our data assets and data products?</p> <p><i>It took a reasonable amount of time to do what I needed.</i></p> <p><i>I found what I needed quickly.</i></p>	<p>These perceptions of speed can also help us measure ease of use.</p>
<p>How can we improve our data assets or data products?</p> <p>What was your first impression of this data asset or product?</p> <p>What are your main concerns or questions about this data asset or product?</p>	<p>If you have a hypothesis about your data experiences, consider a multiple-choice question to get structured feedback about where to make improvements.</p>

In addition to these survey-based questions, it is also possible to measure data products in other ways, including:

- Number of users (number of signups as well as number of views/calls to services)
- Time to activation, time to first use (especially relevant with Application Programming Interfaces)
- Time spent engaged with the product (and, relatedly, number of clicks, where clicks went, etc.) as well as retention rate (repeat users versus one-time users) and churn (users who stop using the products).
- Number of improvements based on customer feedback, or the number of defects addressed based on customer feedback, along with the cost and time to address these.

CDOs can write these customer experience questions in a way that better helps them understand their market as well as their total addressable market (TAM). Understanding and forecasting the market for a data product can help a CDO understand the potential of their initiatives. Likewise, CDOs may also need to focus on equity in their data product’s distribution, quality, and utility. Conducting equity assessments and being mindful of the Federal Data Strategy Data Ethics Framework (<https://resources.data.gov/assets/documents/fds-data-ethics-framework.pdf>) tenets can help CDOs achieve these goals.

CDOs who operate enterprise analytics programs can demonstrate engagement with the data products that are the outputs of such programs. Measuring engagement and uses of these products can be accomplished using the tools and technologies that support an enterprise analytics program. CDOs should understand that data products are also digital services and can borrow from the Digital Services Playbook (<https://playbook.cio.gov/>) to apply relevant plays, such as understanding what people need in a data product, addressing users’ information-seeking experience from start to finish, making data products simple and intuitive, and more. Enterprise analytics programs can drive their user-centric approach by including these types of metrics in their measurement plans.

## **Bringing It All Together**

Having shared a sampling of key management disciplines and proposed a series of sample questions and associated ways to answer them, the CDO can now use these tools to communicate the value and impact of their initiatives.

CDOs should strongly align their measures to the agency's strategic and performance plans, focusing on where data and enterprise analytics programs support or influence those priorities. CDOs should use this alignment to understand how data and enterprise analytics programs relate to the agency's intended outcomes and then link these to their technical outcomes. The metrics outlined in this paper can then support measuring the value and impact of data programs.

CDOs are often leading these types of initiatives either as their own change management program or as part of a larger agency change management program. Many resources are available for helping to measure organizational change. Some resources include the U.S. Agency for International Development (USAID) Change Management Best Practices Guide (<https://www.usaid.gov/sites/default/files/2022-05/597saj.pdf>) and the Association of Change Management Professionals (ACMP) <https://www.acmpglobal.org/>.

Looking toward the future, CDOs may be asked to better understand how their initiatives contribute to their agency sustainability plans and goals. CDO initiatives may have a significant impact on power consumption as data storage and computing needs increase.

### **The Need for Planning and Analytics**

CDOs can use many of the practices shared in this document to ask even more advanced questions about their data programs and priorities. Supply chain mastery generally involves planning and forecasting to achieve optimization.

These planning and forecasting processes can be applied to data programs, as CDOs might ask:

- Which investments will have the greatest impact on our direct and indirect costs for data and data support?
- Is there similarity among our data inventory, and how can we reduce the cost of what we collect or buy?
- Which actions have had the greatest impact on our customer satisfaction and reputation?

These kinds of planning and analytics capabilities for data programs are aligned with the earliest phases and roles of the Federal Data Lifecycle—define, coordinate, and collect—as well as the later phases covering implementation and assessment. The Federal Data Lifecycle is shown below:

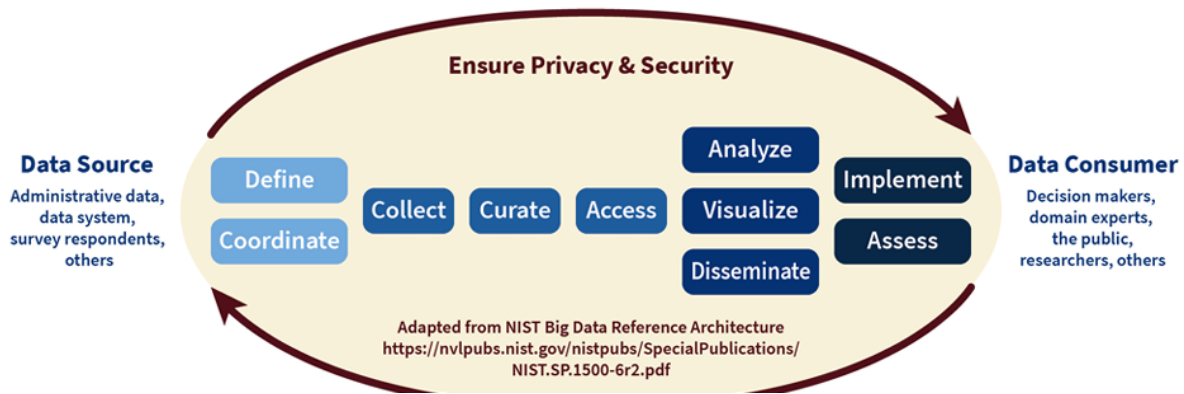


Figure 1 - Federal Data Lifecycle

- **Define:** Identify agency and stakeholder needs for data of sufficient quality for intended uses
- **Coordinate:** Assess the ability of data resources and infrastructure to meet agency and stakeholder needs
- **Collect:** Organize, plan, and execute data collections and acquisitions to meet agency and stakeholder needs
- **Curate:** Organize, refine, and maintain agency data resources with sufficient quality to meet agency and stakeholder needs
- **Access:** Identify and develop multiple data access methods for agency staff and stakeholders
- **Analyze:** Optimize the ability of staff and stakeholders to use agency data to generate insights
- **Visualize:** Present data insights for consumption by leaders and stakeholders
- **Disseminate:** Provide multiple avenues for release of data and insights
- **Implement & Assess:** Maximize the use of data for decision-making, accountability, and the public good, and continuously improve the data process

Source: <https://resources.data.gov/assets/documents/assessing-data-skills-playbook.pdf>

### The Need for Data Product Management

CDOs may also have some cross-cutting questions to better accomplish this alignment work. They may wish to ask:

- What challenges or problems does the data asset address that other data assets or products do not?
- Who are the customers for this data asset or product?
- Do we know if our customers feel informed or consulted about this data? When was the last time we asked?
- Who is responsible for understanding customer needs around this data asset or product? Are they setting their roadmap based on customer feedback?
- Are we closing the feedback loop with our customers in an open and transparent way?

Asking these questions may lead to emerging roles for data product managers, a role that can play a key part in the success of an enterprise analytics program. Data product managers are professionals who are responsible for overseeing the development and delivery of data products within an organization throughout their entire lifecycle. They work with cross-functional teams to identify the data assets needed to support specific products, and they collaborate with other data professionals to develop and deploy these products. Some key responsibilities of data product managers include:

**Setting Product Strategy:** Data product managers work with business leaders to identify opportunities for leveraging data assets to support business objectives. They develop product roadmaps prioritizing data product development based on stakeholder needs and business objectives.

**Managing Product Development:** Data product managers work with cross-functional teams, including data engineers, data scientists, analysts, and designers, to design, develop, and deploy data products. They oversee the development process to ensure products are high quality, accurate, and reliable.

**Managing Product Delivery:** Data product managers are responsible for ensuring data products are delivered to stakeholders and users promptly and effectively. They may work with IT teams to ensure products are integrated into existing systems and users have the necessary training and support to use the products effectively.

Overall, effective data asset management, data product development, and data product management are critical for organizations looking to leverage data to drive business outcomes. Organizations can gain valuable insights and make more informed decisions by having a strong understanding of their data assets and developing high-quality data products. Organizations can also more effectively measure their enterprise analytics initiatives. Data product managers play a critical role in this process by leading the development and delivery of effective data products that meet the needs of stakeholders and users.

However, Data Product Managers' responsibilities don't end with the product's deployment. These managers are also responsible for measuring the value of the product and the impact it has internally to the agency, or to their external data customers.





If you have questions or would like more information about the case studies, contact [cdocstaff@gsa.gov](mailto:cdocstaff@gsa.gov).



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