

Peer Influence on Public Information System Development Decisions: Taking the Municipal OGD Platforms in China as an Example

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Abstract. This paper mainly discusses how governments make decisions by using reference groups in the development of open data. Hypotheses are proposed based on prospect theory and institutional theory, and data collection and hypothesis verification are conducted based on previous research models. It is concluded that municipal governments tend to take the principle "doctrine of the mean" to direct the development of OGD platforms when facing the trait-based reference group, while it will take the radical route when facing the institution-based reference group. The two reference groups play different regulatory roles, prompting the government to dynamically adjust the development direction of OGD.

Keywords: Public Information System, Peer Influence, Open Government Data, Reference Group.

1 Introduction

Decisions on organizational information system development not always depend on the free will of the decision-making organization, but also greatly influenced by institutional environment [1-4]. Although studies have found that organizations in public sectors often succumb to the influence of institutions when developing public information systems [5-6], these studies have not fully explored the dynamics of organizations adjusting their information system development according to the institutional environment.

Open data has attracted more and more attention from the government and the public. In China, Shanghai took the lead in practice of OGD (Open Government Data) development in 2012. Up to the first half of 2019, 82 provincial, deputy provincial and prefecture-level OGD platforms have been online [7].

This research mainly investigates how reference groups affect the development of OGD platforms. On the basis of these studies and according to the model proposed by Du K and Dai Y [8], this study tries to clarify the direction of the development of OGD platforms influenced by peers. By revealing the complex dynamics of peer influence, this research helps enrich the study of institutional environment and information system development, meanwhile provides theoretical reference and practical guidance for the reform of administrative information systems in the era of big data. It also highlights

the unique background of administrative organizations in China and helps to summarize the Chinese experience of policy diffusion theory.

2 Theory and Hypothesis

2.1 Prospect Theory

Prospect theory describes a decision model of game players under uncertain conditions. It proposes that decision-making depends on reference: decision-makers derive utility from “gains” and “losses” measured relative to a reference point [9].

In order to prevent superstitious learning, a rational organization tends to use organizations sharing common or comparable traits as their learning targets [10-11], so as to form a trait-based reference group. It could therefore be argued that the municipal governments would resort to reference groups and take the average development level of them as a reference point. The candidates for the reference group are comparable governments with common characteristics associated with open data development. When a city considers itself behind its reference point, it will try to catch up in the next period by speeding up the development of OGD. Otherwise, it tends to avoid risk by slowing or even blocking its subsequent development of OGD. Generally speaking, the development of open data of a municipal government will step forward to the average level of its trait-based reference group. To sum up, the hypothesis is:

H1: A municipality government will adjust its development level of OGD platforms to the average level of comparable governments with common traits. The more the government deviates from the average in the previous period, the more it will adjust in the next period.

2.2 Institutional Theory

Institutional theory [12] believes that organizations not only operate in a specific technical environment, but also develop in a specific institutional environment. The adoption of information technology by organizations is not entirely technology-driven but largely stimulated by external environmental pressures [3, 6]. Since the provincial government has the legislative and executive power to evaluate the performance of municipal governments, the development level of OGD can also be used as one of the performance evaluation indicators. Therefore, the pursuit of legitimacy will prompt municipal governments to maintain OGD development at the average level of their institution-based reference groups [8]. The following hypothesis is proposed:

H2: A municipal government will adjust its development level of OGD platforms to the average level of peer municipal governments in the same province. The more the government deviates from the average in the previous period, the more it will adjust in the next period.

2.3 Moderating Effects of Superordinate Organizations

Moderating Effects on Trait-based Reference Groups. The development level of OGD often reflects the degree to which the institutional and administrative infrastructure of a government are favorable towards OGD development [13]. Provincial governments with mature infrastructure can compensate for the limitations of trait-based reference groups. Therefore, it can be concluded that provincial governments with more developed OGD platforms can reduce the direct use of trait-based reference groups for decision-making by municipal governments. The hypothesis is:

H3a: The development level of OGD platforms of superordinate governments dampens the influence of trait-based reference groups on focal governments.

Moderating Effects on Institution-based Reference Groups. If a provincial government achieves a high development level of OGD, its subordinate municipal governments will interpret it as a signal that the higher authorities attach special importance to OGD among the many potential legitimizing factors. This consideration will lead the municipal governments to pay more attention to institution-based reference groups to ensure that they do not lag behind groups. In contrast, municipal governments will focus more on their traits and reduces their tendency to closely monitor their institution-based reference groups [8]. Based on the arguments above, the following hypothesis is proposed:

H3b: The development level of OGD platforms of superordinate governments enhances the influence of institution-based reference groups on focal governments.

3 Methods

3.1 Research Data

The data of OGD platforms that the research uses comes from "China Open Data Index", produced by Fudan University and released in May 2017 for the first time. This research mainly evaluates the OGD platforms of prefecture-level municipal governments over a period of five half years, from the first half of 2017 to the first half of 2019. The final sample includes 235 observations from 47 cities. Due to the increase and decrease of OGD platforms in different periods of time, as well as the merging of cities, an unbalanced panel data set was formed. The scores in the index were standardized to measure the development level of open data of municipal governments and used for statistical analysis.

3.2 Measurement

Moderating Effects on Trait-based Reference Groups. Trait-based reference groups were constructed based on two traits: population size and fiscal revenue. For each city in the sample, a trait-based reference group was constructed by searching for other cities

whose population and income are in the range of 80-120% of the focus city in the same period. Cities in the same province were excluded. In our dataset, the number of peers ranges from 1 to 3.

For the institution-based reference groups, all prefecture-level municipal governments established OGD platforms in the same province were included in the reference groups. In the dataset, the number of same-province peers ranges from 1 to 17.

Control Variables. The control variables are basically consistent with the models of Du K and Dai Y [8], including population size, number of higher education institutions, average wage and GDP per capita, government fiscal revenue, annual development gap, standard deviation of reference groups and year fixed effects. The data of population size, average wage and GDP per capita, and government fiscal revenue were obtained from CEIC economic database, and the statistics of higher education institutions were obtained from the list of higher education institutions released by the Ministry of Education of the People's Republic of China. The rest of the data were obtained by calculation. Incomplete parts of the CEIC database were also supplemented through various channels such as government bulletins.

Model Interpretation. To verify the hypothesis, the final form of e-government development model proposed by Du K and Dai Y[8] is referred to in this study:

$$eGovAdjustment_{i,t+1} = \beta_0 + \beta_1 TRGDeviation_{i,t} + \beta_2 IRGDeviation_{i,t} + \beta_3 PreGov_{i,t} + \beta_4 PreGov_{i,t} * TRGDeviation_{i,t} + \beta_5 PreGov_{i,t} * IRGDeviation_{i,t} + Controls + Year_t + \varepsilon_{i,t} \quad (1)$$

Where $eGovAdjustment_{i,t+1}$ represents the adjustment degree of OGD made by the municipal government in the t+1 period. $TRGDeviation_{i,t}$ represents the degree of deviation of the municipal government from the average development level of OGD of its trait-based reference group in the t period. $IRGDeviation_{i,t}$ represents the degree of deviation of the municipal government from the average development level of OGD of its institution-based reference group in the t period. $PreGov_{i,t}$ is the open data score of the provincial government. Controls stands for control variables and coefficients. $Year_t$ represents year fixed effects, and $\varepsilon_{i,t}$ is the residual.

4 Results and Discussion

Eviews 10 was used to estimate the model, and time fixed effect was applied to the panel data. Table 1 and 2 respectively present the results of descriptive statistics and Pearson correlation coefficient, and table 3 presents the results of model estimation.

Table 1. Descriptive Statistics

	Mean	Standard Deviation	N*
TRG	-.022	.685	158
IRG	.094	.919	158
PRE	.763	.778	132
DG	-.606	.976	149
DTRG	.545	.615	162
DIRG	.788	.479	173
GDPC	89.332	44.7	235
HE	.882	.536	235
REV	10.496	.465	235
AW	6.692	.311	234
POP	6.692	.311	235

Note: DG: development gap; DTRG: standard deviation of trait-based group; DIRG: standard deviation of institution-based group; GDPC: GDP per capita (in thousands); POP: population size (log-transformed); AW: average wage (in thousands); REV: government fiscal revenue (log-transformed); HE: number of institutions of higher education (log-transformed).

* The increase and decrease of OGD platforms in different periods of time, as well as the merging of cities leading to a discrepancy in the total number of items.

Table 2. Pairwise Pearson Correlation Coefficients.

	TRG	IRG	PRE	DG	DTRG	DIRG	GDPC	HE	REV	AW	POP
TRG	1										
IRG	.707**	1									
PRE	.157	.206	1								
DG	.567**	.180	.688**	1							
DTRG	.128	.334**	.246*	-.702**	1						
DIRG	-.022	-.134	.056	-.045	.105	1					
GDPC	.252*	.387**	.048	-.008	.290**	.005	1				
HE	.431**	.688**	.102	.138	.150	-.190	.356**	1			
REV	.285**	.652**	.182	-.007	.266*	-.268*	.666**	.676**	1		
AW	.037	-.014	.066	.052	-.019	-.230*	.083	.082	.245*	1	
POP	.133	.406**	.139	.068	.012	-.363**	.099	.545**	.738**	.380**	1

Note: **: $p < .01$ (two-tailed t-test); *: $p < .05$ (two-tailed t-test).

Table 3. Model Estimation Results

Variables	Coefficient	t-Statistic	Prob.
TRG	-0.176	2.305	0.028
IRG	0.777	4.648	0.000
PRE	0.093	0.567	0.573
PRE*TRG	0.221	7.870	0.000
PRE*IRG	-0.432	-3.174	0.002
DG	0.056	0.256	0.799
DTRG	0.028	0.092	0.927
DIRG	0.307	0.665	0.508
GDPC	0.0003	0.112	0.911
HE	-0.235	-1.178	0.243
REV	-0.176	-0.306	0.760
AW	0.114	0.552	0.583
POP	0.161	0.265	0.792
Fixed Effects (Period)			
2017S1--C	0.126		
2017S2--C	-0.551		
2018S1--C	-0.028		
2018S2--C	-0.083		
2019S1--C	0.085		

H1 is supported by the data in table 3. The coefficient of *TRGDeviation* β_1 is -0.176 (Prob. < 0.05). This suggests that, when the development level of a municipality government is above average (*TRGDeviation* > 0), its OGD development will slow down in the later period ($\beta_1 * TRGDeviation < 0$). Conversely, if the development level of a municipality government is lower than the average (*TRGDeviation* < 0), its OGD development will be faster in the following period ($\beta_1 * TRGDeviation > 0$). The bigger the deviation, the more adjustment there will be in the next period. Moreover, the absolute value of β_1 is less than 1, which indicates that there is partial adjustment, the government will make adjustments according to the average of trait-based reference groups, but not completely adjust or overreact.

H2 is not supported by the data. H2 assumes that municipality governments will adjust their development level of OGD platforms to the average level of peer municipal governments in the same province. But the estimated coefficients of *IRGDeviation* β_2 is 0.777 > 0 (Prob. < 0.01). This indicates that the development level of OGD platforms will not be adjusted to the average level of institution-based reference groups. So Hypothesis 2 is rejected.

The rejection of H2 may be related to the early development stage of OGD platforms in China. The number of provincial OGD platforms is small, and municipal OGD platforms are scattered. As a result, when some municipality governments want to select

peers in the same province as their counterparts, they may find that there are few references. However, the rejection of H2 does not mean that the development of OGD platforms is not influenced by institution-based reference groups, but indicates that the adjustment moves towards a more extreme direction. Under the peer pressure from institution-based reference groups, municipality governments will adopt more aggressive policies on OGD development.

H3a and H3b are both supported by the data above. The interaction between *PreGov* and *TRGDeviation* is positive and significant ($\beta_4 = 0.221$, Prob. < 0.01), indicating that if the provincial OGD development get a relatively high score, the municipal governments in this province will do less adjustment on their OGD development to the average level of trait-based reference groups. Moreover, interaction between *PreGov* and *IRGDeviation* is negative and significant ($\beta_5 = -0.432$, Prob. < 0.01), indicating that if the provincial OGD development get a relatively high score, the municipal government will adjust to not so extreme, but to a slightly more moderate direction. That is to say, the municipal government will adjust its OGD development towards the average level of the institution-based reference group.

5 Conclusion

This study discusses the influence of reference group on the development of OGD platforms of Chinese municipal governments. The conclusion is that, municipal governments position the development of OGD platforms near the average level of the trait-based reference group. If the development of OGD platform of a municipal government falls behind the average of its trait-based reference group, it will try to catch up in the following period; If it exceeds the average of its trait-based reference group, it will slow down the development. When it comes to the institution-based reference group, the adjustment becomes radical. That is, the government will take the principle "doctrine of the mean" to direct the development of OGD platforms when facing the trait-based reference group, while it will take the radical route when facing the institution-based reference group. The two reference groups have different regulating effects on the development of OGD platforms.

The significance of this study is to reveal the direction of peer influence on the development of public information systems. Prospect theory well explained the OGD development in China while the institutional theory did not. In the absence of a perfect standard, the public sectors adjust the development of public information system mainly based on the trait-based reference group. According to the conclusion, "best practice" selection of OGD shall be conducted by provincial governments, and the assessment results shall be included in the evaluation of performance assessment of municipal governments, so as to improve the diffusion scale of OGD and prevent aggressive adjustments. In future practice, the institutional environment also needs to be optimized through top-level design.

The limitation of the study is that the development of OGD in China is still in the initial stage. The available data is not that much, which to some extent affects the accuracy of the results. In the future, the research can be re-investigated years after to

make it more convincing. Transnational studies can also be conducted to compare the development of OGD in different countries and examine the moderating effect of different cultural dimensions on the influence of reference groups.

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