

Postprint: A Study on Maturity Assessment of Local Government Open Data Portals

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Abstract

[目的/意义]Developing a maturity assessment model for local government open data portals is of significant importance for enriching and perfecting the theories and methods of government open data evaluation, identifying portal problems, and proposing improvement suggestions.[方法/过程]Based on the Capability Maturity Model and information architecture theory, a “five-level, three-dimensional” maturity model for local government open data portals is established. The measurement criteria for evaluation indicators under each dimension are determined by integrating the Data Management Maturity Model, data center service capability maturity standards, and government open data maturity models. Finally, maturity assessment and analysis are conducted with eight provincial-level portals as case examples.[结果/结论]Through maturity assessment, specific issues of each portal in the three dimensions of “data management”, “data service”, and “user participation” are identified, and portal improvement strategies and directions are indicated.

Full Text

Preamble

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Research on Maturity Assessment of Local Government Data Open Portals

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Abstract

[Purpose/Significance] Constructing a maturity assessment model for local government data open portals is significant for enriching and improving gov-

ernment data openness evaluation theories and methods, identifying portal problems, and proposing improvement recommendations. **[Method/Process]** Based on the Capability Maturity Model and information architecture theory, this study establishes a “five-level, three-dimensional” maturity model for local government data open portals. Combined with the Data Management Maturity Model, data center service capability maturity standards, and government data openness maturity models, measurement criteria for assessment indicators under each dimension are determined. Finally, eight provincial portals are evaluated and analyzed as examples. **[Result/Conclusion]** Through maturity assessment, specific problems in each portal across the three dimensions of “data management,” “data services,” and “user participation” are identified, and improvement strategies and directions for portals are indicated.

Keywords: government data open portal; maturity theory; assessment and improvement

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Data, as a special asset, has gradually become an important component of social infrastructure [1]. Government data accounts for over 80% of total social data and has tremendous influence on government activities, public affairs, and citizens’ lives [2]. The emerging open government data movement is important for promoting secondary data utilization, enhancing citizen political participation, and building a new service-oriented government [3].

Data, platforms, organization, and policy support are important components of government data openness construction that require systematic and comprehensive research. Currently, relatively mature and targeted evaluation systems exist for the “foundation layer” and “data layer,” such as the “UN E-Government Survey,” “World Bank Open Data Readiness Assessment,” and “Open Government Data Index.” As the “platform layer,” government data open portals serve as data carriers and bridges connecting users with data, playing a crucial role in improving user willingness to use, usage efficiency, and satisfaction. Due to differences in nature, service subjects, and service content from general portals, government data open portals cannot be evaluated using general portal assessment standards. However, specialized government data open portal assessment research remains relatively scarce, with insufficient attention paid to evaluating portal development levels. Therefore, this study introduces maturity thinking to comprehensively reflect the staged growth process and capability changes of government data open portals, providing a roadmap for portal development. This approach can also be extended to future research on data quality and related issues.

1. Domestic and International Research and Practice

Foreign research on government data openness evaluation is relatively comprehensive, primarily focusing on integrated assessments of readiness, implemen-

tation, and impact. Specialized portal assessments are relatively rare, but frameworks such as the “Open Government Data Index,” “European Open Data Monitor,” and “Common Assessment Framework” impose requirements on portal functions from different perspectives. The “Open Government Data Index” focuses on data quality provided by portals, requiring data usability, accessibility, and reusability. Usability concerns open data domains such as election and expenditure data; accessibility focuses on data openness degree, including data formats, tool provision, and metadata; reusability emphasizes data promotion and application, such as APP development [4]. The “European Open Data Monitor” dynamically monitors and evaluates four aspects: open licensing, machine readability, accessibility, and metadata completeness, emphasizing the importance of deploying public data portals and directories [5]. The “Common Assessment Framework” particularly emphasizes user-friendly interfaces in its comprehensive assessment [6]. For government data openness maturity assessment, D. Morgan [7] describes characteristics across three dimensions—“strategic assessment,” data “availability,” and “description and archiving forms”—at four stages: “emerging,” “implementing,” “enabling,” and “leading” [8]. J. Tauberer [9] demonstrates the maturity development process of government data openness through changes in data domains from “legal documents” to “public service data” and information technology deepening from “freedom of information access” to “linked data.”

Domestic research on portal assessment mainly includes the “Open Data Mirror” [10], “Open Data Forest Index” [11], and “Five-Level Technical Maturity Model for Government Data Openness” [12]. The first two were proposed by the Digital Governance Laboratory of Fudan University, with similar evaluation indicators that comprehensively assess the “foundation layer,” “data layer,” and “platform layer” of government data openness. The latter was proposed by Inspur Group, dividing government data open portals into five stages: “information disclosure,” “data website,” “data portal,” “data platform,” and “data ecosystem.” This model emphasizes that portal development is a gradual process, but its guidance for evaluation practice is limited due to the lack of specific indicators for each stage.

Current domestic and international research emphasizes the completeness and comprehensiveness of evaluation systems, but specific assessments of indicators often remain at simple binary levels of “yes/no,” “present/absent,” or “satisfied/not satisfied,” making it difficult to reflect the staged growth process and capability changes of indicators. Therefore, this study attempts to construct a maturity assessment model for government data open portals that stages the growth process, implements horizontal assessment at the indicator level, and clarifies stage measurement standards for each indicator, providing clearer guidance for portal improvement.

2. Maturity Models and Their Application in Government Data Openness

2.1 Maturity Models

The concept of “maturity” originates from Carnegie Mellon University’s Capability Maturity Model (CMM), which divides software processes into five levels from low to high: Initial, Repeatable, Defined, Managed, and Optimizing, with detailed descriptions of activities, technologies, and tools at each stage [13]. Crosby applied maturity models to assess enterprise development levels in *Quality is Free*, and this model is now widely used in various fields.

Siemens believes knowledge management runs through all stages of knowledge production, dissemination, application, and innovation. Its Knowledge Management Maturity Model (KM3) determines development levels through a development model, defines assessment dimensions through an analysis model, and establishes standard evaluation processes. Syracuse University’s Data Management Maturity Model (DM3) [14] covers five dimensions: general data management; data collection, processing, and quality control; data description and presentation; data dissemination; and storage services and preservation. Each dimension is further divided into four stages: execution commitment, implementation capability, implementation activities, and process evaluation. These models provide important references for stage division, dimension division, and indicator design in this study’s maturity assessment of government data open portals.

2.2 Application of Maturity Models in Government Data Openness

Joshua’s 2014 book *Open Government Data* proposes a maturity model that identifies development trends from the perspectives of data domains and technological development [15]. The Open Data Institute’s (ODI) government data openness maturity model [16] evaluates from five aspects based on a strategic perspective: data management processes, knowledge and skills, customer support and engagement, investment and financial performance, and strategic oversight. Although these models do not focus specifically on portal assessment, they provide reference for maturity stage division and description.

3. Construction of Government Data Open Portal Maturity Model

This study designs model levels by referencing the stage division method of capability maturity models, determines assessment dimensions and indicators based on information architecture theory, draws on the construction ideas of two sub-models of knowledge management maturity, and clarifies measurement standards for specific indicators under each dimension by referencing the Data Management Maturity Model and related government data openness maturity models, aiming to make the assessment more operable.

3.1 Maturity Model Design

3.1.1 Model Level Design To construct a maturity model, different maturity standards must first be established for each level, followed by specific content according to each level's maturity [17]. Referencing knowledge management maturity concepts and capability maturity model development level descriptions, this study determines that the government data open portal maturity model should satisfy the following principles: (1) Scientific: the model should conform to objective laws of development, progressing from low to high levels, with all functions achievable; (2) Systematic: functional modules at corresponding maturity levels should develop at comparable levels to maintain internal consistency; (3) Operable: each function's development level should be directly measurable to enable concrete assessment.

Therefore, the levels and stage characteristics of the government data openness maturity model are shown in Figure 1 [Figure 1: see original paper].

3.1.2 Assessment Dimension and Indicator Design Government data openness provides services through portals, and information architecture theory is an important theory guiding Web portal construction. Therefore, portal design should follow the basic requirements of this theory. L. Rosenfeld's three-element model of information architecture considers "content," "organization," and "users" as three ecological rings, with their intersection being information architecture [18]. For government data open portals, "content" aims to provide accurate, reliable, and practical data (focusing on data management); "organization" aims to provide user-friendly and efficient service functions (focusing on data services); and "users" aims to provide personalized services and improve user experience (focusing on user participation). Therefore, this study assesses government data open portals across three dimensions: "data management," "data services," and "user participation."

Based on the previously described government data openness maturity level model, the stage characteristics of each dimension across five development levels are shown in Table 1 .

American architect Wurman pointed out that the core goal of information architecture is information clarification and comprehensibility [19]. Subsequently, scholar Zhou Xiaoying, building on information architecture, identified four main goals of Web information architecture: information clarification, information comprehensibility, strong information usefulness and usability, and good user experience [20]. Portals should therefore meet three levels of requirements: (1) provide needed information for users; (2) provide functions for users to obtain and process data; and (3) emphasize user experience while meeting information content and functional needs. These requirements provide the basis for indicator design across the three dimensions of "data management," "data services," and "user participation." Specific assessment indicator design is shown in Table 2 .

To determine indicator weights, frequency analysis was used to count evaluation systems involving portal assessment (see Table 3). Scoring was based on whether an indicator was included, and results were processed proportionally. For example, data source management scored 1.5 points, while the total statistical score was 41 points, giving data source management a weight ratio of $1.5/41 = 3.5\%$. Other indicators were calculated similarly, yielding final weights (see Figure 2 [Figure 2: see original paper]).

Following model level design and assessment dimension design, the final “five-level, three-dimensional” government data openness maturity assessment model was obtained (see Figure 3 [Figure 3: see original paper]). Each dimension has specific measurement indicators and weights, and portal maturity scores can be mapped to the centerline based on indicator weights.

3.2 Maturity Model Measurement Standards

3.2.1 Measurement of “Data Management” “Data management” focuses on data reliability, standardization, and formats. Its maturity design references the Data Management Maturity Model, considering the maturity process from aspects such as controlling data quality and checking multi-source data. Metadata helps users discover, identify, evaluate, and use data resources, enabling data integration, sharing, management, and long-term preservation [21]. Therefore, the maturity path for metadata usage should be considered from the perspective of standardizing metadata. Additionally, only when raw data is published in standard, structured formats can a linked data network be formed, laying the foundation for further user development and utilization [22]. Therefore, the maturity design for data linkage references Berners-Lee’s five-star model. The final maturity measurement standards for “data management” are shown in Table 4 .

3.2.2 Measurement of “Data Services” “Data services” focuses on portal service levels, including retrieval accuracy, data processing and usage convenience, and geographic information service capabilities. Its maturity design draws on the Data Center Service Capability Maturity Standard (GB/T 33136) [23], whose key activities and requirements for routine management, service support, service delivery, security management, and quality management provide important references. The maturity measurement standards for “data services” are shown in Table 5 .

3.2.3 Measurement of “User Participation” “User participation” focuses on interactive communication methods and personalized user services. Its maturity design references ODI’s government data openness maturity model, which describes how to expand user participation, obtain user needs, and seek user support, providing guidance for designing maturity levels for user feedback, developer communities, and user help. Considering portal usability and personalization, maturity designs for registration/login and personal data management

functions were included. The final maturity measurement standards for “user participation” are shown in Table 6 .

4. Government Data Open Portal Maturity Assessment and Application

4.1 Maturity Assessment Results

This study evaluated provincial-level local government portals and found that among 31 provincial governments in mainland China, only eight have built government data open portals, as shown in Table 7 .

Maturity scores were calculated using the following formula:

$$S_{maturity} = \sum S_{Ai} \cdot W_{Ai} = \sum S'_{Bi} \cdot W'_{Bi} = \sum S''_{Ci} \cdot W''_{Ci} \quad (1)$$

Where S represents the maturity score (1-5 points from low to high maturity), W represents weight, Ai refers to a first-level indicator, Bi' refers to a second-level indicator, and Ci'' refers to a third-level indicator.

The final portal assessment results (as of July 2018) are shown in Table 8 .

4.2 Application of Maturity Assessment

4.2.1 Problems and Improvement Strategies The maturity assessment reveals two main problems in current local government data open portal construction in China: “low level” and “imbalance.” “Low level” refers to the generally low construction standards, with some functions universally underdeveloped. “Imbalance” refers to significant regional disparities in portal construction levels and uneven development of functional modules within the same portal.

To address the “low level” problem, we recommend accelerating portal construction and overcoming functional barriers one by one. Among 31 provincial governments, only eight have built data open portals, with 63% at the Defined level, Zhejiang at the Repeatable level, and only Shandong and Ningxia at the Managed level (see Table 8). Additionally, the average score for developer communities is only 1.4, and five functions including data linkage and search have mean scores below 3 (see Table 9). Overall portal construction levels need improvement, and some functions are generally underdeveloped. Therefore, local governments should intensify efforts to build data open portals more efficiently, referencing the indicator development paths in the maturity assessment model to overcome functional construction barriers and strive to build optimized-level portals that unleash data value for big data innovation and application.

To address the “imbalance” problem, we recommend orderly advancement and coordinated development of portal functions. The assessment shows large regional disparities, with eight evaluated portals spanning three maturity levels.

Many portals also show imbalanced functional module development. For example, Guangdong's geographic information services are far ahead, but its data search, data analysis, and user help functions are relatively poor, limiting overall portal quality. Therefore, Chinese local governments should select appropriate benchmarks, advance portal construction orderly, and coordinate functional development to avoid "short-board effects," thereby improving overall portal levels and meeting user needs.

4.2.2 Specific Implementation Plans Applying maturity assessment results to each indicator of each portal can provide specific, feasible recommendations for improvement, guiding orderly construction and continuous enhancement. Taking Zhejiang's portal as an example, Figure 4 [Figure 4: see original paper] shows that nine indicators including data linkage and search functions have maturity scores below 3, the highest number requiring improvement, and the province's overall score of 2.48 ranks last. Table 10 identifies specific problems and improvement directions for each indicator, providing a concrete implementation plan for Zhejiang that can also guide other local government data open portals.

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Yuan Li: Responsible for research topic selection, structural design, theoretical guidance, and manuscript revision.

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Keywords: open government data portals; maturity model; assessment and improvement

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