Information Research, Special Issue: Proceedings of the 15th ISIC - The Information Behaviour Conference, Aalborg, Denmark, August 26-29, 2024

Examining information needs of public data service users: a study based on the 'Message Board for Leaders of People's Daily in China'

Xiaoyue Zhang, Jinya Liu, Xinyue Wang, Wanteng Ma, and Pu Yan
DOI: https://doi.org/10.47989/ir292857

Abstract

Introduction. Governance process optimisation is critical to achieve the goal of improving public services efficiency. Public data service is crucial starting point for realising this goal. However, practical challenges persist in public data service, including unclear processes and insufficient identification of public data service citizens' information needs.

Method & Analysis. We employed an inductive methodology to analyse the public data service users' information needs and annual distribution among information needs. Based on a data-driven approach, we mapped these information needs sub-categories into four main procedures in public data service. This paper further identified the hierarchy of information needs based on public data processing levels. We utilised Sankey diagram to effectively illustrate cross-analysis result between topics and information needs' subcategories.

Results. The typical levels of public data service users' information needs include *informing*, *utilisation*, *problem-solving*, *social life service*, *and society governance*. Furthermore, our study reveals the data flow among sub-categories of public data service information needs follows the logic of *Datafication- Government to Government-Government to citizens- Data to Optimiation*.

Conclusion. Government departments should ensure public data quality and facilitate efficient data circulation processes. We recommend understanding relationships between public data resources and services derived from them through a *problem-solving* lens. Our findings will serve as a reference tool for analysing information needs of public data service users in other countries.

Introduction

Numerous open data movements have emerged around the world in recent years. However, fully realising the potential of open government data and supporting for citizen's open government data utilisation remain important challenges (Attard et al., 2015). Government, as a representative of the public sector, plays a significant role in the generation and maintenance of data (Vetrò et al., 2016).

Clarifying the series of processes for electronic records generated in government affairs services is essential for pioneering and guaranteeing digital government construction. Improving the workflow system in digital government services and identifying the public's common information needs can provide effective solutions to the current bottlenecks in government services.

The openness, sharing, and utilisation of public data, termed as public data services, are crucial for advancing the development of digital governments. Enhancing public data services will serve as a fundamental basis for improving data-driven public services, fostering public value achievement through collaboration among various stakeholders, and shaping the governance approaches to public participation.

Public data services, as a subsidiary concept of information service, adhere to the fundamental principle of being *user-centred* in data provision. A thorough comprehension of the public's demands for public data services is crucial for the subsequent design, planning, configuration, and implementation of such services. Existing research on the demands for public data services primarily consists of case studies providing preliminary descriptions or snowball questionnaires to gather self-reported data from users. However, there is a lack of data mining and analysis based on large-scale users' demands data. Therefore, this study initially utilises the data from the *Message Board for Leaders of People's Daily website*, which was established in 2006 (Hu et al., 2023) , over the past five years(2018-2022) to identify message posted related to public data services. This study conducts an in-depth analysis of users' information needs for public data services, aiming to outline the framework of public data service users' information needs in China and provide recommendations for optimising current public data services.

Related works

Government as a platform and its implement in China

Government as a Platform, proposed by Tim O'Reilly in 2011, aimed to improve the government's public service modes in the digital age through using the computer platform metaphor (O'Reilly, 2011). And the main purpose of *Government as a Platform* is to promote the positive interaction between citizens and the government through government platform reform, and to enhance participation in public services provision (O'Reilly, 2011). O'Reilly did not clearly define the concept of *Government as a Platform*, but mentioned seven features of *Government as a Platform*, such as design for participation, data mining allowing to harness implicit participation. Following such a perspective, Ash Center scholars defined *Government as a Platform* in the *social-technical interaction* lens, that is *Government as a Platform* is the whole ecosystem of shared APIs and components, open standards and canonical datasets, as well as the services built on top of them and governance processes that (hopefully) keep the wider system safe and accountable (Pope, 2019).

Recently, studies on *Government as a Platform* have made a series of progress. Researchers explain its main development goals (Cabinet Office of UK, 2014), explore main stakeholders in the ecosystem and their collaborative mechanisms (Cordella and Paletti, 2019), technical factors and their supporting mechanisms (Bender and Heine, 2021; Kuhn et al., 2022), identification of key influencing factors (Seo and Myeong, 2020), specific public services implementation process (Pope, 2019), supporting policy formulation (Al-Ani, 2017), specific application cases or contexts (Kuhn, 2023; Styrin et al., 2022), Value creation process (Cordella and Paletti, 2019), and evaluation feedback mechanism (Pope, 2019), etc.

China's government is also accelerating the pace of *Government as a Platform*. China has

also launched a series of projects for digital government construction during the 14th Five-Year Plan period (2021-2025) (Xinhua News Agency, 2021), and put forward the basic principle '*more data running, fewer people running errands*' (Haikou Scientific Innovation Today, 2019). Public participation is also a main part of China's digital government deployment, such as the construction of open data platforms from the provincial to the city level, the exploration of data transactions, privacy computing, and other new scenarios for the development of public data. This process has further improved the public opinion response mechanism from the central to the local governments, such as the integration of the 12345-complaint hotline and provincial governors' mailboxes, optimising the services on the *Message Board for Leaders of People's Daily* website and so on.

The Message Board for Leaders of People's Daily is one of China's most mainstream government to citizen interaction platforms. On that platform, ordinary people in China share their problems and suggestions about public affairs directly with government chiefs of localities across China and leading officials in departments of central authorities. By the end of 2022, there have been 3 million messages replied to since 2012 (Xinhua, 2022). Many researchers who investigate China's government and citizen interaction also chose *Message Board for Leaders of People's Daily* as their main data source (Chang and Meng, 2023; Göbel and Li, 2021; Hu et al., 2023; Li et al., 2019; Su and Meng, 2016).

Studies on message board data mainly concern with the intersection among political science, public policy and information science. Relevant research topics focus on the government's responsiveness to citizens' demands, government's governance ability on social affairs, and governance on emerging digital space, etc. Especially, internet creates a new public needs expression space for ordinary people, which also boosts innovative interaction ways between public sectors and individuals. Such development also empowers *government internet activism* (Meng, 2019) that helps government swiftly response to individual public service demands and optimise public service delivery ways.

In fact, government responsiveness is based on government information provision. For different public service types, people's information needs vary as well. Shen et al. (2024) found that Information disclosure ranks the fifth priority in *Government to Citizen* interaction. Such a result emphasises the necessity of meeting citizens' information/data access needs. In China, the public data service is accelerating its pace to integrate into public services framework so as to promote service-oriented government and smart governance in digitalisation era (Xia et al., 2022). However, attention to public data service is only limited to open government data, instead of the whole public data utilisation flow. Thus, understanding citizen's information needs on public data service could provide an empirical reference to public data service that covers open government data, public data operation and so on.

The data flow during the *Government as a Platform* construction process

Government as a platform emphasises empowering citizen users to participate in public administration governance and provide more convenient public services in response to public's demands. These ideas rely on both the continuous opening of public data and sharing of underlying public data among different government internal departments. Therefore, considering the implementation process, dynamic data flow is also an important support in *Government as a Platform*. However, current researches on public data flow mainly focus on the direct use of open government data to ensure citizens' right to know, or how the new data products derived from open government data enable the efficient public services operation. Few studies have considered the effectiveness of data flow among government departments from a public problem-solving perspective, which may lead to user-centred participatory design stuck by obstacles in practical implication.

The public's access to government information is a decisive factor in digital government (Xia

and Huang, 2007). Access to government data is even more important. Because compared with government information that only acts as a means of knowing the public services process, the open government data enables the public or other organisations to construct new public service applications by using these data. Current studies have initially explored the information flow between government and enterprises under the background of *Government as a Platform* (Bharosa et al., 2013). Considering there are huge sub-agencies within the government, data reuse and flow between these governmental agencies are also complex. Therefore, this study will also focus on the main stages of data flow to map the public's information/data needs on government public services.

In the information seeking area, Foster's Nonlinear model of information-seeking behaviour emphasises the interactivity and shifts as described by users the model shows information-seeking to be nonlinear, dynamic, holistic, and flowing (Foster, 2004). Essentially, it is the flow of information obtained in the user's information practice that supports this kind of nonlinear behaviour. Savolainen's research systematically illustrated how information demand triggers and drives users' information search process (Savolainen, 2017). It is explained that the information need may act as the direct driver or secondary trigger of the information search behaviour. The acquisition of information is mainly for satisfying basic needs, like knowing about the restaurant information in order to have a meal. Making such ideas specific to government data acquisition, we can find that in addition to providing data directly to the public, data can also empower public services through data correlation and data flow within internal government departments, which is also known as data driven public services (OECD, 2019). Therefore, data-driven public services are also another kind of public expectation towards public data services in *Government as a Platform* context. In other words, public data service users' information needs could be for direct access to public data or access to data-driven public service. Furthermore, as for the data-driven public services, there will be a chronological chain of *information search - acquisition - use - problem solving* with high possibility. Here, information/data resources play an important role as cognitive resources. Such process was mentioned in Wilson's problem solving model of the information seeking and searching process showed (Wilson, 1999).

Government as a Platform has promoted the efficiency of public data flow and public data integration, and extended public data service utilisation chain. For example, through analysing *Danish Basic Data Program*, Jetzek (2016) explored the value creation mechanism of liquid open data on open data platform. Such research stresses the significance of open data interoperability and specifies it into three dimensions. They are Technical, Conceptual, Organisational. Danneels et al. found one of the most important roles that open government data platform play is Interactions and inter dependencies (Danneels et al., 2017). One of the preconditions that achieve that role above is to establish series of services based on public data flow. As we can see, platform is a kind of important infrastructure to enhance data flow. It is of equal significance to understand users' information needs of public data service from data flow perspective, so that it can help public sectors to deliver better public data services.

Currently, researches on public data flow under *Government as a Platform* are mainly concerned with citizens' different roles on *Government to Citizen* interactions within platforms (Al-Ani, 2017), public sectors' value creation process under *Government as a Platform* (Cordella and Paletti, 2019), basic constitute elements of public services (Bender and Heine, 2021), platform-enabled public data sharing across governmental agencies (Styrin et al., 2022; Zeng et al., 2023). Current studies have preliminarily explored users' potential co-creation value in open government data ecosystem and users' participatory research on public service delivery (Hein et al., 2023). But limited attention has been paid to public data service, and there are still lack of overall framework on users' information need of public data services that include but not limited to

open government data, public data operation, public data and social data integration.

Features of users' data seeking behaviours under *Government as a Platform*

In information behaviour field, Kelly and Sharot (2021) found that action, affect and cognition factors would contribute to individual information searching behaviour differences, and the weights of the three factors depend on different situations and individual traits (Kelly and Sharot, 2021). In other words, in different problem situations, the efficiency of public information acquisition is different. To maximise the public's absorption of government information, it is necessary to analyse the type of information needs for public data services.

Meanwhile, modularity, openness, and content reusability are important characteristics of the government platforms (Bender and Heine, 2021). Therefore, this paper will further summarise the citizen users' information needs into common public data matter units by mapping those needs on stages of public data services. So as to facilitate service providers' understanding of the public service types, data types, and corresponding platform types that correspond to these demand units.

Additionally, existing studies mainly focus on case analysis (van Donge et al., 2022), questionnaire survey (Wilson, 1982), interviews, (systematic) literature review (Reggi and Dawes, 2016), evaluation framework identification and application (Veljković et al., 2014), Multivariate statistics (Zhang et al., 2023), etc. The research methods are still lacking text mining and analysis based on users' total amount, and real-time data demands. Thus, this study will focus on mining large scale user message board text that reflect their real and urgent information needs on public data services.

From individual users' perspective, this paper will identify and sort out their urgent information needs of public data service by using the *Message Board for Leaders of People's Daily website*. Such a message board is a channel for public users to seek help when they encounter difficulties that cannot be solved. Therefore, it can directly reflect the real-time public data needs of the public, and provide more contextual information of each message, compared with traditional non-real-time content, it is more real, comprehensive, and accurate.

Researchers in information science have explored information needs of public data service users. For example, Shepherd et al. (2019) thought that in open government data activity, government needed to consider how to make open government data being meaningful and useful to users in the information environment. Therefore, a comprehensive understanding of users' information needs in public data services is the basis of providing services. Some scholars indeed investigated government officers' information seeking behaviours under *Government as a Platform* and found that it consists of a series of steps. They are identification of information needs, the drivers of the information needs, information sources and its selection criteria, and intervening variables (etc. Legislation, Perceived risks, Perceived capability) (Yang and Wu, 2021). Other studies further focus on users' information needs of specific public services under new media platform environment. For example, digital transportation service (Jiang et al., 2021), and Emergency Needs under digital circumstance (Ma et al., 2021).

Efforts has been paid on the necessity of searching for public service information, and illustrated public's extra information needs in addition to public data itself in digital platform. However, the levels and framework of information needs have not been studied from the public data flow perspective, which will affect the popularisation scope of relevant research results.

Research questions and research design

Research questions

The main purpose of this study is to identify the information needs of public data services users in China, analyse key information needs and

core topic areas that public data service could follow as priority, optimise the current public data service process in China, and provide references for other countries. The research objective of this paper is to comprehend the information needs of public data services users. Our research questions (RQs) are as follows:

RQ1: What are users' public information needs for public data services in China's government digitisation period, as indicated on the *Message Board for Leaders of People's Daily* in China?

RQ2: What are the main categories of public data service users' information needs? Are there any connections that exist in these information needs categories? If so, what are the essential connections among them?

RQ3: How do various topics of public data services correspondent to diverse categories of data service users' information needs?

Research design

Data from the *Message Board for Leaders of People's Daily* website were collected annually from 2018 to 2022. It is an online government and public interaction platform which allows citizens to send messages to public officials or sectors, including major leaders in provinces, cities, and counties. All these messages are required to be answered by specific officials within a certain time. *The Message Board for Leaders of People's Daily* is an important means for measuring government responsiveness (Hu et al., 2023). The webpage of Message Board for Leaders of People's Daily is shown in Figure 1.

Figure 1. The illustration of one specific message on *Message Board for Leaders of People's Daily*

Contents related to the theme of *data* were reviewed, and those pertaining to *public data service* were identified through three rounds of manual screening, resulting in a total of 1,429 items. All the data are anonymised.

Following the screening, a preliminary thematic analysis framework was developed by exploratorily open coding the first 20% of the items. Subsequently, the two authors labelled the items based on this framework, making additions to the original thematic analysis framework. Each message item was labelled with at least one label and at most three. The related information need entries were then summarised and categorised together.

To check the consistency of content among coders, we use the Holsti reliability test (Lombard et al., 2002; Lombard et al., 2004). Due to the special coding structure of this study, we set the standard of Holsti reliability test to '*at least one of the three tags is consistent*'. Finally, we obtained a measurement value of 0.85 Holsti reliability test. We also conducted Scott's pi test to avoid the accidental

consistency (Neuendorf, 2017), and got the final value of 0.83. The above two indicators show that the content consistency of the two coders in this study reach satisfactory standard and the coding scheme could be used for qualitative analysis.

This process resulted in 3,505 data labels, which were aggregated into 5 major categories and 20 sub-categories of public data service users' information needs. The details of China's public data service users' information needs framework will be outlined in the following section. Based on this, a preliminary analysis was conducted to sort the distribution of information need categories in the topics provided by the *Message Board for Leaders of People's Daily*.

In summary, this study categorises the information needs of public data service in the *Message Board for Leaders of People's Daily* into five major categories: *data sharing*, *open data*, *data governance* (focuses on the narrower concept of *governance on data*), *data operation*, and *governance of the data flow environment* (emphasises the effective safeguards for the data governance environment). The corresponding subcategories of public data service information needs in each category are listed in Table 1.

Categories	Subcategories	Definition/Examples
1. Data Sharing	1-1. *One-stop* online government service & Cross regional government services	Inter-provincial and inter-department processing of general public issues, such as health insurance, social security and personnel issues.
	1-2. Offline and online collaborative management of electronic documents	Electronic documents, tickets, fines, online and offline synchronisation issues. The main concern here is the lack of online access to documents/data that generated in offline.
	1-3. *Data silos* among different government departments or information systems	(1) Local governments repeat reporting of the same data to different upper government departments (2) Data among government departments/units/ information systems cannot be interconnected, or data inconsistency (3) Information systems are unable to collect or recall all data completely, resulting in data loss of some users.
2. Open Data	2-1. Non-transparent criteria for relevant subsidies, fees or expenses	(1) The public is sceptical about the charging standards caused by no relevant standards openned. For example, the common area of the property fee, the measure to actual area of house, the parking fee of some districts. (2) Unclear criteria for subsidies to specific citizen groups, e.g., land acquisition subsidies, demolition subsidies，etc. (3) Vague items of subsidies and fees of some public services or special social welfares. E.g. one citizen leaves a message to claim he has paid the fee of social security in his working cities (not his hometown), but officers in his hometown also remind him to pay such fee in his hometown.
	2-2. Data disclosure upon application*****	For the needs of college students' thesis writing, message senders' own interests, and the advancement of affairs related to message senders, individuals or companies apply for disclosure of some data related to economics, cultural activities, and higher education. For example, data on the admission status of the college entrance examination.

Categories	Subcategories	Definition/Examples
	2-3. Quality Problems of Open Public Data	(1) Some members of the public find it is difficult to access the open data. (Unknown sources, unknown clearly content) (2) Inconsistencies in the quality of open data. E.g. the same topic datasets in different provinces have different metadata.
	2-4. Inquiries and Consultations Related to Government Data	(1) Inquiries about the specific meaning and coverage of government reported statistical data fields. (2) Inquiries about the criteria for assigning Health QR code[#]. (During Covid-19 management period) (3) Inquiries for publicly releasable information search functions, or inquiries for extension of the information inquiry period for already existing publicly releasable fields, or building specialised social-economic indicators databases. (e.g., automobile industry data, laws, regulations, and policy). (4) Consulting the release time or specific data topic content of certain public data about previous years. (5) Consultation on the source of government policy disclosure (some government websites have columns for policy disclosure, but the content is empty). (6) claim and ask for optimisation on low response speed of data search system.
3. Data Governance	3-1. The various quality levels of data actually provided, or publicised at the local government	Local government possibly submitting, providing or publising poor quality data or missing data to their upper governments, which the message senders can not use.
	3-2. Integrity of data migration during internal system upgrades	(1) For example, in water and heating bills context, data migration in related systems causes the public to believe that they are obviously paying more fees. Or financial losses caused by the loss of data due to system migration when it is clear that many fees have been prepaid. (2) Data loss or report columns change after upgrading the system, especially in traffic information and weather information. (3) Mismatching Health QR code and the owner's actual location (During Covid-19 management period).
	3-3. Completeness of data generated in the administrative processes	For example, when measuring and dividing land at the grassroots level, there is a lack of appropriate standards and bases for division in some places. Complaints are submitted and the system responds to them. But the complaints are not responded in a timely manner or the responses themselves are unsatisfactory.
	3-4. Measurement accuracy of sensor data	Mainly related to water and electricity bills, such as when using smart water meters and electricity meters, data on those devices is particularly *running fast*, and does not correspond to the actual use of the real situation. And then lead to high bills.
	3-5. *Data only* -ism	Failing to research the real challenges that in the practice. (1) Despite some data standards meeting the documented criteria, there are still issues with noise, sewage, and air quality that continue to affect the residents' life quality. However, this dimension is still not being emphasised.

Categories	Subcategories	Definition/Examples
		(2) In some public sector operations, the *formalism* over considering the actual situation, leading to unnecessary complications in communication.
	3-6. Data maintenance issues	Data are not updated in a timely manner. For example, users could not access their personnel archives data for the recent 5 years online.
	3-7. Suggestions for public data service development	This type of message is characterised by its vague focus on specific issues or the personal concerns of the sender. Instead, it maintains commentors' moderate advice. The commentors also kindly offers suggestions on certain public administrative issues. For example, some people advised that the duration of traffic light could be dynamically changed according to real traffic situation.
4. Data Operation	4-1. Effectiveness of Privacy sectors' Participation in Public Data Operation	For example, the untimely updating of traffic data and the incompleteness of public data authorised for operation. The operation of communication service companies, such as offering extra data packages without reminding uses; Poor communication quality and slow server response speed of digital public service platforms.
	4-2. Privacy Protection in Public Data Operation	It primarily involves the mandatory or excessive collection of personal information. For example, the excessive collection of personal information by various apps, and the subsequent gathering of facial recognition data.
	4-3. Digitisation of public services	(1) Lack of integrated payment platforms, especially those designed for mobile devices of some marketised public service companies. (2) *Supply and demand* Information platforms for agricultural products and bulk logistics that connect with the grassroots level. (3) Updating Public Service Databases on time. (4) Operational issues in digitalised public convenience services. (5) The elderly or accessible version of digital public services. (6) Online data preservation, traceability, and search functions in digital public services. (7) The promotion process of digital public services. (8) Access to and retrieval of public transport information on specific or common digital platforms.
5. Governance on Data Flow Environment	5-1. Requesting the government to handle or regulate disputes and regulation related to data collection, management, and use	Civil disputes or market regulation may requesting the government to fulfil digital social governance. This includes asking the government to intervene and address the challenges faced by individuals who feel they have been unfairly treated when confirming land rights, providing subsidies, or covering daily utility bills.
	5-2. Unclear implementation rules of relevant policies due to unclear data flow	In administrative procedures and processes, rules and systems are sometimes ambiguous or contradictory, leading to difficulties for users to understand information.

Categories	Subcategories	Definition/Examples
		Message senders requested clarification on the relevant rules and systems, including showing timeliness and progress in processing.
	5-3. Internet Content Governance	(1) Regulation of False Advertising. (2) Regulation of Personal Information in Cyberspace. (3) Webcasting Content Governance. (4) Governance on Products Quality from E-commerce platform.

Table 1. Public data service users' information needs framework in *Message Board for Leaders of People's Daily website* (2018-2022)

(*: In China, there are two levels of openness in open government data which are determined by the content security level and relevant criteria. One is open data without any conditions, the other is '*data disclosure upon application*'. In the latter cases, these data are not included in the mandatory open government data content, but if they do not pose security and privacy risks, users could apply for data disclosure. For the purpose of research, business development, individuals, companies or social groups could submit application form to request datasets or APIs. Accordingly, there are some utilisation conditions, application area and technique requirements set for these applicants.

Health QR code is a kind of dynamic, real-time generated individual QR code that shows the owner's current health state. Such code is linked to the user's vaccination information, nucleic acid testing results and the potential infected state in their activity area. Thus, Health QR code can help to show whether onwer is healthy enough to enter public spaces like supermarket, transportation station, school, working places, etc. Users can sign in with their own ID number and current mobile phone number. It is a kind of innovative social-governance tool that China's government promoted during covid-19 management period.**)**

Research Findings

Descriptive Statistics

Our dataset comprises 1429 records, 1341 of which contain explicit labels for provinces. The remaining 88 records have been directly referred to the respective ministries for further handling. The distribution of administrative units of comment records from *Message Board for Leaders of People's Daily* is presented in Table 2. As for number of records at the provincial level, Beijing, Henan, Sichuan, Liaoning, and Shaanxi ranked the top five. As for the records number at the ministerial level, the National Health Commission, the Ministry of Industry and Information Technology, and the National Bureau of Statistics received most messages.

Provincial level	Quantity	Provincial level/ National level	Quantity	National level	Quantity
Anhui	50	Ningxia	4	State Taxation Administration	1
Beijing	**417**	Qinghai	2	**National Bureau of Statistics**	**9**
Fujian	18	Shandong	41	**National Health Commission**	**29**
Gansu	48	Shanxi	11	National Intellectual Property Administration	2

Provincial level	Quantity	Provincial level/ National level	Quantity	National level	Quantity
Guangdong	45	**Shaanxi**	**61**	General Administration of Customs	2
Guangxi	39	Shanghai	13	Ministry of Transport	4
Guizhou	22	**Sichuan**	**101**	Ministry of Science and Technology	2
Hainan	9	Tianjin	15	Ministry of Agriculture and Rural Affairs	2
Hebei	42	Xizang	1	Ministry of Human Resources and Social Security	1
Henan	**103**	Xinjiang	10	Ministry of Ecology and Environment	1
Heilongjiang	24	Yunnan	22	Ministry of Water Resources	1
Hubei	40	Zhejiang	23	Ministry of Justice	2
Hunan	18	Chongqing	7	Ministry of Foreign Affairs	1
Jilin	17	**Ministry of Industry and Information Technology**	**14**	Ministry of Culture and Tourism	2
Jiangsu	18	Ministry of Public Security	4	China Meteorological Administration	1
Jiangxi	12	National Development and Reform Commission	3	Ministry of Housing and Urban-Rural Development	3
Liaoning	**92**	State Administration for Market Regulation	4	**Total**	**1429**
Neimeng	16				

(Note: The cells with white background in the table represent provincial-level, administrative units, while the cells with grey background represent ministerial-level units.)

Table 2. An overview of the distribution of administrative units in the collection of comment records from Message Board for Leaders of People's Daily over the past five years（Data from Macao, Hong Kong and Taiwan in China was not included）

The annual distribution of public data service users' information needs

Based on the information needs framework for public data services, we have analysed in detail the overall distribution of messages related to each information needs sub-category over the past five years (as shown in Table 3).

Category	Sub-category	2018	2019	2020	2021	2022	Total
1.Data sharing	1-1. *One-stop* online government service & Cross regional government services	**10**	1	3	3	2	19
	1-2. Offline and online collaborative management of electronic documents	**10**	7	9	3	3	32
	1-3. *Data silos* among different government departments or information systems	32	57	60	**128**	17	294
2.Open data	2-1. Non-transparent criteria for relevant subsidies, fees or expenses	68	**73**	51	15		207
	2-2. Data disclosure upon application	21	15	33	**43**	5	117
	2-3. Quality Problems of Open Public Data			7	**13**	1	21
	2-4. Inquiries and Consultations Related to Government Data			2	2	**3**	7
3.Data governance	3-1. The various quality levels of data actually provided, or publicised at the local government	65	**90**	74	10	2	241
	3-2. Integrity of data migration during internal system upgrades	18	5	6	2		31
	3-3. Completeness of data generated in the administrative processes	107	**124**	118	3	3	355
	3-4. Measurement accuracy of sensor data	7	**8**	7	5		27
	3-5. *Data only* -ism	43	**54**	36	5		138
	3-6. Data maintenance issues	15	23	44	**462**	47	591
	3-7. Suggestions for public data service development	28	25	38	**63**	16	170
4.Data operation	4-1. Effectiveness of Privacy sectors' Participation in Public Data Operation	10	20	**83**	32	7	152
	4-2. Privacy Protection in Public Data Operation	2	3	**21**	16	2	44
	4-3. Digitisation of public services		1		**14**		15
5. Governance of Data flow environment	5-1. Requesting the government to handle or regulate disputes or regulation related to data collection, management, and use	58	70	63	**398**	40	629
	5-2. Unclear implementation rules of relevant policies due to unclear data flow		7	21	**353**	29	410
	5-3. Internet Content Governance			2		**3**	5
	Total	**494**	**583**	**678**	**1570**	**180**	**3505**

(Note: The numbers in cells corresponding to the year with the highest quantity distribution in each sub-category information need are bolded)

Table 3. The Overall Annual Variation and Yearly Changes in Public Data Service Users' Information Needs

Overall, the top 5 frequently mentioned sub-categories (highlighted in green in Table 3), are (1) '*Requesting the government to handle or regulate disputes or regulations related to data collection, management, and use*' (5-1), (2) '*Data maintenance issues*' (3-6), (3) '*Unclear implementation rules of relevant policies due to an unclear data flow*' (5-2), (4) '*Completeness of data generated in the administrative processes*' (3-3), and (5) '*Data silos among different government departments or information systems*' (1-3).

These five sub-categories are mainly connected with emerging issues, namely, and belong to data flow environment governance, data governance, and data sharing. Especially, in the digital government construction process, the citizen's information needs of public data service tend to be precise, convenient, and quickly responsive. The satisfaction of these hierarchical information needs relies on the communication and data flow between underlying systems, the flow of public service data at the front-end user level, and various data-driven public services derived from these information flow. Such results raise the potential that citizens' information needs types could be mapped in the overall public data service process from the public data flow perspective to explore deeply on how such sub-categories could coordinate with each other.

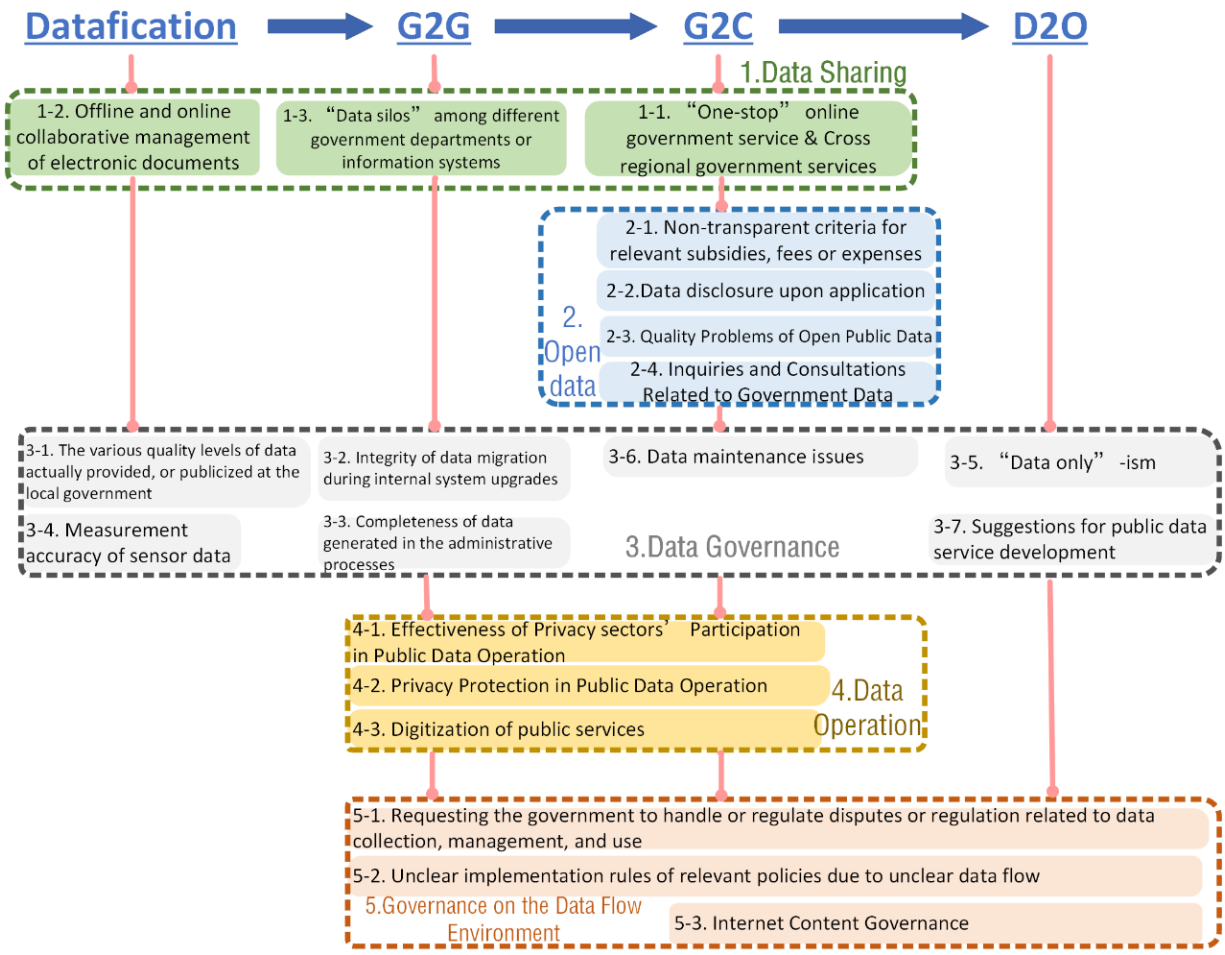

Figure 2. Internal Mechanisms of sub-categories information needs among Public Data Services

Subsequently, to clearly present the interaction processes of each sub-category, public data services, this study mapped these twenty subcategories to key stages in the government business flow path. As shown in Figure 2, four key stages on the top part represent the complete loop of public data flow, from its generation to internal and external circulation, as well as the feedback loop back to internal governance optimisation strategies. The last feedback loop will then reciprocally influence the optimisation of the former three stages. This paper then conducted detailed analysis on the distribution of the identified 20 sub-categories across the four main process stages, and further delineated the overall span and

boundaries of each category within the entire public data service process.

Considering general classification, we first identified information sharing across government departments (*Government to Government*, G2G in Figure 3) and public data utilisation (*Government to Citizen*, G2C in Figure 3).Concerning digital environment characteristics, and *data-driven governance* fundamental requirements for the digital government, we expanded the data flow chain from the original two main stages to four. Firstly, we introduced the *Datafication* stage as the front stage to better connect with the current practical work situation of continuously produced electronic documents, bills, licenses, and other digital records. Such digital documentation will provide authorised proof for citizens to handle relevant government services. In other words, the datafication stage provides reference information to the *Government to Government* stage. Additionally, after the *Government to Citizen* stage, we have added the *Data to Optimisation*(D2O in Figure 3) stage. This stage involved optimising current public services and policy making process based on collected or gathered data from current public service operations and information from *Government to Citizen* stages. The purpose of this stage was to collect and provide feedback on public data service of government. This stage would help in facilitating efficient decision making, process optimisation, and ultimately achieving efficient data-driven social governance in government.

As illustrated in Figure 2, the *Government to Citizen* stage represents potential optimisation points arising from specific interactions between public services and citizens. Among them, the main categories that contain the largest number of sub-categories are *Open Data*, *Data Operation*, and *Data Flow Environment Governance*.

Compared to previous research findings on public data services information needs, there was a strong interactive relationship between citizens' *open data* information needs (Category 2) and the *Data Flow Environment Governance information needs* (Category 5) (Chawinga and Zinn, 2019; Purwanto et al., 2020). On one hand, citizens' feedback on *Open Data* showed strong *matter-associativity*. That is citizens' demands on open data often coincided with '*Requesting the government to handle or regulate disputes or regulations related to data collection, management, and use*' (5-1), demonstrating a strong problem-solving feature. For instance, with the increasing volume of opened data, traditional classification-based website navigation may increase the time cost for citizens to search for specific datasets or interfaces. Therefore, citizens also expressed a demand to government for providing more accurate search functions and search results.

Furthermore, '*Requesting the government to handle or regulate disputes or regulation related to data collection, management, and use*' (5-1.), '*Unclear implementation rules of relevant policies due to unclear data flow*' (5-2) also has co-occurrence relationship with a considerable proportion. These findings revealed that relevant government departments needed to update their open data concept. In addition to opening outcome data, process data from the public service workflow, including handling departments, governments are suggested to consider opening follow data type: processing time limits, progress updates, reasons for delays, and notification methods upon completion. From a *problem-solving* perspective, the processed data, also serves as a way to ensure citizens' right to access information in the digital environment.

Specific commonality items involved in the information flow optimisation of public data services

Besides analysing the items on the service side, we further illustrated the specific service business modules involved in current public data services, along with the underlying data types, through an analysis of the hierarchical levels of citizens' needs and demands for public data, which is also depicted in Figure 3. As shown in Figure 3, such a common public service model provided a better foundation for consolidating sub-categories and transforming them into specific optimised *Service-Technology* public administrative units.

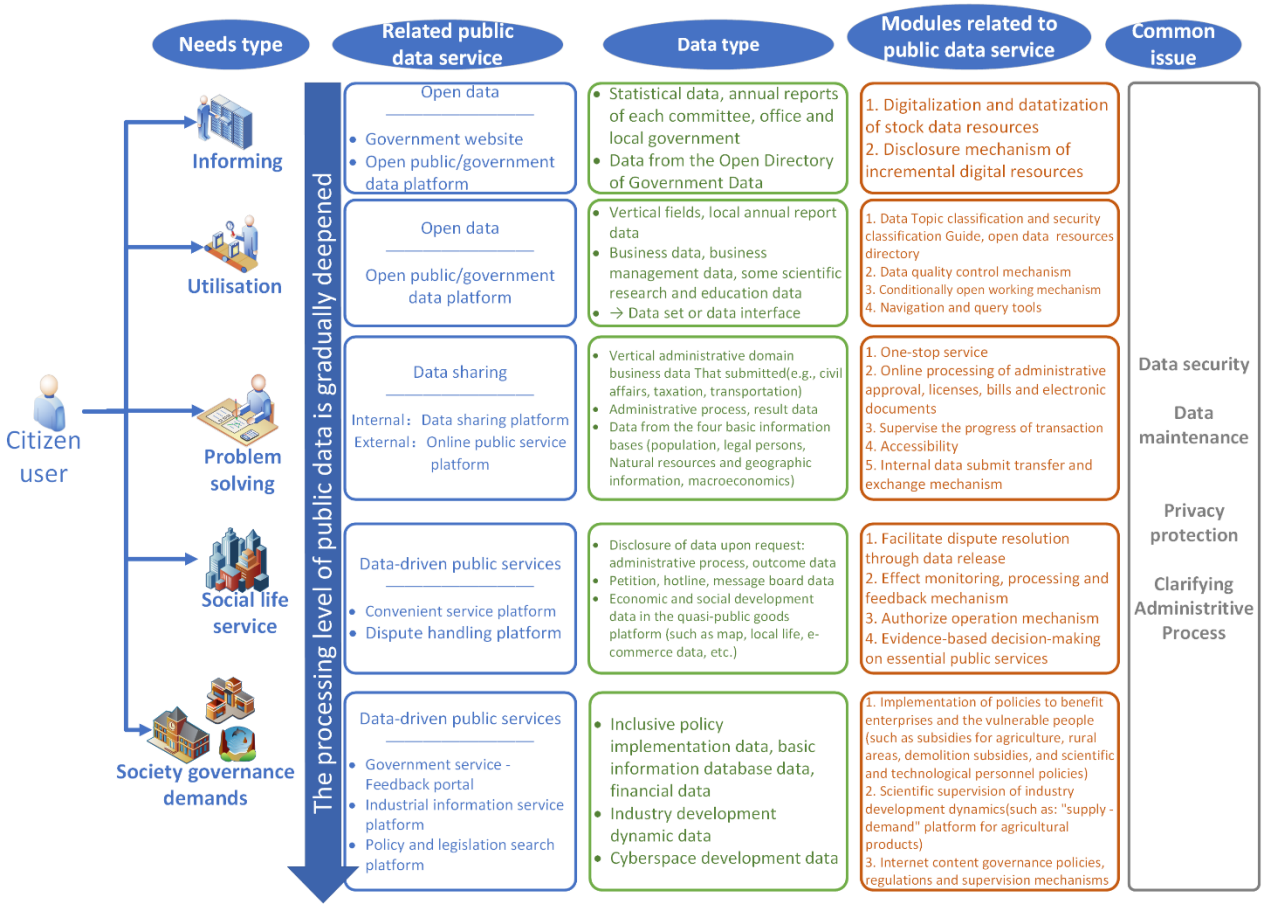

Figure 3. Basic Service Modules for satisfying Citizens' Public Data Services Information Needs

As shown in Figure 3, this paper categorizes users' information needs for public data service into five basic levels based on the public data processing degree. They are *informing*, *utilization*, *problem solving*, *social life service*, *and society governance demands*. As the information needs hierarchy deepens from informing, citizens' public data service information needs progress from raw datasets and APIs to data-driven individual public service problem solving processing, then to dispute resolution mechanisms (play a credential role), and finally to data-driven industry information services (play an intelligence role).

The distribution of public data services topics across information needs categories

In order to explore the key public service topic areas of citizens, we conducted a cross-analysis between information needs sub-categories and the existing topic areas provided on the *Message Board for Leaders of People's Daily*. Specifically, this analysis aimed to identify the distribution of core critical areas in priorities of public data services that need to be optimised. The results could then enable the identification of detailed information management issue that need to be optimised and enhance the precision in the public data service optimisation process. Results are shown in Figure 4.

Figure 4 revealed that on the *Message Board for Leaders of People's Daily* from 2018 to 2022. The top 5 covered public data service topic areas are: Government Administration (899, 25.65%), Healthcare (664, 18.94%), Urban Construction (437, 12.47%), Transportation (360, 10.27%), and Public Safety (349, 9.96%). After cross-analysis, we have identified two potential underlying issues, in addition to the sub information needs categories above. These two emerging issues

are: (1) the underlying data resources construction, and (2) the service effects after public data utilisation.

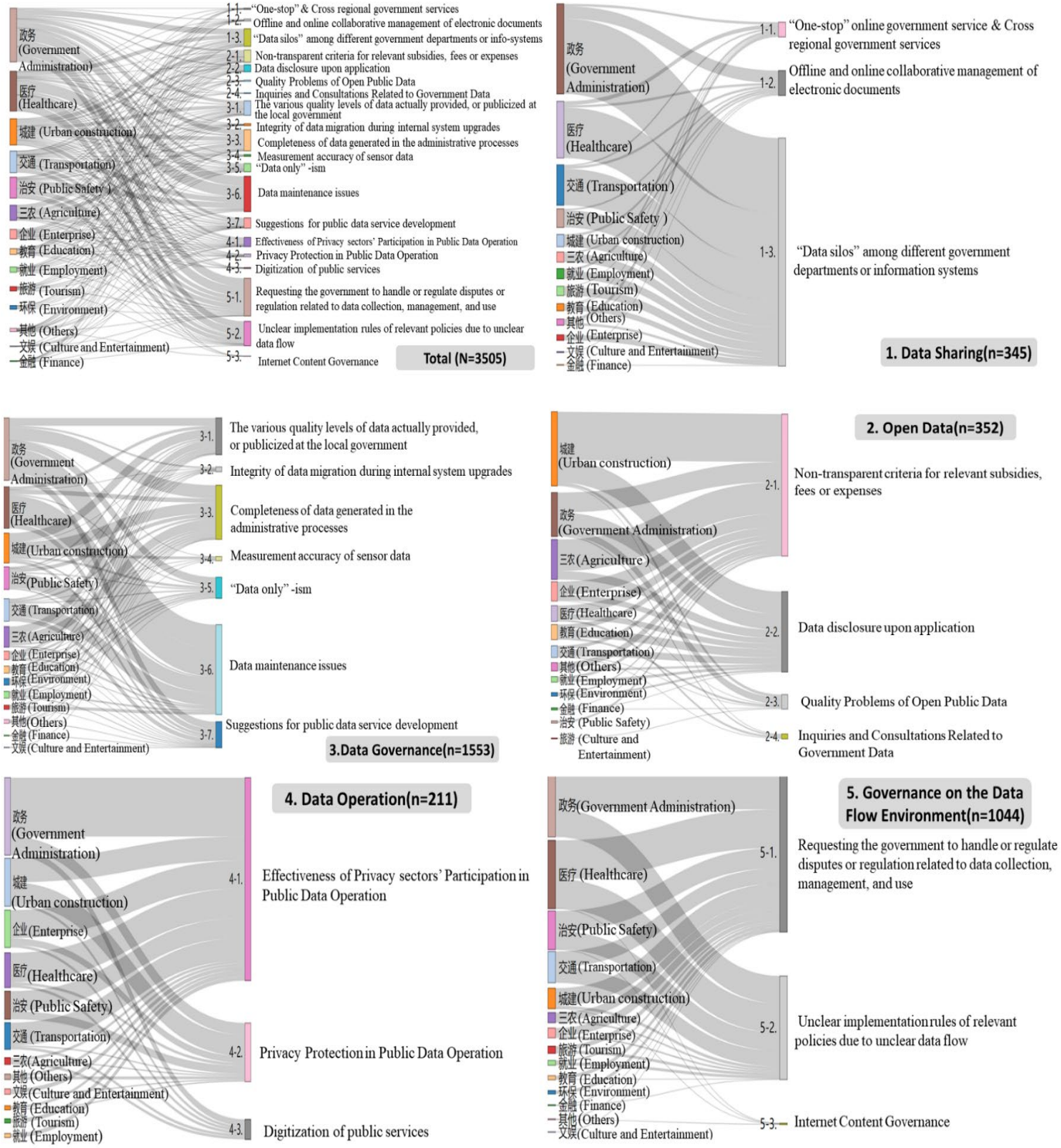

Figure 4. Distribution of Topic Areas in Public Data Service Needs and Demands (N=3505)

Firstly, we have identified the information needs of foundational data resources construction and *datafication* activities, which were '*The various quality levels of data actually provided, or publicised at the local government*' (3-1). This issue involved both grassroots level data governance and deeper issues of standardisation in data collection and processing. Additionally, to some extent, it is also associated with '*non-transparent criteria for relevant subsidies, fees or expenses*' (2-1). Resolving this issue could effectively improve the transparency and credibility of government departments in relevant fields.

Secondly, '*Effectiveness of Private sectors' Participation in Public Data Operation*' (4-1) is another revealed issue. Since it shows the effects after public data utilisation. Such issue is associated with all the top five topic areas, they are *Government Administration, Healthcare, Enterprises, Transportation, and Urban Development*. Typical public data service information need scenarios include: 1) incomplete, real-time unavailability of urban public transportation data, 2) weak signals in rural, remote areas, special spaces (such as underground garages), 3) unexpected data package changing by telecommunication service providers, 4) cross-districts services by telecommunication service providers, 5) mobile applications over acquiring user data (such as personal information obtained by food delivery brands leading to frequent receipt of advertising messages), 6) poor timeliness of content updates in public services' affairs information databases, 7) poor synchronisation, accuracy, and response speed of online services for water and electricity bills, and 8)the application of mobile payment methods in public transportation services. Another typical scenario is, during the pandemic, errors in localisation identification of health codes affected personal daily life. And health QR code identity authentication could not be verified when bound to a deactivated phone number. China's government quickly set up some error correction working mechanism with public data authorised private sectors, so as to better help some citizens to correct such bug. The effectiveness of authorised public data operations service is related to the quality of the operational products. Such products span the chain of signals, data, and information. In other words, it involves not only basic communication issues but also data sharing between institutions and a series of services related to data derived information access.

Conclusion

In conclusion, our findings included three key aspects: public data service information needs hierarchy framework, characteristics of associated issues among information needs sub-categories, and the alignment of information *demand-supply* in public data services. Although we only use one mainstream users' demands message board in China, some conclusion still have reference value for other countries to improve their public data service effectiveness.

Firstly, citizens' information needs for public data services show the typical hierarchical and progressive nature of public data service users' information needs, these information needs hierarches includ *informing, utilisation, problem solving, social life service, and society governance demands*. From the perspective of data flow, citizens' public data service information needs span from datafication, internal data sharing within the government, external data openness and utilisation by the social subjects, and optimisation services based on data derived from the former three steps. From the sources of data flow in public data service, due to the issue of '*Completeness of data generated in the administrative processes*' (3-3), it is possible to optimise the data collection and sharing through setting up public data quality control mechanism between data production departments and data operations sectors.

Secondly, when examining the complete information needs of public data service framework, there has been a sequential order in citizens public data service information needs in terms of data flow. Therefore, on one hand, attention should be paid to 1) the foundational public data resources quality control, 2) the accuracy, standardisation, and timeliness of public data, 3) ensuring public data quality throughout the process, namely, from public data production departments to public data

operation departments. On the other hand, the subsequent advancement of public data openness and utilisation should be implemented from the perspective of *affairs handling* or *problem solving*. Because *Informing* is just a basic goal/step of the citizen's public data services information needs, their most urgent needs are enjoying public data products and services formed through processed open data.

Finally, in order to efficiently match *supply* and *demand* points in public data service, complete public data classification and secure classification lists, and data openness resource catalogues are necessary. In terms of online utilisation of public data service, with the increasing volume of subsequent opened data, traditional classification navigation methods not only waste time, but also impose additional cognitive load on citizens and users of public data services platforms. such as the open government data platform classification and search system. Currently, most open government data platforms provide search options, but are limited to matching in only two metadata fields: full text and title. Such results may lead to fuzzy retrieval results in a vast number of hits with low precision. Meanwhile, precise retrieval, lacking semantic association extension functionality, often leads to the dilemma of *no data*' (Borgman, 2017) (i.e., data is present in the open data catalogue but cannot be found through search). Therefore, in optimising the search function of open government data platforms, we suggest considering incorporating matching options for other metadata fields, such as keywords. Additionally, the natural language processing search tools' can improve the accuracy of semantic-level recognition, effectively addressing the *no data* problem.

Discussions

The contributions of this study lie in the multidimensional, quantitative analysis of authentic public data service information needs based on citizens' actual information needs on *Message Board for Leaders of People's Daily* in China.

This study has extended the data circulation framework for public data services. Beyond the traditional definitions that involve *Government to Government* and *Government to Citizen* (Fang, 2002), we have introduced a new frontend stage named *datafication* stage and a new backend data-driven public service satge named *optimisation* from the data flow perspective (Jetzek, 2015). Public data services within *data-driven public services* ecosystem have been better understood from the above data flow standpoint.

We have classified public data service users' information needs based on the complexity of public data generation. The citizen's public data service information needs could be categorized into five main types: *ensuring informational rights*, *utilisation needs and demands*, *problem solving needs*, *social life needs* (*convenience needs and demands*), *and social governance needs*. The realisation of these public data service information needs relies on different platforms, such as the open government data platform, and digital integrated public service. Meanwhile, there are interrelated data flow mechanisms and common data governance issues among these platforms, including data security, data maintenance, privacy protection, and process optimisation.

This study has identified *Key topics*, *Key sub-categories* to be optimised, which could provide references to polit cases in practice. These key topics include *governance*, *healthcare*, *urban development*, *transportation*, and *public safety*, with other significant potential applications in areas such as *agriculture*, *enterprises*, *education*, *employment*, and *environmental protection*. We have also pointed out the importance of standardisation and data quality governance during the data formation and collection process.

The above findings provide a novel research perspective for public participation in social governance. Especially, we proposed a research framework that connects users' information needs, data resources, related public data service platform and final administration business units together. The related research outcomes also offer a transformation path for data-driven social governance and public

services. This process provides a logical foundation for digital government business related to public data resources, data flow, and process correlation.

However, our findings also have some limitations. Currently, it only uses data entries from the *Message Board for Leaders of People's Daily* over the past five years as the analysis object, without covering content from other similar platforms. Therefore, there is still room for improvement in the public data service information needs hierarchical framework. Since the majority of the *Message Board for Leaders of People's Daily* comes from individuals, the objectives of public data services discussed in our study are mainly citizens, not company users. However, considering that the *Message Board for Leaders of People's Daily* is one of the main platforms for government appeals feedback, paying attention to this platform still has high representativeness in understanding the public data services users' information needs.

Subsequently, we will consider exploring the content of relevant citizens' demands collection channels in China such as the 12345 hotline, open government data platforms, or government service platforms. Such exploration can be synthesised with the relevant research findings of our study to discover and optimise the framework of public data service needs and demands more effectively. Additionally, based on more granular service scenarios throughout the entire public data service process, the depiction of the dynamic flow process of public data can provide references for better optimisation of current public data services.

Acknowledgement

We would like to thank the reviewers for their insightful suggestions. The authors are greateful for financial support from Chinese National Science Foundataion (Project No: 72304017) and Beijing Social Science Foundation (Project No：22XCC013). We are also grateful to editors' contributions on this paper's quality.

About the authors

Xiaoyue Zhang (ORCID: 0000-0001-8605-6491) is a postdoctoral researcher at Institute of Communication Studies, Communication University of China, China. Her research focuses on public data service, digital government and information behaviour. She can be contacted at: zhangxiaoyue@stu.pku.edu.cn.

Jinya Liu (ORCID: 0000-0002-9804-8752) is currently working toward a Ph.D. degree in Information Science with the Department of Information Management, Peking University, China. Her research interests include information seeking, data ethics, and open data. She can be contacted at: liujinya@stu.pku.edu.cn.

Xinyue Wang (ORCID: 0000-0001-7698-8981) is a Ph.D. student at Department of Information Management, Peking University, China. Her research focuses on Information Seeking and Use. She can be contacted at: xinyuewang@stu.pku.edu.cn.

Wanteng Ma (ORCID: 0009-0007-1784-2289) is an undergraduate student at Department of Philosophy and Religious Studies, Peking University, China. His research focuses on Interactive Behaviour in Cyberspace. He can be contacted at: mawanteng@stu.pku.edu.cn.

Pu Yan (ORCID: 0000-0003-2589-5050) is an assistant professor at Department of Information Management, Peking University, China. Her research focuses on computational social science, social science of the internet and everyday life information practices. She can be contacted at: puyan@pku.edu.cn. **Corresponding author of this paper.**

References

Al-Ani, A. (2017). Government as a platform: services, participation and policies. In Digital transfor mation in journalism and news media: Media management, media convergence and globalization (pp. 179-196). Cham: Springer International Publishing.

Attard, J., Orlandi, F., Scerri, S., & Auer, S. (2015). A systematic review of open government data ini tiatives. *Government information quarterly*, 32(4), 399-418. https://doi.org/10.1016/j.giq.2015.0 7.006.

Bender, B., & Heine, M. (2021). Government as a platform? Constitutive elements of public service platforms. International Conference on Electronic Government and the Information Systems Per spective, 12926, 3–20. https://doi.org/10.1007/978-3-030-86611-2_1.

Bharosa, N., Janssen, M., van Wijk, R., de Winne, N., Van Der Voort, H., Hulstijn, J., & Tan, Y.-h. (20 13). Tapping into existing information flows: The transformation to compliance by design in busin ess-to-government information exchange. *Government Information Quarterly*, 30(1), S9-S18. http s://doi.org/10.1016/j.giq.2012.08.006.

Borgman, C. L. (2017). *Big data, little data, no data: Scholarship in the networked world*. MIT press.

Cabinet Office of UK (2014). Action 11 case study: Build government as a platform. https://www.g ov.uk/government/publications/case-study-on-action-11-build-government-as-a-platform/ac tion-11-case-study-build-government-as-a-platform--2.

Chang, D., & Meng, T. (2023). Magnetic effect of government responsiveness on public participati on: An empirical analysis based on the provincial Leadership Message Board in China. *Chinese Pu blic Administration Review*, 14(2), 94-106. https://doi.org/10.1177/15396754221137.

Chawinga, W. D., & Zinn, S. (2019). Global perspectives of research data sharing: A systematic liter ature review. *Library & Information Science Research*, 41(2), 109-122. https://doi.org/https://doi. org/10.1016/j.lisr.2019.04.004.

Cordella, A., & Paletti, A. (2019). Government as a platform, orchestration, and public value creatio n: The Italian case. *Government Information Quarterly*, 36(4), 101409. https://doi.org/10.1016/j. giq.2019.101409.

Danneels, L., Viaene, S., & Van den Bergh, J. (2017). Open data platforms: Discussing alternative kn owledge epistemologies. *Government Information Quarterly*, 34(3), 365-378. https://doi.org/10. 1016/j.giq.2017.08.007.

Fang, Z. (2002). E-government in digital era: Concept, practice, and development. *International Jo urnal of the Computer, the Internet and Management*, 10(2), 1-22.

Foster, A. (2004). A nonlinear model of information-seeking behavior. *Journal of the American soci ety for information science and technology*, 55(3), 228-237. https://doi.org/10.1002/asi.10359.

Göbel, C., & Li, J. (2021). From bulletin boards to big data: The origins and evolution of public com plaint websites in China. *Journal of Current Chinese Affairs*, 50(1), 39-62. https://doi.org/10.1177 /1868102621992144.

Haikou Scientific Innovation Today (2019). Let the data run more and let the public run less erran ds - Haikou does not meet the approval review. https://www.haikou.gov.cn/enhaikou/lyxw/201 906/t908414.shtml.

Hein, A., Engert, M., Ryu, S., Schaffer, N., Hermes, S., & Krcmar, H. (2023). Building open governm ent data platform ecosystems: A dynamic development approach that engages users from the sta rt. *Government Information Quarterly*, 40(4), 101878. https://doi.org/10.1016/j.giq.2023.101878.

Hu, D., Wang, E., Ye, Q., Chen, S., & Gu, X. (2023). How do online public messages affect local gove rnment responsiveness in China? A multilevel analysis based on the message board for leaders. *Jo urnal of Chinese Political Science*, 1-32. https://doi.org/10.1007/s11366-023-09866-y.

Jetzek, T. (2015). The sustainable value of open government data: Uncovering the generative mec hanisms of open data through a mixed methods approach. Copenhagen Business School [Phd diss ertation].

Jetzek, T. (2016). Managing complexity across multiple dimensions of liquid open data: The case o f the Danish Basic Data Program. *Government Information Quarterly*, 33(1), 89-104.https://doi.or g/10.1016/j.giq.2015.11.003

Jiang, T., Wang, Y., Lin, T., & Shangguan, L. (2021). Evaluating Chinese government WeChat official accounts in public service delivery: A user-centered approach. *Government Information Quarterl y*, 38(1), 101548. https://doi.org/10.1016/j.giq.2020.101548.

Kelly, C. A., & Sharot, T. (2021). Individual differences in information-seeking. *Nature Communicat ions*, 12(1), 7062. https://doi.org/10.1038/s41467-021-27046-5.

Kuhn, P. (2023). Government as a platform in practice: Commonalities and differences across thr ee. In Electronic Government: 22nd IFIP WG 8.5 International Conference, EGOV 2023, Budapest, Hungary, September 5–7, 2023, Proceedings (Vol. 14130, p. 34). Springer Nature.

Kuhn, P., Dallner, S., Buchinger, M., & Balta, D. (2022). Towards "Government as a Platform": An an alysis framework for public sector infrastructure. Wirtschaftsinformatik 2022 Proceedings. 4. htt ps://aisel.aisnet.org/wi2022/e_government/e_government/4.

Li, F., Liu, Y., & Meng, T. (2019). Discursive strategy of opinion expression and government respon se in China: Text analysis based on online petitions. *Telematics and Informatics*, 42, 101238. https: //doi.org/10.1016/j.tele.2019.06.001.

Lombard, M., Snyder-Duch, J., & Bracken, C. C. (2002). Content analysis in mass communication: Assessment and reporting of intercoder reliability. *Human communication research*, 28(4), 587-60 4. https://doi.org/10.1111/j.1468-2958.2002.tb00826.x.

Lombard, M., Snyder-Duch, J., & Bracken, C. C. (2004). Practical resources for assessing and repo rting intercoder reliability in content analysis research projects.

Ma, X., Cui, K., Ji, C., & Xue, P. (2021). Visualization of Emergency Needs Posted on Social Media by Metaphor Map. *Data and Information Management*, 5(1), 1-10. https://doi.org/10.2478/dim-2020 -0021.

Neuendorf, K. A. (2017). *The content analysis guidebook*. Sage.

OECD (2019). The application of data in the public sector to generate public value. https://www. oecd-ilibrary.org/sites/1ab27217-en/index.html?itemId=/content/component/1ab27217-en.

O'Reilly, T. (2011). Government as a Platform. *Innovations: Technology, Governance, Globalization*, 6(1), 13-40. https://doi.org/10.1162/INOV_a_00056.

People's Daily website. Message Board for Leaders of People's Daily website. (2023). http://liuya n.people.com.cn/.

Pope, R. (2019). Playbook: Government as a platform. Ash Center for Democratic Governance and Innovation, Harvard Kennedy School, Cambridge, Massachusetts.

Purwanto, A., Zuiderwijk, A., & Janssen, M. (2020). Citizens' trust in open government data: A quan titative study about the effects of data quality, system quality and service quality. *ACM Internatio nal Conference Proceeding Series*, 310–318. https://doi.org/10.1145/3396956.3396958.

Reggi, L., & Dawes, S. (2016). Open government data ecosystems: Linking transparency for innova tion with transparency for participation and accountability. *Electronic Government*, 9820, 74–86. https://doi.org/10.1007/978-3-319-44421-5_6

Savolainen, R. (2017). Information need as trigger and driver of information seeking: A conceptual analysis. *Aslib Journal of Information Management*, 69(1), 2-21. https://doi.org/10.1108/AJIM-08-2016-0139.

Seo, H., & Myeong, S. (2020). The priority of factors of building government as a platform with an alytic hierarchy process analysis. *Sustainability*, 12(14), 5615. https://doi.org/10.3390/su12145615

Shen, C., Wang, Y., Xu, Y., & Li, X. (2024). Unveiling citizen-government interactions in urban rene wal in China: Spontaneous online opinions, reginal characteristics, and government responsivene ss. *Cities*, 148, 104857. https://doi.org/10.1016/j.cities.2024.104857.

Shepherd, E., Bunn, J., Flinn, A., Lomas, E., Sexton, A., Brimble, S., Chorley, K., Harrison, E., Lowry, J., & Page, J. (2019). Open government data: Critical information management perspectives. *Recor ds Management Journal*, 29(1/2), 152-167. https://doi.org/10.1108/RMJ-08-2018-0023.

Styrin, E., Mossberger, K., & Zhulin, A. (2022). Government as a platform: Intergovernmental parti cipation for public services in the Russian Federation. *Government Information Quarterly*, 39(1), 1 01627. https://doi.org/10.1016/j.giq.2021.101627.

Su, Z., & Meng, T. (2016). Selective responsiveness: Online public demands and government respo nsiveness in authoritarian China. *Social Science Research*, 59, 52-67. https://doi.org/10.1016/j.ssr esearch.2016.04.017.

Meng, T. (2019). Responsive government: The diversity and institutional performance of online po litical deliberation systems. *Social Sciences in China*, 40(4), 148-172. https://doi.org/10.1080/025 29203.2019.1674041.

van Donge, W., Bharosa, N., & Janssen, M. F. W. H. A. (2022). Data-driven government: Cross-case comparison of data stewardship in data ecosystems. *Government Information Quarterly*, 39(2), 101 642. https://doi.org/https://doi.org/10.1016/j.giq.2021.101642.

Veljković, N., Bogdanović-Dinić, S., & Stoimenov, L. (2014). Benchmarking open government: An o pen data perspective. *Government Information Quarterly*, 31(2), 278-290. https://doi.org/10.1016 /j.giq.2013.10.011.

Vetrò, A., Canova, L., Torchiano, M., Minotas, C. O., Iemma, R., & Morando, F. (2016). Open data qu ality measurement framework: Definition and application to open government data. *Government Information Quarterly*, 33(2), 325-337. https://doi.org/10.1016/j.giq.2016.02.001.

Wilson, T. (1982). The evaluation of current awareness services in local government. *Journal of Lib rarianship*, 14(4), 279-288. https://doi.org/10.1177/096100068201400404.

Wilson, T. D. (1999). Models in information behaviour research. *Journal of Documentation*, 55(3), 2 49-270. https://doi.org/10.1108/EUM0000000007145.

Xia, Y., & Huang, C. (2007). Government information access: A decisive factor for e-government. In *Integration and Innovation Orient to E-Society Volume 2*: Seventh IFIP International Conference on e-Business, e-Services, and e-Society (13E2007), October 10–12, Wuhan, China.

Xia, Z., Yan, X., & Yang, X. (2022). Research on big data-driven public services in China: A visualized bibliometric analysis. *Journal of Chinese Governance*, 7(4), 531-558. https://doi.org/10.1080/23812346.2021.1947643.

Xinhua News Agency (2021). China approves plan to digitalize government services. https://english.www.gov.cn/premier/news/202111/17/content_WS619508f0c6d0df57f98e5186.html.

Xinhua. China Focus (2022). Online message board enables ordinary people to speak to top officials. https://english.news.cn/20220422/37fb02ec66914cca933a33baf4afcb98/c.html.

Yang, T. M., & Wu, Y. J. (2021). Looking for datasets to open: An exploration of government officials' information behaviors in open data policy implementation. *Government Information Quarterly*, 38(2), 101574. https://doi.org/10.1016/j.giq.2021.101574.

Zeng, Y., Zhang, Q., Zhao, Q., & Huang, H. (2023). Doing more among institutional boundaries: Platform-enabled government in China. *Review of Policy Research*, 40(3), 458-478. https://doi.org/10.1111/ropr.12500.

Zhang, N., Deng, J., Ahmad, F., Draz, M. U., & Abid, N. (2023). The dynamic association between public environmental demands, government environmental governance, and green technology innovation in China: Evidence from panel VAR model. *Environment, Development and Sustainability*, 25(9), 9851-9875. https://doi.org/10.1007/s10668-022-02463-8.