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## Impact of citizen participation through e-government platforms on satisfaction and trust

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**Abstract:** This study investigates the impact of different citizen engagement models in e-government services on user satisfaction and trust, focusing on the co-production and managerial model. Utilising a comparative case study approach, data were collected through structured online surveys targeting user satisfaction, trust, and participation. Users of iShenzhen, which employs a co-production model, reported higher satisfaction and trust levels compared to users of Hangzhou City Brain, which follows a managerial model. The results suggest that co-production enhances satisfaction and trust in e-government services, with participation being a significant predictor of these outcomes. The study highlights the effectiveness of active citizen engagement in service design and implementation, suggesting it enhances public trust in government. Providing empirical evidence within the Chinese context, this research addresses a gap in understanding the impacts of engagement models on user perceptions, offering a comparative analysis that underscores the advantages of participatory approaches in public service delivery.

**Keywords:** co-production; e-government; citizen participation; user satisfaction; trust.

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## 1 Introduction

The advent of the digital age has dramatically altered how governments engage with their constituents, providing new opportunities for communication, public participation, and delivery of public services. E-government, co-production, and managerial model are three key concepts that play a crucial role in understanding how these changes are shaping citizen attitudes towards government services. In this study, we aim to address the gap in research on citizen attitudes towards e-government services with a co-production vs. managerial model of e-participation in China by examining two distinct cases: iShenzhen and Hangzhou City Brain.

Briefly, e-government pertains to the adoption of information and communication technologies (ICTs) by governmental bodies with the aim to enhance public administration, boost the quality of services provided, and foster better interaction with citizens (Muhammad and Hromada, 2022). E-government services include an extensive array of digital platforms, utilities, and applications that facilitate citizen access to government-related data, services, and resources more efficiently and effectively (Thanasi-Boçe and Kulakli, 2023). Co-production is the collaborative process between governments and citizens in the design, development, and delivery of public services. In the context of e-government, co-production involves active citizen participation in identifying needs, providing feedback, and contributing to the improvement of online services (Bovaird and Downe, 2008). The managerial model of e-participation is characterised by a top-down approach, where government agencies determine the design, development, and delivery of e-government services with limited citizen involvement (Pollitt and Bouckaert, 2011). In this model, citizens are treated as customers with assigned needs, and the focus is on providing efficient and effective services rather than fostering active citizen participation.

Guided by public management theory, this approach differs with a traditional model of co-production that incorporates active service user input into public service planning and delivery. In this case, co-production is conceptualised as an ‘add-in’ to, rather than an integral aspect of, planning and design. Public management theory holds that co-production takes place in the choice and control of professionals of service rather than

the user of the service (Brandsen and Pestoff, 2006). This conceptualisation, therefore, does not have to question fundamental axioms of public management and therefore more often than not, restricts the involvement of citizens to predefined roles.

iShenzhen is an exemplary platform for citizen participation, integrating various features that align with the co-production model in public administration. For instance, its 'Speed Citizen Issue Process' allows for seamless submission of citizen concerns, offering an accessible interface where individuals can quickly input issues. Additionally, iShenzhen enables citizens to engage with the governance process through multiple channels: commenting on government services, submitting suggestions to city mayors, participating in surveys, and lodging complaints or service requests. This broad spectrum of engagement mechanisms reflects the essence of co-production as described by Ostrom and Ostrom (1977), where the inputs for service provision are contributed by individuals outside the formal organisational structure. The platform's functionality enhances citizen agency, fostering a direct, collaborative relationship between the government and the public.

In contrast, the City Brain platform falls short in terms of promoting meaningful citizen engagement. While City Brain may offer basic reporting and data-sharing capabilities, it lacks the interactive mechanisms that define co-production. Users can submit concerns, but the absence of feedback or follow-up leaves the process feeling transactional rather than participatory. Without the ability for citizens to comment on services, engage in dialogue, or receive responses, City Brain's offerings are limited compared to platforms like iShenzhen. This gap diminishes its effectiveness as a tool for fostering trust and satisfaction, as engagement is central to these outcomes (Vigoda, 2002). Without ongoing interaction, City Brain risks being perceived as merely a top-down tool, rather than a collaborative platform for public participation.

Despite the growing literature on e-government and co-production, there is a gap in understanding how citizens perceive different models of e-participation and how these attitudes influence their overall satisfaction with e-government services. Though some research discusses the outcomes of co-production (Marks, 2008; Vamstad, 2012) and citizen participation (Wai Michael Siu, 2010) with respect to end-users' perceptions and attitudes (Fledderus et al., 2015), none have explored this in the collectivist, Chinese context, where self-serving bias may play a reduced role (Heine and Lehman, 1997). This study addresses this gap by comparing citizen attitudes towards e-government services in iShenzhen, which emphasises co-production, and Hangzhou City Brain, which follows a managerial model. Through this comparison, we aim to shed light on the factors that shape citizen preferences and offer recommendations for enhancing the effectiveness of e-government services in China. Specifically, we hypothesise that:

*H1: Citizen participation through co-production models (e.g., iShenzhen) leads to higher user satisfaction compared to managerial models (e.g., Hangzhou City Brain).*

*H2: Trust in e-government platforms is positively correlated with citizen participation in co-production models.*

*H3: E-government platforms that offer bi-directional communication and feedback mechanisms (e.g., iShenzhen) result in higher levels of citizen trust compared to those with limited interaction (e.g., City Brain).*

## 2 Literature review

### 2.1 *Managerial model and satisfaction*

The traditional managerial mode of operation in a government context refers to a top-down, hierarchical approach to public service delivery, where decision-making authority and responsibility primarily reside within government institutions (Pollitt and Bouckaert, 2011). The traditional managerial model in public services has received increasing attention in recent times, with various researchers emphasising the importance of incorporating customer-oriented approaches in the traditional model (Boyne, 2002; Gruening, 2001). Although customer satisfaction is more commonly associated with the private sector (Eid et al., 2019; Kotler and Lee, 2007), it is increasingly recognised as a critical factor for public sector organisations seeking to enhance their performance (Eid et al., 2019; Kim, 2020). These studies highlight the necessity of shifting from a purely bureaucratic focus to a more customer-centric approach to enhance satisfaction and service quality.

Moore (1995) and Osborne and Gaebler (1992) advocate for a shift from traditional managerial models to more flexible, value-focused public service delivery that addresses dynamic citizen needs and enhances satisfaction. In contrast, Pollitt and Bouckaert (2011) critique the traditional model's rigidity, arguing it limits adaptability and responsiveness to citizen needs, a view supported by Denhardt and Denhardt (2000), who highlight the benefits of a citizen-centered approach in increasing public trust and satisfaction. Additional studies are required to investigate the optimal methods for incorporating marketing concepts into public service provision and enhancing consumer satisfaction within the constraints of the traditional managerial model.

### 2.2 *Co-production defined*

Co-production emerged from research on city services by Elinor Ostrom and colleagues in the 1970s, challenging the notion that public service delivery was solely a governmental responsibility (Ostrom, 1996; Parks et al., 1981). Co-production was defined to describe the interactive relationship between service providers (such as law enforcement, educators, or healthcare professionals) and the clients benefiting from these services (Ostrom, 1996).

Co-production today is viewed as a collaborative process where clients and providers jointly execute tasks within the service delivery spectrum, with varying levels of user participation. This approach, often termed co-delivery, has been shown to enhance user satisfaction, particularly when users are actively involved in the service delivery process rather than merely in decision-making (Brudney and England, 1983; Bovaird, 2007; Boyle and Harris, 2009). This framework highlights the need for a clear definition and strategic framing of co-production goals to maximise its value in public service delivery (Säwe and Thelander, 2015).

The Managerial Model diagram (see Figure 1) illustrates a hierarchical, top-down approach, characterised by linear information flow from the governing body to the citizens. Governmental agencies, as depicted at the top, are the primary decision-making entities, demonstrating control over the design, execution, and evaluation of public services. Citizens, as shown at the bottom, assume a more passive role, receiving these services with limited active involvement. This model mirrors the earlier stages of the

Digital Government Evolution Model, as it mainly emphasises efficiency and control through standardised processes and rigidly defined roles.

Contrastingly, the Co-production Model diagram exemplifies a more collaborative and dynamic arrangement, indicative of the advanced stages of the Digital Government Evolution Model. Government agencies and citizens are positioned on the same level, reflecting the shared responsibility and mutual engagement inherent in this model. There's an interplay of reciprocal arrows between the two entities, signifying the constant two-way interaction and exchange of information. This model encapsulates the concept of co-delivery, in which citizens not only participate in the decision-making process but also play an active role in implementation.

**Figure 1** Comparative diagram of the managerial and co-production models in public service (see online version for colours)



### 2.3 Co-production and satisfaction

The direct influence of co-production on service quality, specifically service outcomes, is expected (Bovaird and Downe, 2008). Given that users are often better informed about local services' content, costs, and restrictions, their involvement in the delivery process could elevate service quality (Brudney and England, 1983). When citizens and providers collaborate, namely in positive-sum models, there is a notable advantage in terms of quality improvement, as opposed to zero-sum models, where contributions of the service

provider are replaced by those of the citizen (Needham, 2008). The greater the collective actions of the users, the more resources are directed towards the process of delivery, consequently augmenting the quality of service. Therefore, it is expected that co-production efforts by the citizens lead to a greater realisation of desired outcomes compared to those with non-involvement.

Despite active citizen involvement, desired outcomes may not always materialise (Hirschman, 1982). For example, a compliant patient may not improve, potentially leading to self-directed dissatisfaction if perceived personal inadequacies are believed to have caused the failure (Bandura, 2001). Alternatively, individuals confident in their abilities might blame external factors or service providers. With limited user involvement, the responsibility for service outcomes primarily falls on providers (Fiakpa et al., 2022).

In co-production, where users actively participate in service delivery, it is often expected that satisfaction with the service provider will increase, assuming that non-participation leads to poorer outcomes. However, success can occur in both co-production and traditional models. Due to self-serving bias, individuals may attribute more success to themselves and less blame to failures in collaborative settings (Bendapudi and Leone, 2003), potentially leading to decreased satisfaction with providers in co-production scenarios. Nevertheless, this bias is less pronounced in collectivist cultures like China, which are influenced by societal norms (Heine and Lehman, 1997). Additionally, public service expectations and the inclination towards self-serving attributions vary internationally, depending on the country's welfare state status (Zuckerman, 1979). The varied impact of self-serving bias in co-production across different cultures underscores the need for further research into how co-production influences user satisfaction globally.

## *2.4 Co-production in Chinese context*

Donaldson (2016) noted that e-government in China has been largely characterised by a unidirectional communication model where information flows from the government to citizens, predominantly reflecting the Digitisation and Transformation stages of Janowski's Digital Government Evolution Model (Janowski, 2015). These stages focus on incorporating technology into governmental processes and transforming services to utilise electronic methods. However, this model overlooks the Engagement and Contextualisation stages, which are crucial for increasing complexity, contextualisation, and specialisation in government services.

Janowski's model suggests that true evolution in digital government involves advancing to stages where two-way interactions are fundamental, and citizens actively contribute to the design and implementation of services – this is where co-production comes into play. In China, embracing co-production within e-government could transform the traditional top-down approach into a reciprocal relationship between the government and its citizens, enhancing service efficiency, quality, and trust in government. Such a shift would align China's e-government development with the more advanced stages of Janowski's model, indicating a move towards Electronic Governance and a deeper integration of citizen needs and preferences into service delivery.

In China, the Integrated Feedback Mechanism for Government Websites (IFMGW) represents the largest co-production case, initiated in 2015 to improve government websites through citizen feedback (Ma and Wu, 2020). The program allows citizens and

businesses to report issues, expecting governments to enhance online service usability in response.

Unlike other platforms focused on personal grievances, IFMGW participants are mainly altruistically motivated, addressing issues to the government broadly and benefiting both local and central administrations (Su and Meng, 2016). Governmentally, this citizen engagement aids all administrative levels through a platform that tracks and forwards complaints, thus integrating local governments into what may seem solely a central initiative. Unlike similar local initiatives, the distinguishing factor here is that local governments are obliged to submit to central government scrutiny, which may cause reluctance to actively involve citizens due to the potential for increased scrutiny from the central government.

In the Chinese context, where public service delivery is typically initiated by the government and the nascent 'volunteer spirit' (Civicus, 2006), the investigation of user satisfaction in co-production is largely an unexplored area. Hustinx et al. (2010) propose that a highly involved government in delivery of public services is generally associated with a lower propensity for volunteering, underscoring the need to grasp the factors motivating citizen participation in co-production. Xu et al. (2016) began investigating factors like volunteer commitment influencing co-production, yet the role of user satisfaction remains underexplored. This aspect is vital as it affects citizens' willingness to collaborate with authorities and, when examined alongside trust in government, can offer insights into co-production dynamics in top-down governance systems like China. Understanding these relationships is crucial for crafting effective citizen participation strategies in public service.

Public Management Theory was selected as an apt theoretical lens for analysing the role and limits of citizen participation within iShenzhen and Hangzhou City Brain applications because it addresses the evident governance style and administrative framework. The (co-production) iShenzhen app featured limited modes for citizen engagement, mainly an in-app feedback channel and discussion forum. Though there is bi-directional engagement, modes for interaction and engagement are on the terms public service provider, and do not provide a feasible avenue for an involved and ground-up collaboration in the delivery of services. Despite this, in the Chinese context, iShenzhen stands out as offering robust citizen involvement. On the other hand, more typical platforms like Hangzhou City Brain exemplify a managerial model, where the only feedback and engagement possible is to the app developers. This selection of Public Management Theory, therefore, highlights how the administrative structures in place shape the form and extent of citizen participation. This understanding is crucial for developing strategies that could potentially enhance the effectiveness and responsiveness of public services, encouraging a more bi-directional and engaging form of co-production that aligns with the principles of engaged and contextualised digital governance.

### **3 Methods and data**

This research employs a quantitative design and utilises a survey-based approach to investigate citizen satisfaction and trust across three distinct citizen variables in public e-service delivery: satisfaction, trust, and participation. The selection of these two empirical examples of iShenzhen and Hangzhou City Brain provides an opportunity to

quantitatively assess the potential relations between satisfaction, trust, and participation with the co-production and managerial model of public e-service delivery.

These platforms were also selected due to their apparent difference in affordance for citizen participation, with only iShenzhen offering methods for feedback, forum discussion, and contact of local officials (personal observation). The study sample was carefully selected to ensure that the participants were indeed users of the e-services offered by either iShenzhen or Hangzhou City Brain and were at least 18 years old. Participant recruitment occurred through various social media platforms, and all participation was completely voluntary. Interested individuals provided informed consent before completing the survey. Out of the 728 surveys taken, 565 were found to be valid and were thus included in the final analysis. 279 participants were iShenzhen users and 268 were Hangzhou City Brain users.

For the survey design, questions were formulated to precisely measure user attitudes towards the e-services, with the questionnaire organised into several sections targeting specific aspects of user satisfaction, trust, and participation. Each variable was assessed through five questions to maintain survey brevity and minimise participant burden, which helped enhance response rates and response reliability.

The data collection was conducted using the online survey platform from July to August 2023, which preserved participant anonymity and encouraged candid responses. This phase involved distributing a comprehensive survey designed to quantitatively capture user attitudes towards satisfaction, trust, and participation across two different e-service delivery models, providing data for statistical analysis of their complex dimensions.

Satisfaction, the principal measure, gauged the extent to which users perceive the e-services as meeting their needs, expectations, and preferences. This incorporated elements such as ease of use, accessibility, service quality, and responsiveness to user inquiries. To assess user satisfaction, the survey featured Likert scale with items such as:

“Please indicate how much you agree or disagree with the following statements. (1 = Strongly Disagree, 5 = Strongly Agree) 1) You are satisfied with the overall experience of using the Digital Public Service Platform and 2) You are satisfied with the ease of use of the Digital Public Service Platform.”

Trust, as the secondary measure, evaluated users’ confidence in the reliability and integrity of the e-service platforms and the government institutions that maintain them. This included perceptions of transparency, accountability, and the extent to which users believe the platforms safeguard their personal information. Trust was measured through, for example:

“Please indicate how much you agree or disagree with the following statements. (1 = Strongly Disagree, 5 = Strongly Agree). 1) You believe the information provided by the Digital Public Service Platform is accurate and unbiased. 2) You rely on the Digital Public Service Platform to keep personal data confidential.”

Participation, as the third measure, assesses the extent to which users of the e-service platforms feel that they are actively involved in government processes and decision-making. This involves an evaluation of the platforms’ facilitation of two-way communication between the government and the citizens, as well as the platform’s ability to serve as an effective medium for citizen input and consultation. The concept is rooted in theories of participatory democracy, which posits that active citizen involvement leads

to more robust, transparent, and accountable governance. Participation particularly focuses on two avenues for interaction:

- 1 participating in interactive discussions with the government
- 2 consulting on decisions made by the government.

To measure Participation, respondents would be prompted with the following survey items, rated on a Likert scale from 1 (Strongly Disagree) to 5 (Strongly Agree), for instance:

- 1 The Digital Public Service Platform effectively enables you to participate in interactive discussions with the government.
- 2 The Digital Public Service Platform allows you to consult on decisions made by the government.

By employing these quantitative measures and utilising the survey methodology, this study sought to explore user attitudes in the context of public e-service delivery models. This facilitated a comprehensive understanding of the factors that contribute to these attitudes and the implications for co-production and traditional managerial approaches.

In terms of data analysis methods, comprehensive statistical evaluations were performed on the collected survey data. Descriptive statistics, encapsulating measures of central tendency (mean, median) and dispersion (standard deviation, range), were calculated to provide a preliminary understanding of the distribution and central values of user satisfaction and trust across the two e-service platforms.

Moreover, inferential statistics were employed to explore the underlying relationships and associations between variables. Specifically, independent samples t-tests with Bonferroni correction were conducted to assess the statistical differences in user satisfaction, trust, and participation levels between the co-production and managerial models of service delivery.

Subsequently, a multivariate analysis was conducted employing Pearson's correlation coefficients to explore the relationships among satisfaction, trust, participation, frequency of e-service use, age, education level, and gender. This method was selected for its utility in capturing linear associations and its relevance for subsequent regression analyses. The inclusion of demographic variables aims to control for potential confounders and evaluate the independent associations among core variables.

Finally, multiple regression analyses were performed to identify the predictive value of various independent variables, including the type of model (co-production or managerial), frequency of e-service use, age, and education level, on the dependent variables, namely the level of user satisfaction, trust, and participation.

Ethical considerations were paramount throughout this research. All participants were informed about the purpose of the study and how their data would be used. They were assured that their responses were anonymous and could not be linked back to them. Informed consent was obtained from all participants prior to taking the survey. All data were securely stored and only accessed by the researcher for the purpose of this study. No data were shared with third parties, maintaining strict confidentiality and compliance with privacy regulations. The study adhered to the principles outlined in the Declaration of Helsinki regarding ethical conduct in human research and was approved by the University of Malaya Research Ethics Committee (UM.TNC2/UMREC\_2651).

## 4 Findings

A summary of the descriptive statistics for the measures of satisfaction, trust, and participation for both iShenzhen and Hangzhou City Brain users is presented in Table 1. The mean satisfaction rating for all users was found to be 3.27 (SD = 0.87) out of 5, indicating a moderate level of satisfaction among users, a 3.29 average for trust (SD = 0.98), and 3.26 (SD = 0.95) for participation. Interestingly, all independent variables of satisfaction, trust, and participation had similar means around 3.2 out of 5.0, showing little difference between the variables among users when averaged across the platforms. However, to test differences between platforms per variable, see the t-test results in Table 2. Table 1 provides the details for the variable values, and their comprising item values.

**Table 1** Descriptive statistics for user satisfaction, trust, and participation ( $n = 565$ )

| <i>Variable</i>                                                                                                       | <i>Min</i>            | <i>Max</i>         | <i>Mean</i> | <i>Std. Dev</i> | <i>Scale reliability</i> |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------|-------------|-----------------|--------------------------|
| Satisfaction                                                                                                          |                       |                    | 3.265       | 0.870           | alpha = 0.846            |
| Are satisfied with the overall experience of using the Digital Public Service Platform                                | Strongly Disagree = 1 | Strongly Agree = 5 | 3.469       | 1.286           |                          |
| Are satisfied with the speed of feedback from government departments on the Digital Public Service Platform           | Strongly Disagree = 1 | Strongly Agree = 5 | 3.207       | 1.056           |                          |
| Are satisfied with the speed of information released by government departments on the Digital Public Service Platform | Strongly Disagree = 1 | Strongly Agree = 5 | 3.202       | 1.066           |                          |
| Believe that the Digital Public Service Platform will continue to improve in the future                               | Strongly Disagree = 1 | Strongly Agree = 5 | 3.223       | 1.058           |                          |
| Are satisfied with the ease of use of the Digital Public Service Platform                                             | Strongly Disagree = 1 | Strongly Agree = 5 | 3.223       | 1.047           |                          |
| Trust                                                                                                                 |                       |                    | 3.294       | 0.979           | alpha = 0.884            |
| Trust the security measures implemented on the Digital Public Service Platform                                        | Strongly Disagree = 1 | Strongly Agree = 5 | 3.464       | 1.361           |                          |
| Believe the information provided by the Digital Public Service Platform is accurate and unbiased                      | Strongly Disagree = 1 | Strongly Agree = 5 | 3.237       | 1.147           |                          |

**Table 1** Descriptive statistics for user satisfaction, trust, and participation ( $n = 565$ ) (continued)

| <i>Variable</i>                                                                                                   | <i>Min</i>               | <i>Max</i>                | <i>Mean</i> | <i>Std. Dev</i> | <i>Scale reliability</i> |
|-------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------|-------------|-----------------|--------------------------|
| Rely on the Digital Public Service Platform to keep personal data confidential                                    | Strongly Disagree = 1    | Strongly Agree = 5        | 3.246       | 1.145           |                          |
| Feel confident that the Digital Public Service Platform will resolve any issues or complaints in a timely manner  | Strongly Disagree = 1    | Strongly Agree = 5        | 3.264       | 1.128           |                          |
| Perceive the Digital Public Service Platform as a reliable source for government-related information and services | Strongly Disagree = 1    | Strongly Agree = 5        | 3.257       | 1.127           |                          |
| Participation                                                                                                     |                          |                           | 3.255       | 0.954           | alpha = 0.878            |
| Provide information about government practices                                                                    | Strongly Disagree = 1    | Strongly Agree = 5        | 3.393       | 1.324           |                          |
| Participate in interactive discussions with the government                                                        | Strongly Disagree = 1    | Strongly Agree = 5        | 3.237       | 1.150           |                          |
| Collaborate with the government                                                                                   | Strongly Disagree = 1    | Strongly Agree = 5        | 3.204       | 1.136           |                          |
| Contact political office holders                                                                                  | Strongly Disagree = 1    | Strongly Agree = 5        | 3.207       | 1.100           |                          |
| Consult on decisions made by the government                                                                       | Strongly Disagree = 1    | Strongly Agree = 5        | 3.232       | 1.090           |                          |
| Age                                                                                                               | 1=18 years old and below | 6= 60 years old and above | 3.230       | 1.079           |                          |
| Gender                                                                                                            | 1 = Male                 | 2 = Female                | 1.503       | 0.500           |                          |
| Education level                                                                                                   | 1 = Middle school        | 5 = Postgraduate          | 2.689       | 0.837           |                          |
| I frequently use the Digital Public Service Platform                                                              | 1 = Not once             | 5 = Every day or almost   | 3.228       | 1.183           |                          |

To test whether the differences in satisfaction, trust, and participation between the co-production and managerial models were statistically significant, t-tests were conducted. The results are summarised in Table 2. The satisfaction scores between iShenzhen and Hangzhou City Brain were found to be statistically significantly different, with a t-value of  $-2.54$  and a p-value of  $0.011$ . This indicates that the observed difference in satisfaction between the two models is unlikely to be due to chance, affirming the superiority of the co-production model in fostering user satisfaction. Trust was also found to be significantly higher in the iShenzhen platform, with a t-value of  $-2.20$  and a p-value of  $0.028$ . Similarly, participation was elevated in the co-production, iShenzhen platform, with a t-value of  $-2.27$  and a p-value of  $0.024$  (See Table 2).

**Table 2** T-tests for differences in variables between platforms

| <i>Variables</i> | <i>iShenzhen mean</i> | <i>City Brain mean</i> | <i>t-value</i> | <i>p-value</i> |
|------------------|-----------------------|------------------------|----------------|----------------|
| Satisfaction     | 3.51                  | 3.12                   | -2.539         | 0.011          |
| Trust            | 3.69                  | 3.39                   | -2.201         | 0.028          |
| Participation    | 3.16                  | 2.82                   | -2.267         | 0.024          |

Table 3 presents the matrix of Pearson's Correlation Coefficients for all examined variables. The absence of high correlation values suggests that multicollinearity is unlikely to pose a concern. The matrix indicates satisfaction shares a significant positive relation with trust (0.57) and participation (0.49), and trust with participation (0.48). Also, satisfaction (0.14) and trust (0.17) showed significant positive relationships with frequency of e-service use, but they were weak, indicating it frequency does not have a large relation with satisfaction or trust. All of these variable relationships were significant at the 0.01 level.

**Table 3** Correlations among all variables

|                                  | <i>Satisfaction</i> | <i>Trust</i> | <i>Participation</i> | <i>Frequency<br/>of e-service<br/>use</i> | <i>Age</i> | <i>Education<br/>level</i> | <i>Gender</i> |
|----------------------------------|---------------------|--------------|----------------------|-------------------------------------------|------------|----------------------------|---------------|
| Satisfaction                     | 1                   |              |                      |                                           |            |                            |               |
| Trust                            | 0.569**             | 1            |                      |                                           |            |                            |               |
| Participation                    | 0.492**             | 0.480**      | 1                    |                                           |            |                            |               |
| Frequency<br>of e-service<br>use | 0.144**             | 0.171**      | 0.070                | 1                                         |            |                            |               |
| Age                              | -0.032              | 0.006        | -0.007               | 0.007                                     | 1          |                            |               |
| Education<br>level               | -0.038              | 0.010        | -0.061               | 0.033                                     | 0.127**    | 1                          |               |
| Gender                           | -0.021              | 0.009        | -0.041               | 0.022                                     | 0.013      | 0.094                      | 1             |

\*\* $p < 0.01$ .

Utilising ordinary least squares (OLS) regression analysis, the study investigated the influence of participation on two dependent variables, namely satisfaction and trust, while also accounting for control variables such as frequency of e-service utilisation, age, gender, and educational attainment. As delineated in Table 4, the regression outcomes substantiate the assertion that individuals exhibiting elevated levels of participation and frequent use of e-services are more predisposed to higher satisfaction and trust concerning the digital service platform.

The magnitude of the influence exerted by participation was notably substantial, recording a moderate coefficient value of 0.44 for satisfaction and 0.49 for trust. In contrast, the frequency of e-service usage demonstrated a more modest impact, evidenced by coefficients of 0.08 and 0.11 for satisfaction and trust, respectively. These variables were statistically significant at the 0.01 level, thus corroborating the hypothesis that participation is a salient determinant in shaping both satisfaction and trust in digital public service platforms.

**Table 4** Regression results

| <i>Independent variable</i> | <i>Satisfaction</i> |                       |                | <i>Trust</i>       |                       |                |
|-----------------------------|---------------------|-----------------------|----------------|--------------------|-----------------------|----------------|
|                             | <i>Coefficient</i>  | <i>Standard error</i> | <i>T score</i> | <i>Coefficient</i> | <i>Standard error</i> | <i>T score</i> |
| Participation               | 0.441**             | 0.033                 | 13.199         | 0.486**            | 0.038                 | 12.874         |
| Control variables           |                     |                       |                |                    |                       |                |
| Frequency of e-service use  | 0.081**             | 0.027                 | 3.028          | 0.113**            | 0.030                 | 3.732          |
| Age                         | −0.023              | 0.030                 | −0.780         | 0.003              | 0.033                 | 0.097          |
| Gender                      | 0.060               | 0.064                 | 0.952          | 0.051              | 0.072                 | 0.710          |
| Education level             | −0.010              | 0.038                 | −0.262         | 0.039              | 0.043                 | 0.907          |
| <i>R</i> <sup>2</sup>       |                     | 0.256                 |                |                    | 0.251                 |                |

\*\**p* < 0.01.

When these findings are juxtaposed with the data presented in Table 2 – which indicates a pronounced increase in participation among users of the co-production model, iShenzhen – it becomes apparent that iShenzhen users not only score higher on metrics of satisfaction, trust, and participation but also that participation serves as a significant catalyst in elevating levels of satisfaction and trust. Contrary to expectations, age and education level showed minimal to no significant impact on both satisfaction and trust. This finding is interesting as it implies that these demographic characteristics are less crucial in shaping users’ attitudes towards e-services, at least within the context of our study.

In summary, the empirical analysis provides compelling evidence to suggest that participation serves as a significant variable in influencing both satisfaction and trust within the context of digital public service platforms. Utilising robust statistical techniques, namely OLS regression, the study effectively isolates the impact of participation while controlling for demographic and usage-related variables. The resultant moderate coefficients for satisfaction and trust underscore participation’s pivotal role in shaping user experience and confidence in digital governance tools. The implications of these findings are discussed further in the following sections.

## 5 Discussion

### 5.1 Co-production model

The co-production model, a concept popularised by Ostrom and her colleagues in the 1970s, has found new relevance in contemporary public service delivery (Brandsen and Pestoff, 2006; Pestoff et al., 2012). Essentially, this model involves the collaborative efforts of both ‘regular’ service producers and clients to achieve specific outcomes (Ostrom, 1996, p.1079). While it can be argued that every service incorporates elements of co-production to some degree, our analysis primarily concentrates on co-production as an intentional move by service providers to amplify user activities targeted at achieving particular results (Fledderus et al., 2014). Through the lens of public management theory, co-production elements of in-app feedback (with possible responses by public service

officials) and discussion forums with citizen and public service official involvement are two government-controlled 'add-ins' that offer a degree of co-production (Brandsen and Pestoff, 2006). The impetus of this study is to characterise the impact of this degree of co-production on public satisfaction and trust in the Chinese context of Hangzhou and Shenzhen.

Applying this model to our study, the results point to a significantly higher level of satisfaction and trust among users of the co-production platform, iShenzhen, compared to those using the managerial model, Hangzhou City Brain. These outcomes are consistent with the theory that asserts co-production bolsters satisfaction, trust, and participation in public service delivery (Fledderus et al., 2014). Moreover, the regression analysis showed that participation was a significant predictor of both user satisfaction and trust, further bolstering the credibility of these initial results.

This direct correlation between co-production and satisfaction with service confirms earlier research suggestions that user involvement enhances service quality (Bovaird and Downe, 2008; Brudney and England, 1983). The findings also support Needham's (2008) notion that co-production improves resource efficiency and responsiveness to user needs and preferences, thereby fostering higher satisfaction. Moreover, our study suggests that co-production can even foster trust among users, an aspect underexplored in the existing literature.

However, our research also points to the complexities and potential paradoxes of the co-production model. Even with high user involvement, the desired outcome might not always be realised (Hirschman, 1982), and failures may be attributed to either the service provider or user. This risk of self-blame is a unique attribute of the co-production model, warranting further research to understand how it affects user perceptions and experiences.

In light of the correlation and regression analyses presented, several important insights emerge regarding the efficacy of the co-production model. The Pearson's Correlation Coefficients elucidated in Table 3 confirm significant positive associations between satisfaction and trust (0.57), satisfaction and participation (0.49), as well as trust and participation (0.48), all statistically significant at the 0.01 level. Furthermore, while frequency of e-service use demonstrated a positive but weak association with satisfaction (0.14) and trust (0.17), its relative insignificance underscores the pivotal role of participation.

The regression results reinforce these associations, showing moderate coefficient values for the impact of participation on both satisfaction (0.44) and trust (0.49). These findings coalesce to affirm that participation serves as a crucial element within the co-production model. Specifically, it suggests that when users feel they are actively participating in the governance process, this perception translates into higher levels of satisfaction and trust in the digital public service platforms.

The role of participation is particularly salient when juxtaposed with the cultural context discussed earlier. Our findings challenge existing literature on self-serving bias within co-produced services, notably Bendapudi and Leone (2003), by suggesting that in collectivist cultures like China, the dynamics may operate differently. In such contexts, participation may not just be an add-on but could serve as a cultural lever, elevating both trust and satisfaction levels to a significant degree.

To summarise, the results of our study provide crucial empirical support for the effectiveness of the co-production model in boosting user satisfaction and trust in the realm of e-government services. The pronounced role of participation, especially within a collectivist cultural setting, represents a vital contribution to the co-production literature.

However, they also underscore the need for a deeper understanding of the intricate dynamics at play in co-production, particularly in different cultural contexts. This calls for more nuanced, culture-sensitive research into the variables and interactions that define the co-production experience.

## 5.2 *Managerial model*

When examining the results from our study, t-tests indicate lower satisfaction, trust, and participation levels among users of the managerial model platform, Hangzhou City Brain, as compared to the co-production platform, iShenzhen. The regression analysis further expounded on these findings, indicating that participation was a significant predictor of user satisfaction and trust. This is consistent with previous work that shows that co-production models have the capacity for an increase in participation (Rosen and Painter, 2019). While some research has found that co-production efforts may encounter low citizen engagement (Van Eijk and Steen, 2016), participation in the co-production model was significantly higher than in the managerial model, possibly due to high convenience to provide feedback. This discrepancy between models underscores the inherent limitations of the traditional managerial model in meeting dynamic citizen needs, as indicated in the literature (Denhardt and Denhardt, 2000; Pollitt and Bouckaert, 2011).

Indeed, the managerial model, in its rigidity and reliance on formal bureaucracy, may fall short in creating an adaptable and responsive environment for public service delivery. This aligns with observations from scholars like Moore (1995) and Osborne and Gaebler (1992), who advocate for a more flexible, citizen-centric approach to boost satisfaction. The relatively lower satisfaction, trust, and participation levels in our study validate this need for innovation within the traditional managerial model.

At the same time, our findings contribute a nuanced understanding of the managerial model in the context of e-government services. While customer-oriented approaches are traditionally associated with the private sector (Kotler and Lee, 2007), they have started permeating public sector organisations as well (Kim, 2020). Our study reinforces this opportunity, highlighting the potential benefits of integrating marketing principles into public service delivery, even within the confines of a managerial model.

However, despite these strides, the managerial model, as evidenced by our results, has not been able to match the performance of the co-production model in fostering user satisfaction, trust, or participation in the e-service platform. These results thereby stress the need for a more profound paradigm shift, which extends beyond the integration of marketing principles to possibly include active citizen involvement in service design, delivery, and evaluation.

In conclusion, our study's findings underscore the limitations of the traditional managerial model and echo the growing literature calling for more customer-centric, flexible approaches in public service delivery. This research, thus, contributes valuable empirical evidence to this evolving discourse, highlighting the pressing need for innovative strategies within the traditional managerial framework.

## 5.3 *Comparing models*

The differential impact on citizen satisfaction, trust, and participation, as evidenced in our study, underscores the distinct nature of these two models. This finding is indicative of the diverse citizen needs in the public service context and supports the ongoing discourse

concerning the need for responsive and adaptable approaches in service delivery (Brudney and England, 1983; Denhardt and Denhardt, 2000).

In essence, our analysis indicated that users of the co-production model platform, iShenzhen, exhibited significantly higher satisfaction, trust, and participation levels than those utilising the managerial model platform, Hangzhou City Brain. This variation can be traced back to the foundational principles of the two models. Co-production's emphasis on citizen involvement likely contributes to a more personalised service delivery experience, which could explain the higher levels of satisfaction and trust (Brandsen and Pestoff, 2006; Fledderus et al., 2014). The managerial model, conversely, adopts a more impersonal, bureaucratic approach, which limits its responsiveness to individual user needs, as reflected in our results.

Moreover, the regression analysis results reinforced these observations, pointing to participation as a significant predictor of user satisfaction and trust across both models of e-service platforms. It is intriguing to observe that despite its limitations, the managerial model could still foster user satisfaction, albeit to a lesser extent than the co-production model. This suggests that integrating customer-centric strategies into a traditionally bureaucratic structure, as argued by Moore (1995) and Osborne and Gaebler (1992), could indeed yield positive outcomes.

However, the superior performance of the co-production model in this study highlights its potential as a viable alternative to traditional service delivery approaches in the Chinese e-government context. China's cultural landscape, with its collectivist tendencies, might be particularly conducive to the co-production model, as it promotes communal participation and shared responsibilities (Heine and Lehman, 1997). Our results add empirical weight to this hypothesis and present an opportunity for public policymakers to consider the benefits of co-production in enhancing service quality and citizen satisfaction. Indeed, larger benefits in satisfaction and trust are expected if the co-production model increased citizen engagement further, fostering an inclusive environment where citizens are empowered to participate in decision-making, co-design, and service implementation. Such inclusive engagement would deepen the collaborative relationship between government and citizens, ultimately reinforcing public trust and paving the way for a more responsive, citizen-centric digital government.

In conclusion, this comparative examination of the co-production and managerial models reinforces the inherent strengths of each approach while highlighting the value of flexibility and responsiveness in public service delivery. Ultimately, our findings emphasise the potential benefits of integrating citizen-centric strategies into both co-production and managerial frameworks, contributing to the evolving discourse on e-government service delivery in China.

## **6 Conclusion**

This study critically explores two distinct models of e-government service delivery in China: the co-production model of iShenzhen and the managerial model of Hangzhou City Brain. The findings demonstrate that the co-production model, which encourages active citizen participation, significantly enhances satisfaction and trust in public services. This highlights its potential as an effective alternative to traditional managerial approaches. iShenzhen's participatory features, such as feedback channels and forums, offer a valuable blueprint that could be integrated into existing managerial systems like

Hangzhou City Brain to improve citizen engagement at minimal cost. Further research could examine the structural changes required to facilitate this integration and sustain citizen participation.

While the co-production model shows superior results in terms of satisfaction, trust, and participation, the managerial model also achieves a level of success. This suggests that even hierarchical, bureaucratic systems can deliver satisfactory services when augmented with customer-oriented strategies. However, this study does not argue for a binary choice between these models. Instead, it advocates for a hybrid approach that combines the strengths of both models, tailored to the specific needs of different public services. The central finding is that citizen participation is crucial in building satisfaction and trust, offering a path for enhancing managerial models.

It is important to note the limitations of this research. The findings are based on data from two Chinese cities, and broader generalisations should be made cautiously. Public service delivery is complex, involving multiple stakeholders, and further research is needed to explore how interactions between government and citizens shape satisfaction, trust, and participation. Additionally, the depth of participation in these digital platforms may be limited, possibly inflating its perceived impact, and the study's findings are subject to change over time.

In conclusion, while the study offers compelling insights, its results must be interpreted within the scope of these limitations. Future research should focus on long-term studies that consider the multi-faceted nature of participation and how it evolves across different contexts. Ultimately, the findings underline the importance of innovative, flexible, and citizen-centric e-government models in fostering public trust and satisfaction, and in creating more responsive and effective public services.

## Competing interests

The authors declare no competing interests.

## Data availability statement

The datasets generated during and/or analysed during the current study are available on figshare: 10.6084/m9.figshare.25895143.

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