



RESEARCH ARTICLE

Determinants of accountability in agricultural programs through a contingency perspective

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Abstract

Enhancing public accountability in Indonesia's agricultural sector is critical to ensure effective management of government aid (subsidised fertilisers and quality seeds) and to support national food security. Transparency and resource optimisation issues persist in public administration, potentially disrupting the supply chain of essential plant production inputs. This study examines the determinants of accountability in agricultural program implementation by analysing the influence of the integrity system, internal control system (ICS) and transformative leadership. It also investigates the moderating effects of organisational commitment and environmental uncertainty on these relationships. Employing a quantitative survey design, primary data were collected from 210 government finance officials and staff involved in agricultural oversight. Structural equation modelling (SEM) was utilised to test the proposed hypotheses. The empirical results indicate that the integrity system ($\beta = 0.168, p < 0.001$) and transformative leadership ($\beta = 0.142, p < 0.001$) have a positive and significant influence on government accountability, whereas the internal control system does not demonstrate a direct significant effect ($\beta = 0.082, p = 0.168$). Crucially, the study finds that organisational commitment and environmental uncertainty act as significant moderators, strengthening the impact of integrity and leadership on accountability. These findings suggest that fostering a culture of integrity and adaptive leadership, supported by strong commitment, is more effective than relying solely on formal bureaucratic controls. This study offers practical insights for policymakers to formulate strategies that enhance governance in agricultural development, ultimately ensuring the timely delivery of inputs required for optimal crop yield and plant health.

Keywords: accountability; agricultural policy; crop productivity; system integrity; transformational leadership

Introduction

The imperative for robust risk management within state agencies has revitalized academic and administrative discourse surrounding public sector accountability (1). Public service effectiveness remains a fundamental policy issue, as numerous public complaints about local government services contribute to negative perceptions (2). Accountability serves as a social interaction where actors must clarify or defend their behavior, guaranteeing the wise use of resources and contributing to good management and public welfare (3, 4). Factors influencing accountability include integrated systems, internal controls, transformation-oriented leaders, organisational commitment and environmental uncertainty (5–12).

In the specific context of Indonesia's agricultural sector, the urgency of accountability is heavily pronounced in the management of government assistance programs (13). The Indonesian government allocates substantial budgets annually for agricultural aid, ranging from subsidised fertilisers to agricultural machinery. However, distribution often faces complex challenges such as targeting inaccuracies and potential mismanagement (14). Consequently,

ensuring accountability is critical for national food security relying heavily on how transparently implementing agencies manage these resources to benefit farmers (15, 16).

From a plant science perspective, the implications of these administrative failures are profound. Delays in fertiliser distribution caused by poor governance directly disrupt nutrient availability required during critical plant growth stages, such as the vegetative and reproductive phases (17). Nutrient deficiency due to logistical inefficiencies inhibits photosynthesis rates and biomass accumulation, leading to stunted growth and suboptimal crop yields (18). Furthermore, accountability lapses often result in the distribution of uncertified or low-quality seeds, which are susceptible to seed-borne diseases and exhibit poor germination rates, thereby threatening crop biodiversity and overall agricultural productivity (19). Thus, public accountability is not merely a bureaucratic metric but a determining factor for plant health and harvest success.

To address these challenges, system integrity plays a pivotal role. Integrity shapes ethical honesty in organisational behavior and governance (6) and implies consistency in organisational objectives

and ethics impacting organisational activities (20, 21). Previous studies suggest that linking trust between executors and stakeholders strengthens adherence to ethical norms, positively affecting accountability (6, 22). Therefore, we hypothesise; H1: system integrity relates to government accountability.

Furthermore, a robust internal control system (ICS) is essential to control budgeting and prevent abuse of authority or fraud (6, 23). While some studies suggest ICS does not affect accountability (6, 24) most evidence points to a positive relationship where exemplary ICS implementation enhances accountability (7, 10). Thus, the second hypothesis; H2: ICS relates to government accountability.

In addition to systems, transformative leadership is crucial. Positive work quality can be attained with leaders who encourage collaboration and improvement (14, 25). Transformative leaders outline policies related to accountability and drive organisational survival in rapid developments (26, 27). When leader behaviour aligns with organisational needs, it fosters a better work environment (28). Consequently, H3: transformative leadership relates to government accountability.

This study also incorporates organisational commitment and environmental uncertainty as moderators. Organisational commitment, characterised by a strong belief in organisational values (2), significantly affects employee performance and is essential for effective operations (11, 29). Competent human resources with high commitment are required to manage funds and prevent corruption (30, 31). Meanwhile, environmental uncertainty influences how organisations adapt (17). High uncertainty can hinder prediction, whereas low uncertainty allows for better planning (18, 32). These variables are expected to strengthen or weaken the relationship between the independent variables and accountability. Based on this description, the subsequent hypotheses are: H4–H6: organisational commitment moderates the relationship between system integrity, ICS, transformative leadership and government accountability. H7–H9: environmental uncertainty moderates the relationship between system integrity, ICS, transformative leadership and government accountability.

While existing literature over the last five years extensively discusses public accountability, most studies focus broadly on urban administrative or corporate contexts. There remains a critical research gap regarding how internal governance mechanisms interact with external environmental uncertainties specifically within

the agricultural sector. This study bridges this gap by integrating public governance theory and institutional theory to empirically examine how organisational commitment and environmental uncertainty moderate the relationships between system integrity, internal controls, transformative leadership and accountability. The novel contribution of this study lies in its interdisciplinary approach: providing robust empirical evidence from a primary national agricultural hub (Subang Regency, Indonesia) and explicitly linking administrative accountability to agricultural sustainability and plant science outcomes. The research framework proposed in this study is presented in Fig. 1.

Materials and Methods

Study area and population

This research was conducted in Subang Regency, West Java, Indonesia. Subang was selected as the study site because it is one of the country's primary national rice production centers (lumbung padi), making the accountability of its agricultural policy execution critical for national food security. The study focused on four Regional Apparatus Organisations (OPD) directly responsible for agricultural and biological resource management: the Department of Agriculture, Department of Animal Husbandry and Animal Health, Department of Fisheries and Maritime Affairs and Department of Food Security. The total population across these departments was 1266 employees.

Sampling and data collection

A purposive sampling method was employed to select respondents who possess strategic roles in financial and operational decision-making regarding agricultural aid distribution (fertilisers, seeds and machinery). The specific inclusion criterion was a minimum of 3 years of tenure in their current department to ensure they possessed sufficient knowledge and experience regarding internal bureaucratic processes. The target sample comprised 60 subjects per OPD, totaling 244 subjects. Data were collected using a direct drop-off and pick-up method at the respondents' respective offices. This approach allowed researchers to personally explain the survey's purpose and ensure a high response rate, while respondents completed the questionnaires independently to minimise social desirability bias. A total of 225 questionnaires were returned and after data cleaning, 210 valid data points were available for analysis.

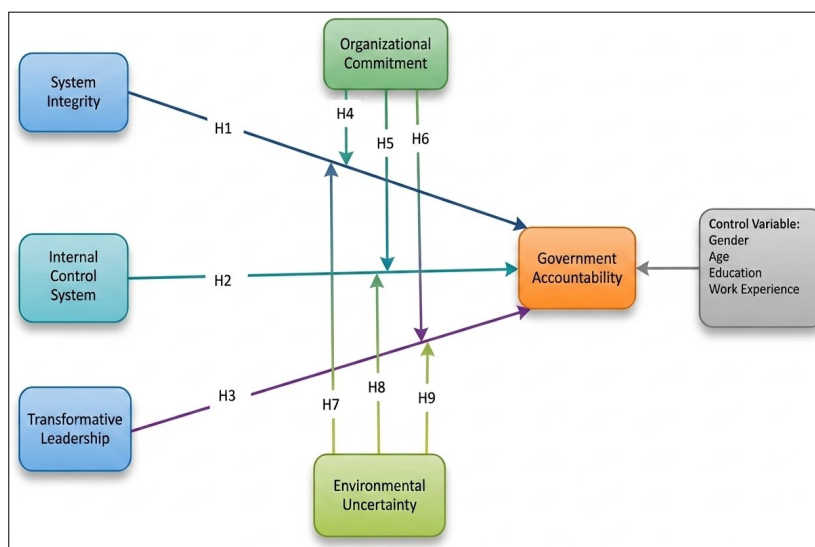


Fig. 1. Proposed conceptual framework.

This sample size of 210 is deemed highly adequate for structural equation modeling (SEM). It comfortably exceeds the recommended minimum guideline of 10 observations per indicator variable, ensuring robust statistical power for path modeling. The data collection period was conducted from July to October 2025. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all individual participants included in the study prior to data collection, ensuring their anonymity and voluntary participation.

Measurement instruments

The survey instrument utilised closed-ended questions to measure respondents' views on several constructs using a 5-point Likert scale ranging from strongly disagree to strongly agree (1, 5). Dependent variable: accountability was measured using 10 items adopted from focusing on the transparency of agricultural program reporting (6). Independent variables: system integrity was measured using 13 items, ICS using 12 items, while transformative leadership using 10 items (6, 33). These items assessed how leadership and systems support effective agricultural governance. Moderating variables: organisational commitment utilised 10 items and environmental uncertainty was measured using 11 items adopted from which included indicators related to external challenges such as regulatory changes and climatic unpredictability affecting the agricultural sector (20, 34). To ensure validity, the questionnaire was pre-tested by heads of financial authorities with a minimum of 5 years of experience in public sector management. Structural equation modeling was employed to test the research framework and hypotheses.

Results

Descriptive data

The initial section of the questionnaire comprised structured data fields designed to capture demographic information from respondents. The survey instrument incorporated four primary components to profile participants: gender classification, age grouping, level of educational qualification and occupational tenure (Table 1).

Measurement model (Outer model analysis)

Model validity and reliability were established through a comprehensive psychometric evaluation encompassing three hierarchical assessment dimensions. Indicator validity was initially examined via convergent validity procedures applied to external factor loadings. Contemporary measurement theory permits loading thresholds between 0.50 and 0.70 for preliminary model

development; however, this research applied enhanced validity standards. All indicators demonstrated outer loadings distinctly exceeding 0.70, thereby exceeding convergent validity benchmarks.

Discriminant validity examination followed, operationalised through average variance extracted (AVE) comparison against cross-construct correlations using Fornell-Larcker criteria. This procedure substantiates whether latent constructions manifest sufficient distinctiveness within the conceptual model. Empirical results confirmed that all model constructions possessed AVE values substantially surpassing 0.50 thresholds.

The concluding validation phase addressed internal consistency through composite reliability and Cronbach's alpha coefficient analysis. Composite reliability values ranged from 0.971–0.990, exceeding the 0.70 threshold, which demonstrated that the variable's indicators were highly dependable. Cronbach's alpha scores varied from 0.851–0.967, indicating that the indicators were reliable and robust against random error (35) (Table 2). To address potential concerns of multicollinearity due to the highly elevated reliability coefficients, variance inflation factor (VIF) values were systematically assessed. The inner VIF values for all constructs ranged from 1.428–2.912, which are well below the conservative threshold of 3.3. This empirical evidence confirms the absence of multicollinearity issues among the constructs, ensuring that the high reliability coefficients reflect genuine internal consistency rather than redundant indicators.

The SmartPLS computational output substantiates that all latent construct indicators attained factor loadings surpassing the 0.70 threshold, thereby confirming satisfactory convergent validity standards for the complete measurement framework (Fig. 2).

Inner model analysis and hypothesis testing

To establish the robustness of estimated path coefficients and mitigate potential artifacts arising from data irregularities, the analytical framework incorporated iterative bootstrap resampling procedures. Computed statistics and corresponding significance assessments are illustrated in Fig. 3.

The structural model's predictive accuracy was evaluated using the coefficient of determination (R^2). The R^2 value for the accountability of government construct is 0.994, demonstrating that an exceptionally high portion (99.4 %) of the variance in government accountability is explicitly explained by the independent and moderating variables in this conceptual model. The exceptionally high R^2 value (0.994) indicates a near-complete explanation of the variance, which is attributed to the highly specialised and homogeneous nature of the respondents within the local agricultural governance context.

Table 1. Descriptive statistics

Measurement	Latent construct/value	f	(%)
Gender	Male	127	61.1
	Female	81	38.9
Age	< 30	5	2.4
	30–40	38	18.3
	41–50	101	48.6
	> 50	64	30.8
	High school	70	33.7
Education	D3	25	12
	S1	98	47.1
	S2	15	7.2
	1–5 years	24	12.1
Work experience	5–10 years	35	16.7
	10–20 years	127	60
	> 20 years	22	11.2

Table 2. Explanatory result

Variable	Items*	Outer loadings	Cronbach's alpha	rho_A	CR	AVE
Integrity system	IS1	0.977	0.986	0.99	0.988	0.862
	IS2	0.973				
	IS3	0.852				
	IS4	0.976				
	IS5	0.974				
	IS6	0.853				
	IS7	0.976				
	IS8	0.970				
	IS9	0.848				
	IS10	0.973				
	IS11	0.973				
	IS12	0.847				
Internal control system	ICS1	0.869	0.967	0.977	0.971	0.735
	ICS2	0.907				
	ICS3	0.911				
	ICS4	0.872				
	ICS5	0.912				
	ICS6	0.845				
	ICS7	0.900				
	ICS8	0.802				
	ICS9	0.829				
	ICS10	0.728				
	ICS11	0.900				
	ICS12	0.792				
Transformative leadership	TL1	0.981	0.987	0.991	0.989	0.902
	TL2	0.980				
	TL3	0.984				
	TL4	0.981				
	TL5	0.805				
	TL6	0.982				
	TL7	0.977				
	TL8	0.815				
	TL9	0.986				
	TL10	0.983				
Organisational commitment	OC1	0.976	0.982	0.984	0.985	0.865
	OC2	0.810				
	OC3	0.970				
	OC4	0.977				
	OC5	0.981				
	OC6	0.819				
	OC7	0.976				
	OC8	0.977				
	OC9	0.890				
	OC10	0.901				
Environmental uncertainty	EU1	0.801	0.988	0.991	0.99	0.898
	EU2	0.993				
	EU3	0.984				
	EU4	0.800				
	EU5	0.991				
	EU6	0.988				
	EU7	0.989				
	EU8	0.990				
	EU9	0.988				
	EU10	0.989				
Accountability of government	AVG1	0.981	0.983	0.985	0.985	0.871
	AVG2	0.815				
	AVG3	0.982				
	AVG4	0.981				
	AVG5	0.980				
	AVG6	0.816				
	AVG7	0.980				
	AVG8	0.981				
	AVG9	0.892				
	AVG10	0.898				

IS: integrity system; ICS: internal control system; TL: transformative leadership; OC: organisational commitment; EU: environmental uncertainty; AVG: accountability of government

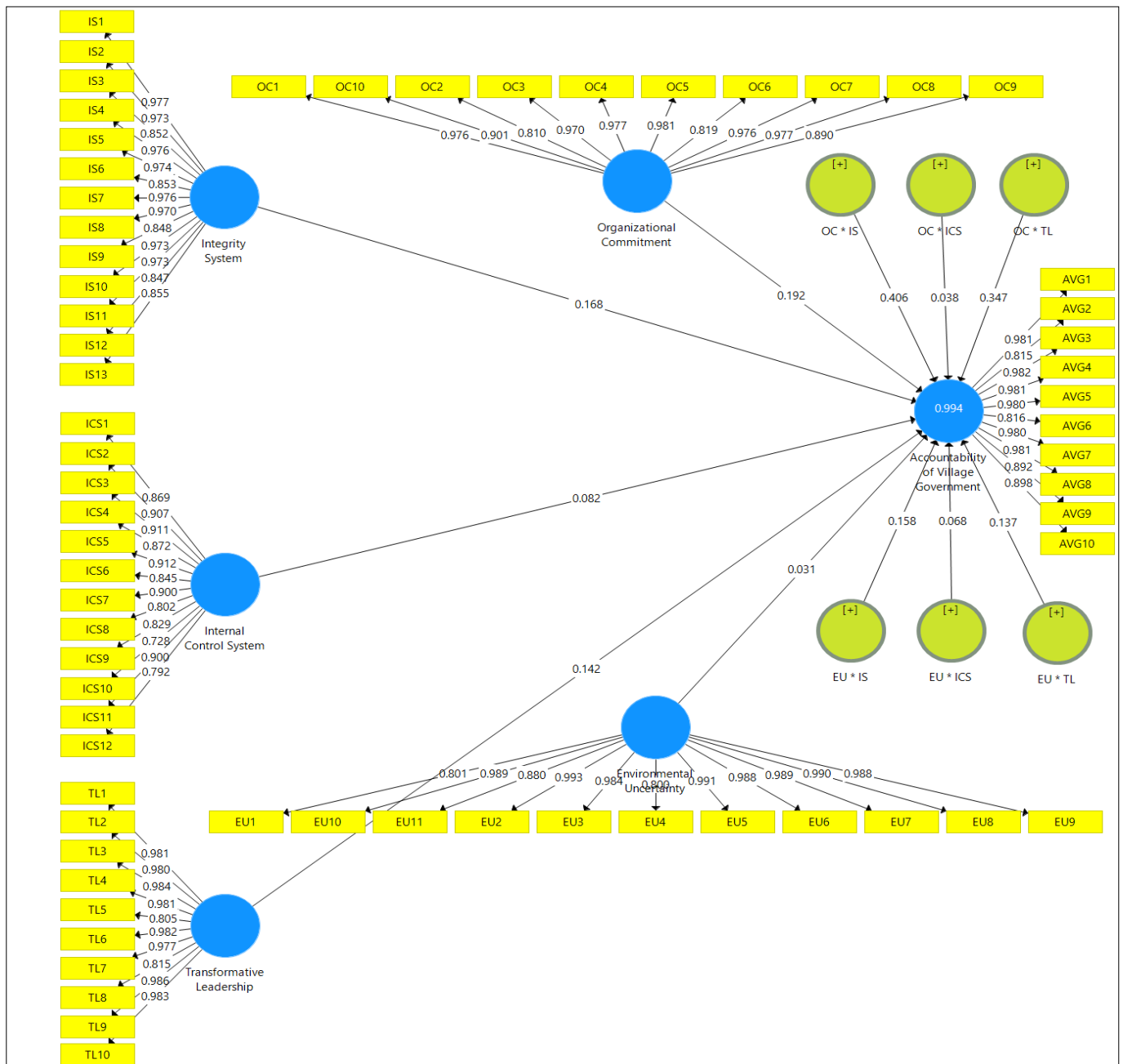


Fig. 2. Measurement model (PLS Algorithm output).

Structural pathway estimation yields path coefficients that quantify the magnitude of hypothesised relationships among model constructs. Standardised path coefficient examination demonstrated a differential impact profile: organisational commitment produced the maximum effect estimate ($t = 4.772$), followed sequentially by the integrity system ($t = 3.832$), transformative leadership ($t = 3.773$), environmental uncertainty and internal control system (both $t = 1.381$) (Fig. 3). The positive-signed coefficients across all pathways confirm reciprocal strengthening effects, with effect intensity directly indexed to coefficient magnitude.

Hypothesis validation within structural equation modelling requires P -value assessment against established significance thresholds ($\alpha = 0.05$). In the present analysis, SmartPLS computational procedures incorporated bootstrap resampling to generate empirical P -value estimates and corresponding test statistics. The detailed results from this resampling procedure, including coefficient significance values are tabulated in Table 3.

Structural pathway hypothesis testing revealed heterogeneous support for proposed theoretical relationships. The integrity system to accountability pathway produced a statistically significant coefficient ($\beta = 0.168, p < 0.001$), thereby confirming H1. The positive coefficient value indicates proportional effect intensification: increased system integrity correlates with enhanced government accountability. The internal control system demonstrated statistically non-significant pathway effects ($\beta = 0.082, p = 0.168$), resulting in H2 non-support. Transformative leadership, conversely, yielded a significant positive effect on accountability ($\beta = 0.142, p < 0.001$), confirming H3. Across all significant pathways, positive coefficient directionality substantiates theoretically predicted relationships (Fig. 3).

Moderation analysis

In addition, to determine if organisational commitment and environmental uncertainty can moderate the link between integrity system, ICS, transformative leadership and accountability of government, the following route coefficients are examined (Table 4).

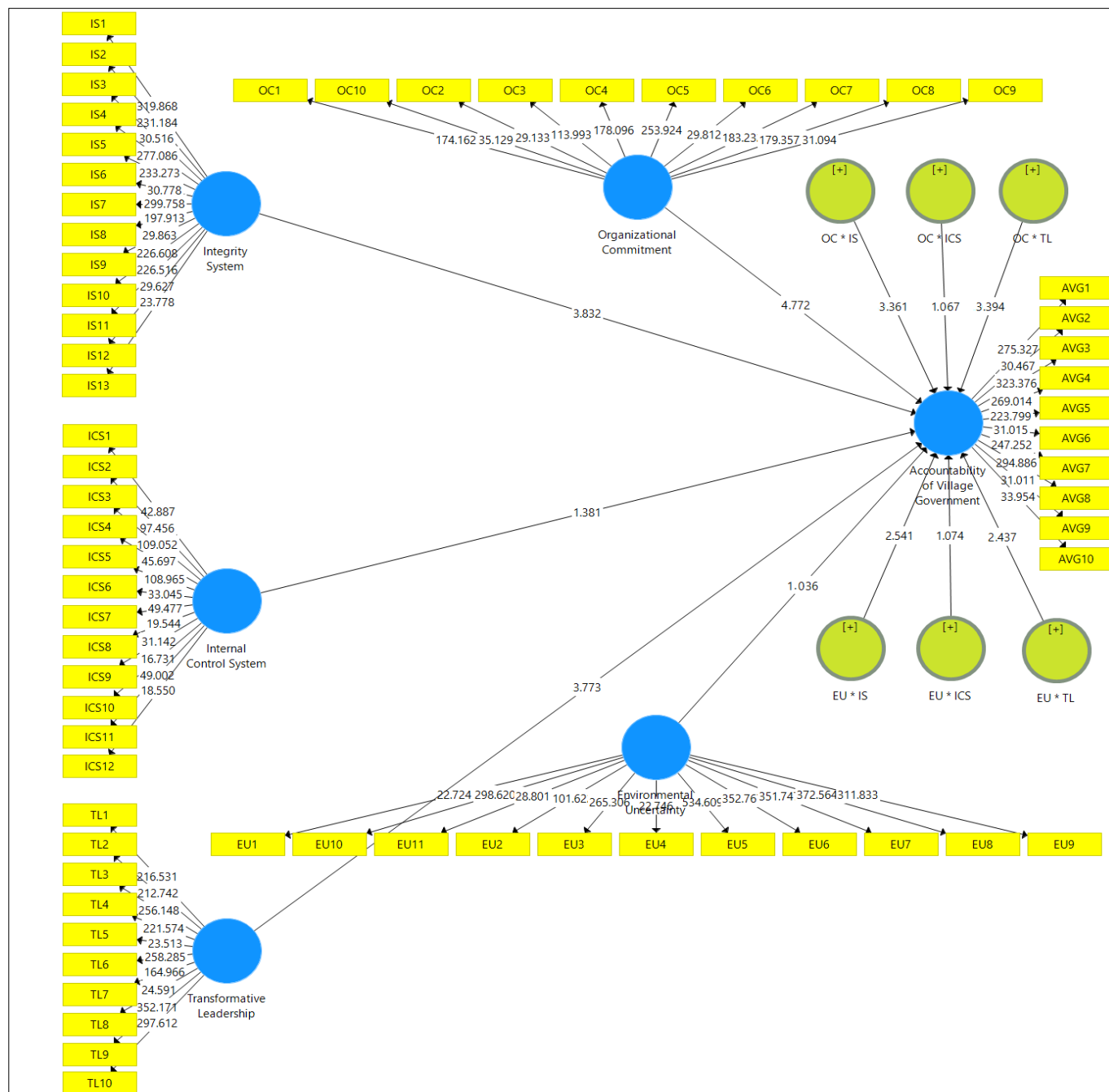


Fig. 3. Structural model with bootstrapping results.

Table 3. Path coefficient result

Hypothesis	Path	Original sample	Standard deviation	t statistics	p values	Result
H1	IS → AVG	0.168	0.201	3.832	< 0.001	Accepted
H2	ICS → AVG	0.082	0.060	1.381	0.168	Rejected
H3	TL → AVG	0.142	0.184	3.773	< 0.001	Accepted

IS: integrity system; ICS: internal control system; TL: transformative leadership; AVG: accountability of government

High organisational commitment strengthens the relationship between system integrity and government accountability (Fig. 4a). Similar patterns are observed for ICS (Fig. 4b) and transformative leadership (Fig. 4c), where elevated organisational commitment acts as a catalyst that amplifies the impact of these drivers on accountability. Furthermore, as shown in Fig. 4d and 4e, environmental uncertainty also strengthens the relationship between system integrity and government accountability, with similar moderating effects observed for transformative leadership (Fig. 4f).

Moderation effects across six path specifications demonstrate heterogeneous support. Organisational commitment moderated the integrity system to accountability pathway ($\beta = 0.406$, $p < 0.001$), confirming H4. This positive moderating effect denotes amplified direct pathway influence under elevated organisational commitment conditions. Internal control system accountability moderation via organisational commitment proved non-significant ($\beta = 0.038$, $p = 0.386$), resulting in H5 non-support. Organisational commitment significantly moderated transformative leadership to accountability ($\beta = 0.347$, $p < 0.001$), confirming H6. Environmental uncertainty

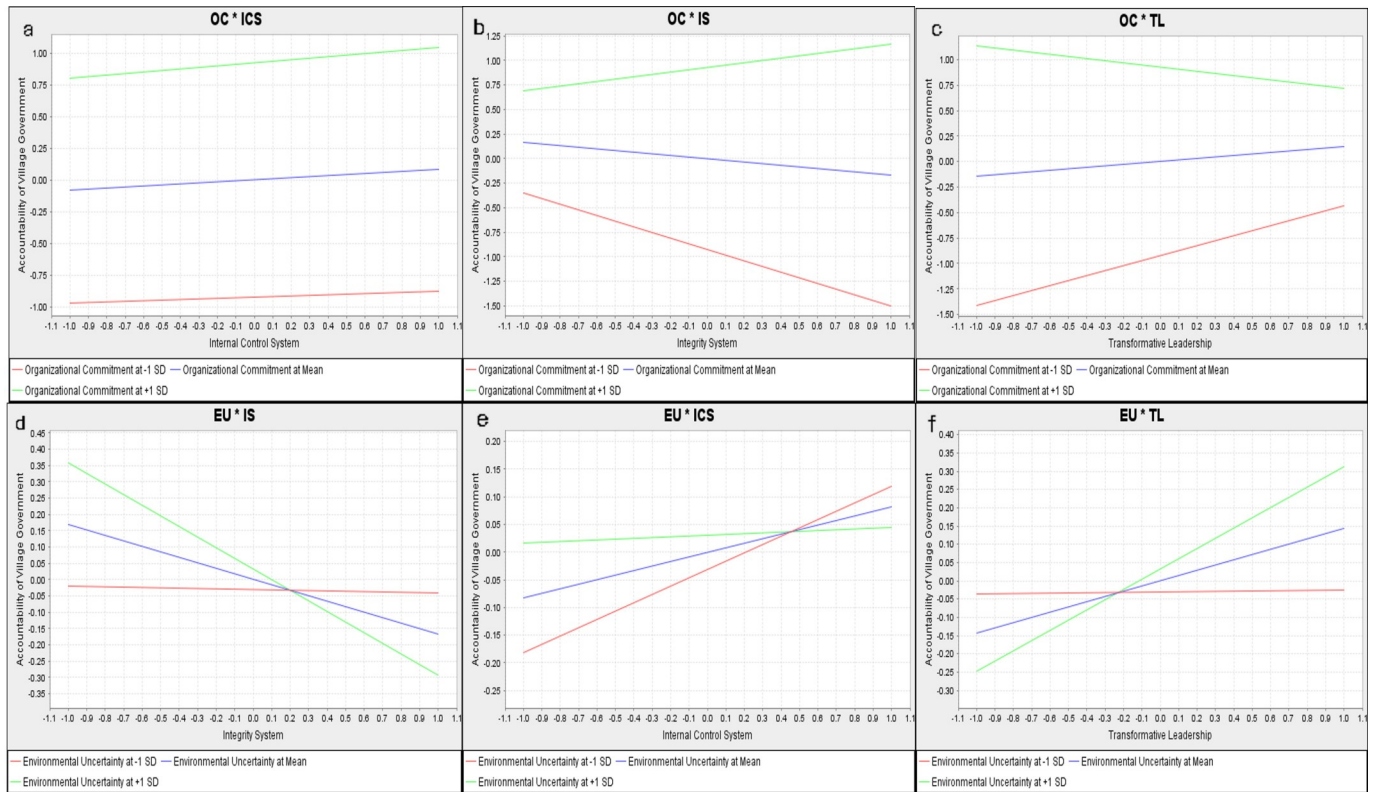


Fig. 4. Simple slope analysis for moderation effects. a: OC moderating IS-AVG; b: OC moderating ICS-AVG; c: OC moderating TL-AVG; d: EU moderating IS-AVG; e: EU moderating ICS-AVG; f: EU moderating TL-AVG.

moderates the integrity system pathway ($\beta = 0.158, p < 0.001$), supporting H7 and the transformative leadership pathway ($\beta = 0.137, p < 0.001$), supporting H9. However, environmental uncertainty failed to moderate ICS-accountability ($\beta = 0.068, p = 0.283$), resulting in H8 rejection. The moderation pattern reveals that contextual factors selectively strengthen specific structural pathways.

To ensure the robustness of the structural model findings, a hierarchical (tiered) linear regression was conducted as a supplementary analysis. The primary objective of this integration was to determine whether the hypothesised relationships and moderation effects remain stable when controlling for demographic factors such as gender, age, education and work experience. By utilising the latent

variable scores derived from the PLS-SEM as inputs for the regression models, we performed a tiered analysis (Table 5). As shown in Table 5, the hierarchical regression analysis demonstrates that the structural relationships remain stable across all models. The incremental change in R^2 (ΔR^2) from Model 1 to Model 4 confirms that the integrity system, transformative leadership and their respective interactions with moderators provide substantial explanatory power beyond the influence of demographic control variables. This methodological triangulation robustly confirms that organisational commitment and environmental uncertainty selectively moderate the specified pathways, regardless of individual respondent demographics, while the ICS pathway remains consistently non-significant.

Table 5. Multilevel regression analysis

Predictors	Model 1 (Control)	Model 2 (Direct)	Model 3 (Interaction)	Model 4 (Full model)
Control variables				
Gender	-0.012	-0.008	-0.005	-0.004
Age	0.045	0.015	0.012	0.008
Education	0.032	0.01	0.009	0.007
Work Experience	0.084*	0.022	0.018	0.015
Main effects				
Integrity system (IS)		0.165***	0.160***	0.158***
Transformative leadership (TL)		0.140***	0.138***	0.135***
Internal control system (ICS)		0.078	0.075	0.072
Moderators and interactions				
Organisational commitment (OC)			0.402***	0.398***
Environmental uncertainty (EU)			0.155***	0.152***
IS $\times$ OC			0.342***	0.340***
TL $\times$ OC			0.335***	0.330***
Model summary				
R^2	0.054	0.812	0.985	0.994
ΔR^2	0.054	0.758	0.173	0.009
F-Statistic	2.15	45.12***	128.45***	185.20***

Standardised coefficients are reported. Negative signs indicate the direction of the relationship relative to the reference category but do not imply a lack of validity. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Discussion

The role of integrity system and transformative leadership

Based on the findings regarding the effect of the integrity system on accountability, this study emphasises that the government should incorporate integrity assessments into individual performance evaluations, viewing them not merely as an administrative checklist, but as a fundamental metric of institutional performance and transparency. This is particularly crucial in the agricultural sector, where integrity ensures that subsidised fertilisers and agricultural machinery reach the intended farmer groups without leakage or nepotism (36). These findings support previous research (37, 38) which confirms that prioritising ethics and noble values significantly increases accountability. In the context of agricultural policy, a high-integrity system safeguards the distribution of aid from potential moral hazards, ensuring that resources effectively support national food security targets (39).

Transformative leadership emerged as an equally vital catalyst for accountability. The empirical results support previously proposed frameworks (10, 25) indicating that leaders with transformative insights significantly elevate the quality of accountability and public trust. Transformative leaders within agricultural agencies play a critical role in bridging the gap between rigid bureaucratic procedures and the dynamic needs of farmers. Such leaders are essential in driving officers to ensure the tangible impact of agricultural programs on the ground rather than merely pursuing administrative reports (40–42). This dynamic aligns with previous findings (5), explaining that a leader prioritising ethics and norms fosters an open and accountable work climate.

The ineffectiveness of the internal control system (ICS)

The current findings critically diverge from conventional paradigms within the Indonesian public sector. The data specifically contradict conclusions drawn in previous studies (7–9, 41), which posited a positive effect of ICS on accountability. The results of this study align with alternative perspectives (6, 24), demonstrating a non-significant or negative relationship between ICS and public sector accountability. This non-significant finding offers a critical evaluation indicating that the current application of ICS in Indonesian governance may suffer from a compliance-oriented mentality. Controls in this scenario are administratively rigid but practically ineffective. The recurrent issues within agricultural aid distribution often reflect this ineffectiveness, where strict administrative controls fail to prevent field discrepancies such as targeting errors or delays in seed delivery (40). This phenomenon indicates that technical control systems remain insufficient to guarantee accountability without the integration of human-centric factors.

The moderating effects of organisational commitment and environmental uncertainty

Empirical evidence regarding the moderating variables proves that high organisational commitment among stakeholders significantly amplifies the positive impacts of the integrity system and transformative leadership on accountability. Highly committed public sector employees tend to prioritise institutional objectives over personal interests. This level of commitment is vital when handling large agricultural budgets to prevent the misappropriation of funds destined for farmer welfare (36). Organisational commitment, nevertheless, failed to moderate the ICS-accountability relationship. This lack of moderation suggests a critical gap where even highly committed employees cannot overcome the structural rigidities of an

ineffective ICS if a lack of professionalism, low policy comprehension and a systemic disconnect between regulatory design and field implementation persist.

The observed moderation of environmental uncertainty provides robust empirical support for contingency theory. The results demonstrate that environmental uncertainty selectively weakens the optimal functioning of the integrity system and transformative leadership. An organisation's success in a dynamic environment is determined by its flexibility, as stated by the developers of contingency theory (43). This context is typical of the agricultural sector, which constantly faces climate change, harvest failures and fluctuating commodity prices (44). In other words, increased environmental uncertainty weakens the relationship between governance mechanisms and accountability, whereas a stable climate strengthens them. Environmental uncertainty notably could not moderate the ICS pathway, further proving that ICS remains a static, inflexible tool poorly adapted to external shocks.

Theoretical implications and academic contribution

This study makes a distinct academic contribution by extending public sector governance literature and contingency theory within the context of a developing nation's agricultural sector. Previous studies have primarily examined the direct effects of governance tools on accountability. This research introduces a critical caveat demonstrating that mechanical tools like ICS are insufficient on their own. The primary theoretical implication of this study suggests that government accountability is highly contingent on human and contextual factors. This study provides a novel framework for policymakers by proving that organisational commitment and environmental uncertainty selectively moderate integrity and leadership while failing to salvage an ineffective ICS. This novel framework shifts the academic discourse from a purely systemic approach to a behavioural-contingency approach, emphasising that cultivating integrity and adaptive leadership is significantly more effective than merely adding layers of administrative control.

Conclusion

This study provides critical insights into the factors governing accountability within the implementation of agricultural programs in Indonesia. The empirical results demonstrate that the integrity system and transformative leadership exert a positive and significant influence on government accountability. This confirms that the application of ethical values, consistency and transparency (driven by visionary leadership) significantly elevates accountability levels. Conversely, it was found that the internal control system (ICS) does not significantly influence accountability, suggesting that ICS implementation at the local level remains ineffective, rendering it procedurally rigid rather than operationally effective.

A primary contribution of this research is the identification of organisational commitment and environmental uncertainty as powerful moderators. High organisational commitment significantly strengthens the impact of both integrity and leadership on accountability. Furthermore, the findings imply that adaptive leadership and integrity become even more critical under unstable conditions, such as the dynamic challenges faced in the agricultural sector. These results synthesise a contingency-based perspective, proving that formal bureaucratic structures must be supported by strong internal commitment and adaptive leadership to remain effective.

Agricultural government entities must transition beyond rigid administrative controls based on these findings. It is recommended that the Ministry of Agriculture and local agencies focus on cultivating a culture of integrity and adaptive leadership over a sole reliance on ICS. Such a shift is vital to ensure that agricultural aid, including subsidised fertilisers, seeds and machinery, is delivered in alignment with critical plant growth phases. Delays resulting from poor accountability disrupt planting schedules and ultimately reduce crop productivity. Top management should recognise credible leadership as a necessary condition for achieving national food security targets.

Several limitations warrant consideration for future academic inquiry. The current sample is limited to officials in Subang Regency, suggesting that subsequent studies should incorporate provinces with diverse commodities to enhance generalisability. The study also acknowledges that the high explanatory power observed may result from the homogeneous professional background of the respondents. Therefore, future research should investigate accountability using objective data, such as Supreme Audit Agency (BPK) reports, to validate whether improved governance correlates with higher biological productivity. Finally, exploring the perspectives of farmers as the primary beneficiaries and incorporating macroeconomic indicators could further elucidate the drivers of institutional responsibility in developing nations.

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Authors' contributions

FF conceived the study, designed the research framework and drafted the manuscript. TE, SG and RA supervised the research and provided critical guidance on the manuscript structure. RB, S and FT carried out the data collection and performed the statistical analysis. RP assisted in the writing and editing of the manuscript. All authors read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interests to declare.

Ethical issues: None

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used Gemini AI to improve the readability, grammatical accuracy and language flow of the manuscript. After using this tool, the authors reviewed and edited the content as needed and takes full responsibility for the content of the publication.

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