

From Digital Information Access to Rural Well-Being: Transparency Capability in the ICT–Capability–Functioning Nexus

Bo Cunshui*, Wong Swee Kiong, Haslina Binti Hashim

Faculty of Social Sciences and Humanities, UNIMAS, Kota Samarahan, Sarawak, Malaysia

*Corresponding Author Email: 20010106@siswa.unimas.my

DOI Link: <http://dx.doi.org/10.6007/IJARBSS/v16-i9/28923>

Published Date: 26 September 2026

Abstract

Digitalisation has substantially expanded the technical availability of policy, subsidy, project, and public-finance information in rural communities; however, access alone does not ensure that households can locate, understand, verify, and use such information effectively. This study examines Transparency Capability as a substantive conversion mechanism linking ICT Usage to productive functioning and rural well-being within a Resource–Capability–Functioning–Quality of Life (RCF-QoL) framework. ICT Usage is conceptualised as a developmental resource, Transparency Capability as the effective opportunity to access clear, timely, and monitorable institutional information, New-Type Productive Forces as realised productive functioning, and Quality of Life as the final well-being outcome. Using 401 valid household questionnaires from flower-cultivation communities in Qingzhou, Shandong Province, China, the results show that ICT Usage is positively associated with Transparency Capability ($\beta = 0.429$, $p < .001$). Transparency Capability predicts productive functioning after controlling for ICT Usage ($\beta = 0.275$, $p < .001$) and remains positively associated with Quality of Life after ICT Usage and productive functioning are entered simultaneously ($\beta = 0.209$, $p < .001$). A 5,000-resample nonparametric bootstrap confirms a significant ICT → Transparency Capability → QoL indirect effect of .090, 95% CI [.050, .134], and a significant serial ICT → Transparency Capability → productive functioning → QoL effect of .031, 95% CI [.017, .049]. The combined indirect contribution involving Transparency Capability is 0.121, 95% CI [.079, .167]. These findings demonstrate that digital information becomes developmentally meaningful when households can convert access into usable transparency that reduces information asymmetry, clarifies institutional rules, strengthens accountability, and supports informed choices. The study contributes to capability-based ICT4D research by identifying Transparency Capability as a distinct household-level conversion mechanism and by showing the importance of separating resource use, capability, functioning, and well-being in questionnaire design.

Keywords: Ict Usage, Transparency Capability, Information Asymmetry, Rural Well-Being, Rcf-Qol, Capability Approach

Introduction

Digital transformation has become an increasingly important component of rural development, reshaping how households obtain policy information, access public services, coordinate production, and interact with local institutions. Rural households now encounter policies, subsidies, public projects, administrative procedures, market rules, and service information through websites, mobile applications, messaging groups, e-government platforms, and social-media channels. These digital channels can reduce information-search costs and expand opportunities for institutional transparency. However, the technical availability of information does not necessarily mean that rural households can find, understand, verify, and use it effectively (Bai et al., 2024). Recent Chinese evidence links rural digitalisation and digital governance to subjective well-being and health, although the benefits vary across groups and mechanisms (Chen & Ye, 2024; Wang et al., 2025; Wei et al., 2024).

Problem Statement

The phenomenon investigated in this study is the persistent gap between digital information availability and usable transparency at the household level. A policy notice may be online but difficult to locate; a subsidy rule may be public but difficult to interpret; project information may be disclosed without enabling residents to assess implementation; and public-expenditure records may exist without providing a realistic opportunity for scrutiny. This gap matters because rural households make livelihood and community decisions within an institutional environment shaped by eligibility rules, funding arrangements, infrastructure projects, collective resources, and administrative procedures. When such information is technically available but not usable, digitalisation may expand the supply of information without equally expanding households' substantive freedom to act on it.

Existing evidence demonstrates why this problem deserves closer examination. Hu et al. (2023) show that digital-government development is associated with greater fiscal transparency across Chinese prefecture-level cities, indicating that digital infrastructure can strengthen disclosure capacity. Lee and Sun (2024), however, demonstrate that government transparency in China is multidimensional and may be managed selectively rather than automatically produced by digitalisation. At the citizen level, Ling et al. (2026) find that different forms of government transparency are related to public-service satisfaction, while Xia and Zhang (2026) link open-government data and transparency perceptions to public trust. These studies establish the institutional and welfare relevance of transparency, but they do not explain whether rural households can convert digitally available information into a substantive capability that supports productive action and well-being. Recent household evidence shows that digital ability and ICT adoption can improve agricultural production efficiency, commercial orientation, and labour productivity (Li et al., 2024; Zhang & Mishra, 2024).

The problem is especially salient in Qingzhou's flower-cultivation economy. Flower-growing households interact simultaneously with digital markets, agricultural-support programmes, village infrastructure, collective arrangements, and administrative procedures. Information concerning flower-industry support funds, infrastructure projects, application requirements, collective subsidies and dividends, and village public expenditure can affect whether households recognise opportunities, prepare applications, coordinate production, anticipate

institutional conditions, and protect their interests. Qingzhou therefore provides an appropriate empirical setting for examining not simply whether information is disclosed, but whether digital information becomes usable transparency in everyday rural production and community life. The study aims to answer three research questions:

Is ICT Usage positively associated with Transparency Capability among rural households?

Is Transparency Capability positively associated with New-Type Productive Forces and Quality of Life after accounting for ICT Usage?

Does Transparency Capability mediate the relationship between ICT Usage and Quality of Life, both directly and sequentially through New-Type Productive Forces?

Research Gap and Objective

A review of the relevant literature reveals three interrelated gaps. First, digital-government and transparency studies have predominantly examined transparency from the supply or institutional side, including fiscal disclosure, managed transparency, public-service satisfaction, and public trust (Hu et al., 2023; Lee & Sun, 2024; Ling et al., 2026; Xia & Zhang, 2026). This literature provides important evidence about disclosure and institutional outcomes, but gives less attention to transparency as a household-level substantive opportunity. Second, ICT4D scholarship has long emphasised that access to technology does not guarantee equivalent developmental benefits and that the conversion of ICT resources into valued outcomes depends on capabilities and context (Zheng, 2009; Díaz Andrade & Urquhart, 2012; van Deursen & Helsper, 2015; Dini et al., 2023). Nevertheless, the specific conversion of ICT Usage into Transparency Capability has not been sufficiently conceptualised or empirically tested. Third, previous studies have not adequately examined a sequential household-level mechanism in which ICT Usage strengthens Transparency Capability, Transparency Capability supports productive functioning, and these processes subsequently relate to Quality of Life in a specialised rural Chinese economy. Recent digital-village studies have examined farmer enrichment, core capabilities, mental health, and poverty vulnerability (Chen et al., 2025; Lai et al., 2024; Wan et al., 2025; Zhao et al., 2025), but they have not isolated household-level Transparency Capability within a resource-capability-functioning sequence.

These gaps provide the rationale for applying Sen's Capability Approach. Sen identifies transparency guarantees as an instrumental freedom supporting development (Sen, 1999). From this perspective, the central issue is not merely whether information is formally disclosed, but whether people possess a genuine opportunity to understand rules, scrutinise public decisions, monitor relevant processes, and interact with institutions under conditions of openness and trust (Sen, 1999; Robeyns, 2005). Accordingly, this study conceptualises Transparency Capability as a household's effective ability to obtain, understand, and scrutinise clear, timely, and monitorable information relevant to livelihood and community decisions. To address these limitations, the research seeks to:

To examine whether ICT Usage is positively associated with Transparency Capability.

To determine whether Transparency Capability is associated with New-Type Productive Forces and Quality of Life after accounting for ICT Usage.

To test whether Transparency Capability mediates the ICT Usage–Quality of Life relationship directly and sequentially through New-Type Productive Forces.

These objectives are examined within the Resource–Capability–Functioning–Quality of Life (RCF-QoL) framework, in which ICT Usage represents Resource (RES), Transparency Capability represents substantive opportunity, New-Type Productive Forces represent realised productive Functioning (FUN), and Quality of Life (QoL) represents the final well-being outcome.

This study contributes to the field in three specific ways. First, it advances transparency research by shifting the analytical focus from information disclosure alone to Transparency Capability as a household-level substantive informational freedom. Second, it extends capability-based ICT4D research by specifying and testing a resource-to-capability conversion mechanism through which meaningful ICT Usage is associated with usable institutional information and, subsequently, productive functioning and well-being. Third, it contributes methodologically by separating ICT resource use, transparency opportunity, productive achievement, and Quality of Life in the measurement model, thereby reducing conceptual overlap and strengthening the interpretability of mediation results. In practical terms, the study also provides a capability-oriented basis for rural digital-governance policy: successful digitalisation requires not only publishing information but ensuring that rural households can find, understand, compare, and monitor information relevant to valued action.

Literature Review and Hypothesis Development

Digital information access is not equivalent to transparency

The expansion of digital government has substantially increased the capacity of public institutions to disseminate policy information and administrative procedures through open-data portals, government websites, digital-service systems, and social-media accounts. Nevertheless, disclosure does not automatically constitute effective transparency. Information must be visible, sufficiently complete, interpretable, timely, and relevant to the decisions citizens face. The developmental value of disclosure therefore depends on how information is organised and whether users can translate it into actionable knowledge (Meijer, 2013).

Evidence from China illustrates this distinction. Hu et al. (2023) find that digital-government development is associated with greater fiscal transparency across prefecture-level cities, suggesting that digital infrastructure can improve disclosure capacity. Lee and Sun (2024), however, show that government transparency in China takes multiple forms and should not be treated as a single undifferentiated phenomenon. More recent national evidence indicates that different forms of transparency have different relationships with public-service satisfaction, with policy-content transparency emerging as particularly important (Ling et al., 2026). These findings imply that the developmental effect of digital information depends on content, usability, and institutional context.

At the household level, this distinction is particularly consequential. Rural households do not benefit from a policy merely because the relevant document is available online. They must be able to locate pertinent information, understand eligibility criteria, compare available options, identify deadlines, and assess whether implementation is consistent with published rules. Transparency can therefore be understood as a conversion achievement between digital information availability and informed action. Unequal digital skills and platform conditions can also limit who converts access into productive or welfare gains, reinforcing the

need to distinguish technical access from effective capability (Du et al., 2024; Feng, 2024; Lyu et al., 2025).

Taken together, prior studies show that digital systems can improve formal disclosure and that transparency is related to citizen evaluations and trust, but they leave a household-level conversion question unresolved: when does digitally available information become a substantive opportunity that rural households can actually use? Addressing this question requires distinguishing ICT Usage as a resource from Transparency Capability as an effective informational opportunity. This distinction provides the theoretical basis for H1 and prevents digital access from being treated as equivalent to transparency.

Transparency Capability in Sen's Capability Approach

Transparency guarantees occupy a distinctive position in Sen's account of instrumental freedoms. They concern openness, trust, disclosure, and the conditions under which people can interact without concealment or arbitrary informational disadvantage. In a capability-based interpretation, transparency is not reduced to the quantity of information released. It is the real opportunity to know and use relevant information in ways that support agency, accountability, and informed choice.

This perspective is particularly relevant to ICT4D because digital systems can simultaneously increase information availability and information complexity. A platform may contain extensive documentation while remaining difficult to navigate for users with limited education, time, or digital experience. Digital interfaces may also reproduce information asymmetries when some households can navigate application procedures, verify subsidy rules, or monitor public spending more effectively than others. A capability-based analysis therefore asks whether digital information is converted into effectively usable freedom.

The present measure operationalises this concept through five concrete opportunities: checking collective subsidy and dividend information online; obtaining clear and timely disclosure of flower-industry support funds; viewing detailed information on village infrastructure projects; accessing clearly published agricultural-project application requirements and procedures; and using information platforms to monitor village public expenditure. Together, these indicators capture transparency as access, clarity, procedural intelligibility, and oversight.

H1: ICT Usage is positively associated with Transparency Capability.

Transparency Capability and productive functioning

Transparency Capability can support productive activity by reducing information asymmetry and institutional uncertainty. Rural households may be better positioned to invest, apply for programmes, adopt new technologies, or coordinate with public and collective actors when eligibility rules, funding arrangements, project information, and administrative procedures are clear. Conversely, opaque procedures increase search and transaction costs and may discourage participation even when formal support is available.

In a specialised agricultural economy, transparency may also affect the timing and quality of productive decisions. Clear infrastructure-project information can help households anticipate

logistics or production conditions; transparent support-fund information can clarify available resources; and understandable programme procedures can reduce administrative friction. These effects do not make transparency a productive functioning in itself. Rather, transparency enlarges the institutional opportunity set within which productive functioning can be realised. Recent studies similarly associate digitalisation with agricultural production resilience and connect rural e-commerce with market integration, entrepreneurship, and family-farm resilience (Huang et al., 2024; Li & He, 2024; Lin et al., 2024; Luo et al., 2025; Yi et al., 2023).

H2: Transparency Capability is positively associated with New-Type Productive Forces after accounting for ICT Usage.

Transparency Capability and rural well-being

Transparency Capability may improve Quality of Life through pathways that do not depend on immediate gains in productivity. Predictable rules can reduce uncertainty, accessible information can lower the time and effort required to obtain services or resolve administrative problems, and the ability to monitor public expenditure can strengthen perceived accountability and fairness. Clear disclosure may also support institutional trust when residents perceive local processes as understandable and open to scrutiny. Recent rural China studies report positive well-being or mental-health associations with technology adoption, rural e-commerce, and digital-village development, while also identifying distributional differences (Chen et al., 2025; Liu et al., 2024; Wan et al., 2025; Wei et al., 2024).

Recent Chinese evidence is consistent with these expectations. Ling et al. (2026) report positive relationships between government transparency and public-service satisfaction, while Xia and Zhang (2026) show that open-government data can shape perceptions of transparency and public trust. Related research on corruption perceptions and subjective well-being suggests that institutional quality and evaluations of government performance matter for citizens' welfare (Ma et al., 2022). These studies support the proposition that transparency has direct welfare relevance.

H3: Transparency Capability is positively associated with Quality of Life after accounting for ICT Usage and productive functioning.

Transparency within the RCF-QoL nexus

The RCF-QoL framework makes it possible to distinguish two transparency pathways. The first is RES → Transparency Capability → QoL. This route captures the direct welfare relevance of informational openness, predictable procedures, and accountability. The second is RES → Transparency Capability → FUN → QoL. This route captures the possibility that transparency enables households to convert digital resources into productive achievements by improving access to programmes, reducing uncertainty, and clarifying institutional conditions.

These pathways are complementary rather than mutually exclusive. ICT may also influence FUN directly through digital sales, communication, or production technologies, and it may influence QoL directly through convenience, communication, and service access. Allowing these direct routes prevents the model from imposing an unrealistically closed chain. Digital

financial inclusion provides an additional route through income mobility, livelihood strategies, and health-related outcomes among rural households (Tian et al., 2024; Zhang et al., 2024).

H4: Transparency Capability mediates part of the positive association between ICT Usage and Quality of Life.

H5: ICT Usage has a positive serial indirect association with Quality of Life through Transparency Capability and New-Type Productive Forces.

Methodology

Research design, study context, and sample

This study adopts a quantitative, cross-sectional household survey design in flower-cultivation communities in Qingzhou, Shandong Province, China. The final analytical sample comprises 401 valid questionnaires. Each household was represented by an adult respondent with sufficient knowledge of household digital practices, productive activities, and living conditions. Qingzhou provides an analytically relevant setting because specialised flower production depends on market coordination and digital tools while also interacting with local public infrastructure, collective resources, agricultural-support programmes, and administrative procedures.

The sample is heterogeneous rather than restricted to highly educated or affluent digital users. Women account for 54.36% of respondents; 63.10% fall into the two oldest age categories used by the questionnaire; high-school education is the modal category at 38.40%; 66.83% report monthly household income between RMB 3,000 and 9,999; and 57.11% have at least six years of flower-cultivation or related business experience. Such variation creates realistic differences in the ability to locate, interpret, and use digital information.

Questionnaire architecture and construct operationalisation

The focused model contains four first-order constructs, each measured with five five-point Likert items. ICT Usage (RES; Q6-Q10) captures meaningful digital use for information acquisition, communication and coordination, procurement and logistics, digital payment and finance, and public-service or production decisions. Transparency Capability (CAP-T; Q31-Q35) captures effective access to subsidy and dividend information, disclosure of industry-support funds, infrastructure-project information, agricultural-project requirements and procedures, and monitoring of public expenditure. New-Type Productive Forces (FUN; Q36-Q40) represent realised digital productive practices, while Quality of Life (QoL; Q41-Q45) captures final household well-being.

This measurement architecture is central to the article's theoretical claim. ICT Usage measures the use of digital resources; CAP-T measures whether those resources are converted into usable transparency; FUN measures what households actually do in productive practice; and QoL measures broader welfare outcomes. The sequence would become conceptually circular if, for example, online policy searching were counted simultaneously as ICT use and transparency capability or if satisfaction with government were embedded directly in the transparency scale.

Table 1

Focused RCF-QoL questionnaire architecture

Construct	Code/items	RCF-QoL role	Operational content
ICT Usage	RES; Q10	Q6- Resource	Information acquisition; communication/coordination; procurement/logistics; digital payments/finance; public-service or production decisions.
Transparency Capability	CAP-T; Q31-Q35	Capability / mediator	Collective subsidy/dividend information; industry-support fund disclosure; infrastructure-project information; programme requirements/procedures; monitoring public expenditure.
New-Type Productive Forces	FUN; Q40	Q36- Productive functioning	Online sales; digital branding; data-informed production; smart/connected agriculture; innovative digital practices.
Quality of Life	QoL; Q45	Q41- Well-being outcome	Income stability; livelihood security; access/convenience; resilience; overall life evaluation.

Why questionnaire quality matters for transparency research

Transparency is especially vulnerable to measurement error because availability, awareness, comprehension, trust, satisfaction, and accountability are related but not identical concepts. A single item such as 'government information is transparent' asks respondents to summarise several processes at once. Such a measure may correlate strongly with satisfaction because both are general evaluations. The present questionnaire instead uses concrete informational opportunities that can be judged more consistently across respondents.

The five CAP-T items also broaden content validity. Two items concern financial disclosure, one concerns infrastructure projects, one concerns application rules and administrative process, and one concerns monitoring of public expenditure. This spread reduces the risk that the construct is merely a measure of one specific policy channel. It also reflects the Capability Approach's emphasis on substantive freedom: transparency is evaluated through what residents can actually access and scrutinise.

Reliability and validity are assessed before interpreting mediation. Cronbach's alpha evaluates internal consistency (Cronbach, 1951). Confirmatory evidence uses standardised loadings, composite reliability (CR), average variance extracted (AVE), the Fornell-Larcker criterion, and the heterotrait-monotrait ratio (HTMT) (Fornell & Larcker, 1981; Henseler et al., 2015). The broader measurement system has excellent factorability, with KMO = 0.948 and Bartlett's $\chi^2(990) = 10,742.48$, $p < .001$. Common-method risk is also considered because all focal constructs come from one household questionnaire; the first unrotated factor accounts for 33.97% of total variance, below the commonly used 50% warning threshold (Podsakoff et al., 2003).

Analytical strategy

The analysis proceeded sequentially from measurement assessment to mechanism testing. First, arithmetic-mean construct scores were computed according to the predetermined questionnaire mapping. Second, descriptive statistics and Cronbach's alpha were calculated from the 401 respondent records, while CFA-based standardised loadings, composite reliability (CR), average variance extracted (AVE), and discriminant-validity evidence were used to assess the measurement foundation. Third, standardised regression paths were estimated for the focused RCF-QoL model: RES predicted CAP-T; FUN was regressed on RES and CAP-T; and QoL was regressed on RES, CAP-T, and FUN.

Fourth, indirect effects are evaluated using 5,000 nonparametric bootstrap resamples following resampling-based mediation principles (Preacher & Hayes, 2008). The analysis estimates both the simple RES → CAP-T → QoL path and the serial RES → CAP-T → FUN → QoL path. Finally, a robustness specification includes gender, age, education, household income, and flower-business experience as controls. Because the data are cross-sectional, the directional ordering follows theory and should not be interpreted as experimentally identified causality.

Analysis and Results*Descriptive statistics and measurement quality*

ICT Usage has a mean of 3.320 (SD = 0.966); Transparency Capability averages 3.340 (SD = 0.976); New-Type Productive Forces average 3.234 (SD = 1.025); and Quality of Life averages 3.301 (SD = 0.950). The CAP-T mean is moderately above the midpoint of the scale, suggesting that digital transparency opportunities are present but not uniformly strong. Its standard deviation also indicates meaningful between-household variation in perceived access to clear and monitorable information.

Internal consistency is strong: Cronbach's alpha is 0.882 for RES, 0.886 for CAP-T, 0.899 for FUN, and 0.878 for QoL. CFA-based standardised item loadings range from .768-.789 for RES, .772-.788 for CAP-T, .785-.812 for FUN, and .743-.781 for QoL. CR values are .883, .886, .899, and .878, and AVE values are .601, .609, .639, and .590, respectively. The CAP-T scale therefore combines strong internal coherence with a content domain that extends across financial, project, procedural, and oversight transparency.

Table 2

Descriptive statistics and measurement quality

Construct	Mean	SD	α	Loading range	CR	AVE
RES	3.320	0.966	0.882	.768-.789	.883	.601
CAP-T	3.340	0.976	0.886	.772-.788	.886	.609
FUN	3.234	1.025	0.899	.785-.812	.899	.639
QoL	3.301	0.950	0.878	.743-.781	.878	.590

Correlations and construct distinctiveness

Case-level composite correlations are moderate and positive: RES-CAP-T = 0.429, RES-FUN = 0.476, RES-QoL = 0.470, CAP-T-FUN = 0.429, CAP-T-QoL = 0.432, and FUN-QoL = 0.476. These

relationships are sufficiently strong to support mechanism testing but remain far from unity. Complementary CFA evidence also supports construct distinctiveness: the square roots of AVE are .775 for RES, .780 for CAP-T, .800 for FUN, and .768 for QoL, while HTMT values in the wider measurement architecture remain below .60.

Table 3

Case-level correlations among focal constructs

Construct	RES	CAP-T	FUN	QoL
RES	.775			
CAP-T	0.429	.780		
FUN	0.476	0.429	.800	
QoL	0.470	0.432	0.476	.768

Note. Diagonal values are square roots of AVE; off-diagonal entries are case-level composite correlations.

Transparency conversion and mediation results

ICT Usage is positively associated with Transparency Capability ($\beta = 0.429$, $p < .001$; $R^2 = 0.184$), supporting H1. The result indicates that broader meaningful ICT use is associated with stronger access to clear and monitorable institutional information, but the R^2 also shows that ICT use alone does not determine transparency capability.

When productive functioning is regressed on RES and CAP-T, both predictors remain positive and significant. $RES \rightarrow FUN$ is $\beta = 0.358$, while $CAP-T \rightarrow FUN$ is $\beta = 0.275$ (both $p < .001$; $R^2 = 0.288$). This supports H2 and suggests that transparency contributes to productive functioning beyond the direct technological association of ICT use.

In the QoL equation, $RES \rightarrow QoL$ is $\beta = 0.255$, $CAP-T \rightarrow QoL$ is $\beta = 0.209$, and $FUN \rightarrow QoL$ is $\beta = 0.265$ (all $p < .001$). The equation explains 33.6% of QoL variance. The positive CAP-T coefficient supports H3 and confirms that transparency has a welfare association that is not exhausted by the productive-functioning route.

The bootstrap results support both indirect hypotheses. The simple $RES \rightarrow CAP-T \rightarrow QoL$ effect is 0.090, 95% CI [0.050, 0.134], supporting H4. The serial $RES \rightarrow CAP-T \rightarrow FUN \rightarrow QoL$ effect is 0.031, 95% CI [0.017, 0.049], supporting H5. The combined indirect contribution involving Transparency Capability is 0.121, 95% CI [0.079, 0.167]. None of these intervals includes zero.

The robustness models retain the same directional pattern after demographic controls are added. The adjusted $RES \rightarrow CAP-T$ coefficient is $\beta = 0.358$; $CAP-T \rightarrow FUN$ remains $\beta = 0.245$; and in the adjusted QoL equation CAP-T remains $\beta = 0.178$, FUN $\beta = 0.223$, and RES $\beta = 0.198$. These results suggest that the transparency pathway is not simply a reflection of gender, age, education, income, or industry experience.

Table 4

Standardised path and bootstrap indirect effects

Effect	Estimate	95% bootstrap CI	Interpretation
RES → CAP-T	0.429	[0.347, 0.506]	ICT use is associated with stronger transparency capability.
RES → FUN CAP-T	0.358	[0.265, 0.452]	ICT retains a direct productive association.
CAP-T → FUN RES	0.275	[0.185, 0.366]	Transparency supports productive functioning.
RES → QoL CAP-T, FUN	0.255	[0.156, 0.349]	A direct ICT-well-being route remains.
CAP-T → QoL RES, FUN	0.209	[0.119, 0.299]	Transparency has direct welfare relevance.
FUN → QoL RES, CAP-T	0.265	[0.171, 0.359]	Productive functioning contributes to QoL.
RES → CAP-T → QoL	0.090	[0.050, 0.134]	Simple transparency-capability mediation.
RES → CAP-T → FUN → QoL	0.031	[0.017, 0.049]	Serial RCF-QoL pathway.
Total indirect involving CAP-T	0.121	[0.079, 0.167]	Combined CAP-T indirect contribution.

Discussion*Transparency Capability bridges digital information and usable freedom*

The first major finding is that meaningful ICT Usage is positively associated with Transparency Capability, but the relationship is not deterministic. The RES → CAP-T coefficient indicates that households using ICT more meaningfully tend to report stronger access to clear and monitorable institutional information, while the remaining unexplained variance shows that ICT use alone is insufficient to generate usable transparency. This pattern is consistent with the Capability Approach: digital technologies provide resources and potential access, whereas substantive transparency also depends on the clarity, timeliness, intelligibility, and credibility of institutional disclosure. The finding therefore extends access-centred accounts of digitalisation by identifying the conversion from digital information to usable transparency as a distinct developmental mechanism.

This distinction helps explain why digital-government projects can generate uneven benefits. A technically sophisticated portal can still produce weak capability if residents do not know where information is located or cannot interpret administrative language. Conversely, relatively simple digital channels can produce meaningful capability when information is timely, clearly organised, locally relevant, and linked to practical decisions. Transparency should therefore be evaluated from the user's opportunity set rather than from the supply side alone.

Transparency has direct well-being value

The positive CAP-T → QoL relationship remains significant after ICT Usage and productive functioning are controlled, indicating that Transparency Capability has a direct association with rural well-being. This finding supports the Capability Approach's treatment of transparency as an instrumental freedom whose value extends beyond income or productive output. A transparent institutional environment may improve well-being by reducing uncertainty, increasing procedural predictability, lowering information-search costs, and strengthening residents' ability to scrutinise decisions that affect their livelihoods.

The finding is consistent with emerging Chinese evidence connecting transparency to public-service satisfaction and trust (Ling et al., 2026; Xia & Zhang, 2026). It also complements research linking corruption perceptions, government performance, and subjective well-being (Ma et al., 2022). The present household-level result adds a capability interpretation: what matters is not simply a general evaluation that government is transparent, but whether residents possess usable informational opportunities in domains that affect their livelihoods and community life.

Transparency supports productive functioning without becoming an economic variable

The positive CAP-T → FUN relationship suggests that transparent institutions can support productive transformation. Clear programme requirements can reduce the cost of applying for support; timely disclosure of industry funds can improve awareness of available resources; infrastructure-project information can reduce planning uncertainty; and public-expenditure visibility can strengthen expectations of accountability. These mechanisms can create a more predictable environment for productive decisions.

However, Transparency Capability should not be collapsed into Economic Capability. The former concerns openness, information symmetry, procedural clarity, and accountability; the latter concerns market choice, financing, competition, and customer reach. Their downstream consequences may intersect, but their conceptual foundations differ. Preserving this distinction is important for both theory and policy diagnosis.

The serial RCF-QoL pathway and multiple routes to well-being

The significant serial indirect effect through CAP-T and FUN provides additional support for the RCF-QoL framework. Although the serial effect is smaller than the simple transparency-mediated pathway, this difference is theoretically meaningful: Transparency Capability contributes to Quality of Life partly by enabling productive functioning, while a substantial share of its welfare relevance operates independently of immediate productive outcomes. The findings therefore support a plural RCF-QoL mechanism in which institutional capability has both direct and functioning-mediated consequences for well-being.

The retained direct ICT → QoL and ICT → FUN paths further reinforce this interpretation. ICT can improve communication, convenience, market coordination, or service access through mechanisms outside the transparency domain. Transparency Capability is therefore one identifiable pathway within a broader digital-development system rather than a universal mediator.

Why questionnaire quality is decisive for better transparency results

Transparency research often relies on objective disclosure indices, expert assessments, or general citizen perceptions. Each approach has value, but a capability analysis requires a different measurement question: can the household actually obtain and use the information needed for valued action? A questionnaire is therefore necessary when the target construct is effective informational opportunity rather than formal disclosure alone.

The quality of that questionnaire directly affects the quality of the results. The CAP-T scale avoids asking respondents to rate an abstract concept such as 'government openness'. Instead, it asks about recognisable tasks: checking collective subsidy information, seeing industry-support fund disclosure, viewing project details, understanding application procedures, and monitoring public spending. This reduces ambiguity and gives the construct a concrete policy interpretation.

The psychometric results reinforce the value of this design. CAP-T has $\alpha = .886$, CR = .886, AVE = .609, and item loadings between .772 and .788. These values indicate a coherent scale while preserving multiple manifestations of transparency. High reliability is useful, but conceptual coverage is equally important: a five-item scale that repeats one type of disclosure would be statistically consistent yet substantively narrow.

Questionnaire wording also matters for respondents with different education and digital experience. Administrative concepts can be difficult to interpret when presented in abstract language. Concrete items reduce cognitive burden and improve the likelihood that variation reflects genuine differences in opportunity rather than differences in familiarity with academic terminology. The fixed item-to-construct map further protects the analysis from accidental recoding that would blur resources, capabilities, functionings, and outcomes.

Future research should strengthen questionnaire evidence through cognitive interviews, expert content-validity review, pilot testing, translation and back-translation where bilingual instruments are used, and measurement-invariance testing across age, education, income, and digital-experience groups. Survey measures could also be linked with objective disclosure records, portal usage logs, subsidy announcements, public-project databases, or complaint and information-request records. Combining subjective capability measures with observable institutional data would provide particularly strong evidence about the gap between formal transparency and usable transparency.

Policy implications: from disclosure to usable transparency

The findings imply that digital-governance policy should move beyond publication counts. The first priority is findability. Residents should be able to locate subsidy, project, procedure, and public-expenditure information through consistent navigation and commonly used local channels rather than searching across fragmented platforms.

The second priority is intelligibility. Policy and programme information should use plain language, clear eligibility criteria, visible deadlines, process maps, and contact points. Publishing a legal or administrative document without an understandable summary may satisfy a formal disclosure requirement while generating little capability.

The third priority is timeliness and comparability. Funding announcements and project information lose value when published after relevant decisions have effectively been made. Standardised formats can help residents compare programmes, track changes, and identify whether actual implementation corresponds to announced rules.

The fourth priority is monitorability. Transparency Capability is stronger when residents can not only read information but also trace spending, project progress, and implementation outcomes. Digital platforms can support this through searchable records, status updates, and clear links between budgets, projects, and responsible units.

Finally, RCF-QoL provides a useful diagnostic framework. High ICT Usage combined with low CAP-T suggests a transparency-conversion problem. Strong CAP-T but weak FUN suggests that information is available but other barriers prevent productive realisation. Strong digital and productive indicators with weak QoL imply that gains are not translating into broader welfare. Such staged diagnosis is more useful than treating portal availability as evidence of successful digital governance.

Conclusion

This study examined how Transparency Capability connects digital information access with rural productive functioning and well-being among 401 households in Qingzhou's flower-cultivation communities. Within the focused RCF-QoL framework, ICT Usage was treated as a developmental resource, Transparency Capability as substantive informational freedom, New-Type Productive Forces as realised productive functioning, and Quality of Life as the final well-being outcome. The empirical evidence supports the proposed nexus: ICT Usage is positively associated with Transparency Capability; Transparency Capability predicts productive functioning beyond ICT Usage; and it retains a direct positive association with Quality of Life after productive functioning is controlled. Bootstrap analysis further confirms both a simple transparency-mediated pathway and a serial transparency-to-functioning pathway. Theoretically, the study extends access-centred accounts of rural digitalisation by demonstrating that information access should not be treated as transparency by default. Methodologically, it shows that separating resource use, informational opportunity, productive achievement, and well-being is essential for interpretable mechanism testing. Practically, the findings indicate that rural digital-governance initiatives should move beyond publication counts and platform availability toward information that is findable, intelligible, timely, and monitorable. The findings should nevertheless be interpreted in light of the cross-sectional design, reliance on self-reported household data, and the specialised institutional context of Qingzhou's flower economy. Future research should employ longitudinal and comparative designs, examine moderators such as digital literacy and institutional responsiveness, and link survey-based Transparency Capability with objective disclosure and administrative data.

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The study makes three principal contributions. Theoretically, it demonstrates that information access should not be treated as transparency by default and conceptualises Transparency Capability as a distinct household-level informational freedom within the Capability Approach. Mechanistically, it extends the RCF-QoL framework by showing that Transparency Capability is associated with Quality of Life through both a direct pathway and a sequential pathway through productive functioning. Methodologically, it shows that separating ICT behaviour, informational opportunity, productive achievement, and well-being is necessary to avoid tautological mediation and to make the stages of digital-development conversion empirically interpretable.

The methodological implication is that questionnaire design is central to mechanism testing. Separating ICT behaviour, informational opportunity, productive achievement, and well-being avoids tautological mediation and makes the RCF-QoL stages empirically interpretable. Strong reliability and validity are necessary, but the greater contribution of the questionnaire is conceptual: it translates an abstract institutional freedom into concrete experiences that rural households can evaluate.

Three limitations should guide interpretation. First, the cross-sectional design does not establish temporal causality. Second, focal variables are self-reported by one knowledgeable household respondent, so common-source bias cannot be eliminated fully. Third, Qingzhou's specialised flower economy and local institutional setting may shape the magnitude of the observed relationships. Future research should use longitudinal designs, compare rural sectors and provinces, test institutional responsiveness and digital literacy as moderators, and link survey-based transparency capability to objective disclosure and administrative data.

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