

## Measuring the Value of Open Government Data: A Comparative Study of Characteristics and Methods (Postprint)

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**Date:** 2023-04-01T16:16:02+00:00

### Abstract

[Purpose/Significance] This study systematically reviews and compares existing practices in open government data value measurement, provides recommendations for future open government data measurement initiatives, and serves as a reference for the domestic academic community.

[Method/Process] This research systematically examines 16 representative domestic and international evaluation projects and research reports concerning open government data value measurement, comparing their evaluation timing, subjects, objects, gradients, scope, and value types; summarizes their value measurement methodologies; and elaborates on the characteristics and applicability of various value measurement approaches.

[Results/Conclusion] The study clarifies the distinctions and interrelationships among three categories of evaluation objects: public sector information resources, open data, and open government data; distinguishes three gradients of open government data value measurement—output, outcome, and impact; compares the characteristics and applicability of different value measurement methods; and summarizes the existing problems and challenges in current open government data value measurement practices. In terms of characteristics, evaluation practices have generally evolved from assessing public sector information resource utilization and reuse to evaluating government data openness, and from emphasizing single economic value to focusing on comprehensive value. In terms of methodology, value measurement methods currently employed in practice can be macroscopically categorized into quantitative and qualitative approaches, with quantitative methods further subdividable into two types: those based on socio-economic indicator calculation and those based on multi-dimensional evaluation framework and indicator system construction.

## Full Text

### Preamble

#### Open Government Data Value Measurement: A Comparative Study of Features and Methods

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**Abstract:** [Purpose/Significance] This study systematically reviews and compares existing practices in open government data value measurement to provide recommendations for future assessment projects and references for domestic scholars. [Method/Process] We examined 16 representative evaluation projects and research reports related to open government data value measurement, comparing their evaluation timing, subjects, objects, gradients, scope, and value types. We summarized the value measurement methods and explained the characteristics and applicability of each approach. [Result/Conclusion] The study clarifies the distinctions and connections among three types of evaluation objects: public sector information resources, open data, and open government data; distinguishes three gradients of open government data value measurement (output, outcome, and impact); compares the characteristics and applicability of different value measurement methods; and summarizes existing problems and challenges in current practices. In terms of features, evaluation practices have generally evolved from assessing public sector information resource utilization and reuse to evaluating government data openness, and from focusing on single economic value to emphasizing comprehensive value. In terms of methods, current practices can be broadly divided into quantitative and qualitative approaches. Quantitative methods can be further categorized into socioeconomic indicator-based calculations and multi-dimensional evaluation framework and indicator system construction.

**Keywords:** Open government data; Value; Measurement; Methods; Features; Comparison

**Classification Number:** G250

**DOI:** 10.13266/j.issn.0252-3116.2020.19.015

Evaluating the value generated after data is opened and utilized represents the ultimate indicator for assessing open government data effectiveness. However, measuring open government data value presents considerable challenges for two main reasons: First, the effects of open government data may require substantial time to materialize, and in most places where open data is still in its infancy, insufficient opening and utilization make it difficult to discuss effects. Second, measuring open government data value is inherently difficult and complex, making it no easy task to reasonably and effectively assess the value generated by open government data.

## 2 Literature Review

Research on open government data value measurement primarily follows two paths: The first path emphasizes theoretical discussion, focusing on measurement methods and analyzing or proposing models, frameworks, and corresponding indicators for open government data value assessment. The second path emphasizes practical application, analyzing and comparing existing domestic and international open government data value assessment projects, or conducting empirical research on actual value generated through specific cases.

### 2.1 Open Government Data Value Measurement Methods

Regarding value measurement methods, some scholars have proposed models and analytical frameworks for measuring and evaluating open government data value from multiple perspectives. From a user evaluation perspective, Y. Charalabidis et al. [3] constructed a value model for assessing open government data projects, using user utilization behavior as an outcome variable to examine the degree of support provided by open government data platforms to user goals and data provider goals. C. Origlia et al. [4] assessed the value realization of open government data by measuring user satisfaction and perceived value. S.S. Dawes, N. Helbig [5] and T.M. Harrison et al. [6] applied the Public Value Framework to analyze the multi-dimensional value of open government data, helping researchers identify value generation mechanisms and assess comprehensive impacts based on stakeholder analysis. M. Stuermer and M.M. Dapp [7] applied the Social Return on Investment (SROI) method to propose an analytical framework (Impact Monitoring Framework) for measuring the social and environmental value of open government data, distinguishing among input, output, outcome, and impact.

Other scholars have reviewed or constructed indicator systems for open government data value dimensions. S.S. Dawes, N. Helbig [5] and T.M. Harrison et al. [6] categorized the public value of open government data into seven types: economic, social, political, managerial, strategic, quality-of-life, and spiritual-cultural. Zheng Lei and Guan Wenwen [1] comprehensively reviewed outcome dimension indicators in existing assessment frameworks, identifying four primary indicators (public society, ecological environment, political government, and economic business) and multiple secondary and tertiary indicators. Similarly, Wei Xinling et al. [8] argued that open government data impact assessment should comprise four aspects: social benefits, environmental benefits, economic benefits, and government accountability capacity. Huang Ruhua et al. [9] constructed a basic value system for open government data through policy literature review, encompassing political, social, economic, and technological values, with 16 secondary indicators and 43 tertiary indicators under these four categories.

## 2.2 Open Government Data Value Measurement Practices

In practice, open government data value assessment projects are primarily conducted by various organizations. Around 2000, European and American countries began focusing on the economic value of public sector information resources, conducting a series of studies to calculate market share and contributions to national economies from public sector information resource utilization and reuse. Representative reports include the PIRA report [10] and the MEPSIR report [11]. With the rise of the open government data movement, organizations have conducted value assessments targeting open data or open government data, such as the McKinsey research report [12], the European Data Portal research report [13], and the Sunlight Foundation's open data social impact research report [14]. Some scholars have studied these assessment projects. For example, P.F. Uhlir [15] discussed the research methods and results of some reports, while T. Noda [16] compared methods for inferring the economic value of open government data. Chen Chuanfu and Huang Xuan [17] briefly introduced the results of PIRA, MEPSIR, and Canadian geographic information resource economic value assessments, demonstrating the necessity of value-added utilization of government information resources in China. Chen Mei [18] reviewed some value assessment reports on public sector information resources and open data, briefly introducing their evaluation strategies and results. Based on this, Chen Mei [19] noted that methodological disagreements remain in open government data value assessment, with difficulties centering on how to evaluate indirect effects.

In addition to organizational assessment projects, some scholars have employed various research methods to conduct empirical studies on open government data impacts through specific cases. Based on interviews and surveys of internal and external stakeholder groups, P. Parycek et al. [20] studied the beneficial impacts of Vienna's open government data project. G.V. Pereira et al. [21] used the public value analysis framework to evaluate Rio de Janeiro's open government data project, finding that open government data generated different types of value for citizens, businesses, government departments, and employees, but also created issues such as exacerbating the digital divide. A. Zuiderwijk et al. [22] compared open government data cases across 156 countries and regions, finding that the benefits and objectives of open government data are not necessarily closely related. Current benefits primarily manifest in improving government transparency, enhancing data reuse, empowering citizen participation, improving decision-making processes, and optimizing administrative procedures. Domestically, Zheng Lei and Lü Wenzeng [23] used Shanghai's 2015 Open Data Innovation Contest as a case study to examine beneficiaries, utilization outputs, and effects of open data utilization, finding that open government data could generate potential commercial value (cost reduction, revenue increase, targeted advertising, new services) and social value (addressing urban traffic congestion, saving social costs, improving resource utilization, promoting energy conservation and emission reduction). Zhao Jidi and Zhang Hanlun [24] evaluated Shang-

hai's open government data effectiveness from three dimensions: provision and management, user participation, and data utilization.

### 2.3 Literature Evaluation

In summary, research on open government data value measurement has begun, achieving preliminary progress in methodological preparation and practical application. However, studies on value measurement methods and practices remain fragmented, with key concepts not yet clearly defined, lacking systematic review of available methods and insufficient discussion of their applicability. Compared with academic research, organizational assessment projects have accumulated considerable experience, with their methods and strategies worthy of scholarly study and reference. Although domestic scholars have conducted some research, it mostly remains at the level of experience introduction, lacking in-depth analysis.

Therefore, this paper systematically reviews authoritative assessment projects and research reports involving open government data value measurement, conducting in-depth analysis and comparison of project features and measurement methods to clarify important concepts, summarize existing value measurement methods, and discuss the applicability of various approaches, hoping to provide references for future assessment research.

## 3 Research Methods

Based on the above research status, this study examines assessment projects and research reports involving open government data value measurement, conducting comparative analysis of project features and measurement methods. Considering that public sector information resource value assessment constitutes a research foundation for open government data value assessment [13], we used keywords including “open government data/open data/public sector information” and “value/effectiveness/outcome/impact” to retrieve materials through web searches and literature review. We manually screened materials based on the following criteria: assessment subjects are government agencies, large consulting firms, or research institutions such as universities and institutes; having systematic assessment methods or clear evaluation indicators; being frequently cited in literature; reflecting the latest achievements in relevant assessment practices. We ultimately selected 16 authoritative and representative assessment projects and research reports as our analysis objects (see Table 1 ).

It should be noted that this paper focuses on reviewing and summarizing existing assessment practices, limiting its scope to organizational research reports. We did not include econometric impact evaluation methods commonly used in academic research (such as quasi-experiments, instrumental variables, and difference-in-differences), which, although advantageous in controlling for confounding variables and verifying causal relationships, have rarely been applied in actual open government data value measurement and only sporadically appear

in economics papers [25].

## 4 Features of Open Government Data Value Measurement Assessment Practices

### 4.1 Assessment Timing and Subjects

In terms of assessment timing, since the beginning of this century, European Union countries initiated systematic calculations and assessments of public sector information resource utilization and reuse value, with representative studies including the PIRA report [10] and MEPSIR report [11]. Value assessment projects targeting open government data (or open data) emerged mainly after 2012, consistent with the timeline of the open data movement.

Regarding assessment subjects, current value assessment projects primarily come from Western Europe, North America, and other pioneering regions in open government data. In recent years, domestic scholars have also explored open government data value assessment. In 2019, Fudan University's Digital and Mobile Governance Lab [34] and the Shanghai Academy of Social Sciences Information Institute [35] respectively initiated assessment research on open government data utilization output and value release.

### 4.2 Assessment Objects

Existing assessment projects and research reports cover three types of assessment objects: public sector information resources, open data, and open government data, which are distinct yet interconnected.

Public Sector Information (PSI) refers to various types of information resources generated, created, collected, processed, preserved, maintained, and disseminated by government departments and other public institutions in fulfilling their functions [37]. Open Data (OD) is “data that can be freely used, reused, and distributed by anyone for any purpose without restrictions, while maximally maintaining its original source and openness” [38]. Open Government Data (OGD) refers to government data that can be freely, costlessly accessed, used, and shared by anyone [39]. OGD has narrow and broad definitions: the narrow definition limits data sources to government departments at all levels, while the broad definition includes other public sector organizations (also called public sector open data) [40].

These three concepts overlap. Open data is a practice applicable to multiple domains including government, enterprise, and social organizations, with open government data being a subset and important component of open data. Simultaneously, open government data is also a subset of public sector information resources. Government information resources include not only data but also information [27], encompassing both socially open and non-open portions. Therefore, broadly defined open government data can be understood as the intersection of public sector information resources and open data concepts, as

shown in Figure 1 [Figure 1: see original paper].

These three concepts also differ in connotation. In terms of sources, PSI and OGD are generally produced or held by government departments and public institutions, while open data sources also include enterprises and social organizations. In terms of format, PSI exists not only as raw and processed datasets but also as documents, reports, laws and regulations, technical standards, databases, designs, images, etc. [17, 41], whereas open data and OGD primarily exist as electronic, structured, machine-readable datasets. In terms of provision methods, PSI is provided through public publication, internet browsing and downloading, electronic or paper document distribution, etc., while open data and OGD are generally obtained through data platform downloads or API interfaces.

### 4.3 Assessment Gradients

Assessing the value of PSI, open data, and OGD essentially evaluates the effectiveness of results generated after these information and data resources are supplied. Although these assessment projects can all be collectively called “value assessment,” they actually examine different gradients (see Figure 2 [Figure 2: see original paper]).

Overall, open government data results can be divided into three gradients: output, outcome, and impact [14, 29, 31, 33]. Definitions of these gradients are not yet unified in existing literature. Based on D. Easton’s [42] and O.R. Young and A. Underdal’s [43] distinctions among policy input, output, outcome, and impact, combined with definitions in the above assessment projects and research reports, this paper defines open government data value gradients as follows:

**Output** refers to direct products and services generated after government data is opened and utilized. Various forms of outputs from societal utilization of open government data, such as analysis reports, data visualization products, mini-programs, and apps, belong to this category. Outputs from data innovation contests also constitute a special form of utilization output. Output represents short-term results of open government data practice and is relatively easy to quantify.

**Outcome** refers to short- to medium-term, relatively visible results that open government data outputs bring to different stakeholders. Conveniences obtained by users from utilizing open government data outputs, profits created by enterprises in the process of utilizing open government data, and cost savings and revenue gains obtained by government departments from open government data utilization outcomes all fall within the scope of outcomes. Compared with output, outcome measurement is more difficult.

**Impact** refers to long-term or indirect results that open government data brings to data suppliers, users, and the overall environment, including promoting economic growth, saving social costs, and enhancing social equity. Determining whether impact truly exists requires controlling for other variables that may

cause result changes to exclude interference from other factors. Therefore, compared with open government data outcomes, impacts are more uncertain and difficult to measure.

Additionally, three stages before output should be clarified: input, opening, and utilization. **Input** refers to resources and preparatory work needed to achieve government data opening and utilization, including data and information resources, human, financial, and material inputs, and corresponding legal, regulatory, policy, and institutional guarantees. **Opening** refers to government behavior in providing open data, such as platform construction, platform maintenance, data uploading, and data updating. **Utilization** refers to various societal activities using open government data, including data interpretation, analysis, processing, integration, and application development. Data opening and utilization together constitute open government data value creation activities (see Figure 2 [Figure 2: see original paper]).

#### 4.4 Assessment Scope

Assessment scope can be compared from two dimensions: the thematic scope of evaluated data and information resources, and the geographical scope of the assessment.

Regarding thematic scope, most assessment projects and research reports cover multiple types of data or information resources. Some projects explicitly define the themes of studied data or information resources, such as the PIRA report [10], MEPSIR report [11], and McKinsey research report [12]. Others do not clearly specify thematic distribution, such as the Sunlight Foundation's open data social impact research report [14], the developing countries open data impact assessment report [29], and New York University Governance Lab's open data impact report [30]. A few projects focus only on specific data types, such as the UK Ordnance Survey's evaluation of economic and social value of open map data (OS OpenData) [28]. Frequency analysis shows that among projects explicitly stating thematic distribution, frequently occurring keywords include transportation, geography, meteorology, and culture, as shown in Figure 3 [Figure 3: see original paper].

Regarding geographical scope, among the 16 selected assessment projects and research reports, 11 are cross-national studies, 2 are national-level studies, and 2 focus on cities within a country. Since the Universal Assessment Framework [31] only proposed an evaluation framework without actual implementation, it is not included in the statistics.

Early assessments were mostly conducted in economically developed countries and regions in Western and Northern Europe and the United States. With the global expansion of the open data movement in recent years, developing countries have gradually been included in open government data value assessment scope. For example, the World Wide Web Foundation and Canada's International Development Research Center studied emerging impacts of open data in

developing countries [29]. Both the Sunlight Foundation [14] and New York University Governance Lab [30] included cases from developing countries in their studies of open data impact. Among the above assessment projects and research reports, those involving China include the Open Data Barometer [34], China Open Data Forest Index [35], Global Major Cities Open Data Index [36], and Sunlight Foundation's open data social impact research report [14].

#### 4.5 Value Types

Different periods of assessment research have emphasized different value types. Early assessments of PSI utilization and reuse focused primarily on economic value, including calculating market size formed by PSI utilization and reuse, and estimating direct and indirect economic benefits obtained by consumers, enterprises, and public sectors. The PIRA report [10], MEPSIR report [11], European Commission's G. Vickery research report [26], and Deloitte research report [27] all belong to this category.

After the rise of the open data movement, the multi-dimensional value of open data and open government data began receiving attention. Assessment research started focusing on non-economic value generated by data opening and utilization while still attending to economic value (such as in the McKinsey open data research report [12]), including social value (e.g., Sunlight Foundation's open data social impact research report [14]), political value (e.g., Open Data Barometer [34]), and environmental/ecological value (e.g., European Data Portal research report [13]). This shift reflects society's increasingly comprehensive and diverse understanding of open government data value.

### 5 Comparison of Open Government Data Value Measurement Methods

In open government data value measurement practice, different assessment subjects employ various methods based on differences in assessment objects, gradients, scope, value types, and resource constraints. These methods can be broadly divided into quantitative and qualitative categories.

#### 5.1 Quantitative Value Measurement Methods

Quantitative value measurement methods measure and calculate quantifiable aspects of open government data outputs, outcomes, and impacts to describe the status and development trends of open government data value. Using digital symbols as the measurement foundation, these methods have two specific forms in practice: socioeconomic indicator-based calculation and multi-dimensional evaluation framework and indicator system construction.

**5.1.1 Socioeconomic Indicator-Based Calculation** This method selects quantifiable socioeconomic indicators as proxy variables for open government data value, collecting macro or micro data to estimate benefits formed after

data opening and utilization. These assessments are generally predictive and most common in economic value estimation. Common economic value indicators include market size, contribution to national economy (GDP contribution rate), and new job creation. With appropriate proxy indicators, this method can also estimate non-economic value of open government data (e.g., measuring governance, environmental, and social value by estimating cost savings for public sectors, saved travel time, and reduced accident numbers from open data utilization [13]).

Among the 16 selected assessment projects and research reports, 7 primarily adopted this method, with variations in research pathways, strategies, and specific methods.

**Research Pathways:** Economic value calculation mainly follows two pathways: top-down and bottom-up. The top-down pathway generally uses macro-level economic statistics to infer direct and indirect economic impacts of open data (or PSI utilization and reuse) from a resource utilization perspective, such as in the European Commission's G. Vickery research report [26]. The bottom-up pathway starts from the market endpoint, using enterprise and user surveys to obtain micro-level economic data that aggregates into overall economic value estimates, such as in the MEPSIR report [11], McKinsey open data research report [12], and UK open map data value assessment report [28]. Each pathway has advantages and disadvantages: top-down approaches tend to overestimate economic value due to difficulty separating substitute effects, while bottom-up approaches tend to underestimate economic value due to difficulty incorporating spillover effects [19]. To reduce bias, some assessment projects combine both pathways, such as the European Data Portal research report [13].

**Research Strategies:** Different assessment projects employ varying research strategies. Existing national economic accounting systems cannot directly reflect economic value generated by open data (or PSI utilization and reuse), requiring alternative estimation methods that differ across projects (see Table 2 ), leading to variations in assessment results.

**Data Collection and Analysis Methods:** The 7 assessment projects primarily used seven data collection methods: secondary data, literature review, interviews, desktop research, enterprise surveys, web surveys, and online questionnaires. Secondary data was most frequently used (6 times), followed by literature analysis and interviews (4 times each). Data analysis methods correspond to research strategies, mainly including cost method, value-added method, subjective estimation method, and revenue estimation method.

**5.1.2 Multi-Dimensional Evaluation Framework and Indicator System Construction** In recent years, multi-dimensional, scale-based evaluation frameworks and indicator systems have become mainstream for assessing open government data performance. Open government data performance comprises five dimensions: foundation, platform, data, usage, and effectiveness, with effec-

tiveness (i.e., value) being the ultimate indicator [1]. Among the 16 projects and reports studied, 6 used multi-dimensional evaluation frameworks and indicators to measure open government data value, but only the Open Data Barometer [34], China Open Data Forest Index [35], and Global Major Cities Open Data Index [36] conducted actual evaluations. Comparative analysis of these frameworks and indicator systems is shown in Table 3 .

**Framework Structure:** Existing evaluation frameworks mostly adopt two- or three-tier indicator structures. Finland’s Ministry of Finance open data impact assessment [32], China Open Data Forest Index [35], and Global Major Cities Open Data Index [36] use three-tier indicators. The Universal Assessment Framework [31], San Francisco open data assessment [33], and Open Data Barometer [34] use two-tier indicators. Indicator tier design must balance effectiveness and operability: more tiers provide more comprehensive indicators and better reflect reality but increase data collection costs and difficulty; fewer tiers make assessment more intuitive and concise but place higher demands on selecting limited proxy variables, potentially reducing credibility and effectiveness.

**Specific Indicator Design:** Current open government data value dimension indicators are designed in three ways. First, primary indicators are beneficiary-based: using cost-benefit thinking to distinguish beneficiary groups of data opening and utilization at the macro level, then examining utility enhancement methods and results for different groups. For example, Finland’s Ministry of Finance open data impact assessment [32] uses enterprises, residents, public sectors, and national economy as primary indicators, with secondary indicators as specific benefit pathways and tertiary indicators quantifying secondary indicators.

Second, primary indicators are value-type-based: distinguishing different value types of open government data and using value types as primary indicators with specific manifestations as secondary indicators. The Universal Assessment Framework [31], Open Data Barometer [34], and Global Major Cities Open Data Index [36] belong to this category, though specific indicator selections differ. For instance, the Universal Assessment Framework’s social value comprises increased public participation, enhanced social inclusion, and improved social policies [31], while the Global Major Cities Open Data Index’s social value examines citizen cost reduction and research output [36].

Third, primary indicators are gradient-based: distinguishing among output, outcome, and impact gradients for step-by-step assessment. San Francisco’s open data assessment [33] and China Open Data Forest Index [35] belong to this category. The former primarily evaluates whether open data has begun generating value from output and internal government impact perspectives, while the latter examines actual effectiveness of open government data utilization from the “output” perspective based on current development status of Chinese local government open data.

**Data Collection Methods:** The 5 assessment projects involving data collection primarily used eight methods: secondary data, questionnaire surveys,

desktop research, data scraping, expert evaluation, self-assessment, literature analysis, and manual observation. Secondary data collection was most frequent (4 times), followed by questionnaire surveys and desktop research (2 times each).

## 5.2 Qualitative Value Measurement Methods

Qualitative value measurement methods employ qualitative research approaches such as field experience, open interviews, participatory and non-participatory observation, literature analysis, and case studies [46] to assess open government data utilization value. Qualitative methods emphasize inductive rather than deductive thinking in analyzing materials and forming conclusions, particularly advantageous when evaluating difficult-to-quantify effects and impacts of open government data. Among the 16 selected assessment projects, 3 primarily used qualitative methods to evaluate economic, social, environmental, and governance value (see Table 4 ).

**Research Strategies:** Most assessment projects adopted case-based research strategies, extensively collecting open data utilization cases to build case databases and conducting field investigations and tracking studies to identify actual value generated by data opening and utilization.

**Data Collection Methods:** These 3 assessment projects primarily used eight data collection methods: interviews, expert consultation, crowdsourced feedback, workshops, and desktop research. Interviews were most frequently used.

**Data Analysis Methods:** Content analysis was the primary data analysis method in qualitative assessment. The Sunlight Foundation's open data social impact research report noted that examining mid-term outcomes rather than short-term outputs or long-term impacts is more meaningful at the current stage, thus adopting Outcome Mapping Method to demonstrate non-linear relationships between open data utilization and effects [14].

## 5.3 Characteristics and Applicability of Value Measurement Methods

We found that method selection relates to project features. By correlating project features with methods used, we can preliminarily summarize characteristics and applicable scenarios of different value measurement methods (see Table 5 ).

**Comprehensive Analysis:** For regions in early stages of open government data development with low maturity and less apparent economic value, qualitative methods are more applicable. For assessment projects targeting government data opening departments or platforms, multi-dimensional evaluation framework and indicator system methods are more common, directly reflecting open government data utilization and 成果转化 while demonstrating benefits generated within government departments. However, if the assessment scope is too broad, using multi-dimensional frameworks and indicator systems, though simple and convenient, places high demands on indicator selection; otherwise, it

becomes difficult to construct data that can verify causal relationships between opening and value.

For widely utilized data types such as geographic information, transportation, and meteorological data, using economic models to infer economic value has become feasible. However, these methods rely heavily on economics model assumptions, require high data quality, are costly, and have controversial accuracy in estimation results.

## 6 Summary and Recommendations

This paper conducted comparative analysis of 16 representative domestic and international assessment projects and research reports involving open government data value measurement, reviewing, comparing, and summarizing features and methods in practice.

Feature comparison focused on assessment timing, subjects, objects, gradients, scope, and value types. In terms of timing and subjects, early economic value assessments of PSI utilization and reuse in EU countries formed the foundation for open government data value assessment. With the globalization of open data practice, assessment subjects are no longer limited to Europe and America. Regarding assessment objects, we clarified distinctions and connections among PSI, open data, and OGD; distinguished three gradients of open government data value measurement (output, outcome, and impact); and found that existing assessments mostly involve transportation, geography, meteorology, and other fields, with early assessments concentrated in developed countries and regions in Europe and North America. In terms of value types, early assessments focused on single economic value, while recent years have seen increased attention to multi-dimensional value in political, social, and environmental domains.

In practice, open government data value measurement methods can be broadly divided into quantitative and qualitative categories, with quantitative methods further subdivided into socioeconomic indicator-based calculation and multi-dimensional evaluation framework and indicator system construction. For reports using socioeconomic indicator calculation, we compared their research pathways, strategies, and data collection and analysis methods. For projects using multi-dimensional frameworks and indicator systems, we compared framework composition, specific indicator design, and data collection methods. For reports using qualitative methods, we compared research strategies and data collection and analysis methods. Finally, we discussed characteristics and applicable scenarios of various methods.

Although open government data value measurement practice has made progress, several prominent issues remain: Most assessments use secondary rather than primary data; Some studies lack clear gradient definitions, confusing short-term outputs, medium-term outcomes, and long-term impacts; Some studies do not clearly explain their methods and data, reducing reproducibility.

Current difficulties in open government data value measurement remain concentrated in: Access to primary data; Data granularity and quality; Reasonable selection of assessment indicators (proxy variables) and estimation models; Constructing counterfactuals and controlling for other variables to demonstrate that measured value is indeed caused by open data rather than other factors.

Addressing these issues and challenges, we offer the following recommendations for future open government data value measurement practice: Establish open government data utilization case databases [14, 28-29] to accumulate high-quality micro-data for tracking actual effects; Clearly define assessment objects with reasonable operational definitions; Consider assessment gradients (output, outcome, or impact) based on local practice development; Introduce econometric research methods into open government data assessment to promote interdisciplinary integration; Consider complex non-linear relationships between data opening and value output and the influence of other variables, being cautious about attribution; Make reasonable choices among value measurement methods considering resource readiness, time constraints, and data collection capabilities.

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## Open Government Data Value Measurement: A Comparative Study of Features and Methods

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**Abstract:** [Purpose/significance] With the growing trend of open government data around the world, assessments on the value of open government data have emerged and become increasingly important. This paper aims to reveal a comparative study on the features and methods presented in the value assessment projects, and to provide meaningful references for future research and practice. [Method/process] By examining 16 representative projects, this paper

analyzed the features among those value assessment practices and summarized the existing methods for measuring the value of open government data. [Result/conclusion] The economic value assessment of using and reusing public sector information provide the basis of the value assessment of open government data. In recent years, the multi-dimensional value of open government data has received more research interest than the single economic value. For measuring the value of open government data, related methods can be generally divided into quantitative ones and qualitative ones. Quantitative methods include two broad strategies. One is based on the estimation of socio-economic indicators and the other is based on the ratings of evaluation metrics and indices. Different methods have their different properties and applicability. This paper also provides some suggestions based on the analysis.

**Keywords:** open government data; value; assessment; feature; method; comparison

*Note: Figure translations are in progress. See original paper for figures.*

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