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Simulation of Multiple Mediation Variables for Finding the Ideal Model to Improve the Performance of the Chicken Farming Business in Indonesia

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ABSTRACT

The success of chicken farming can be assessed using performance indicators. The present study aimed to investigate internal and external environmental factors, entrepreneurial skills, innovation, financial management, and the business performance of chicken farms in the Penebel District, Indonesia. A total of 51 chicken farmers meeting the criteria were included as the study sample. Data collection methods included interviews, surveys, documentation, and literature review. The analysis employed quantitative descriptive methods, including simple tabulation and generalized structured component analysis software. The feasibility of the initial model was tested, and if any discrepancies were found, the model was re-specified and retested until it achieved overall goodness-of-fit criteria. The simulation model included 11 paths connecting variables. Five path coefficients demonstrated significant effects, while six did not. Significant effects were found between the internal environment and entrepreneurship, the external environment and entrepreneurship, the internal environment and innovation, the external environment and innovation, and the internal environment and financial management. The present findings indicated that entrepreneurship did not serve as a mediating variable. The internal and external environments significantly impacted farmers' entrepreneurial skills. However, entrepreneurial skills did not significantly enhance business performance. Furthermore, internal and external factors influenced innovation, but innovation did not affect business performance.

Keywords: Business competence, Business environment, Business performance, Chicken farming, Financial management, Innovation

INTRODUCTION

Failures in business stem from a failure to understand and accurately identify the conditions of the business environment. Al-Maskari et al. (2019) stated that the external and internal business environments are interconnected and each presents its own challenges for a company. According to Borodakfo et al. (2015) and Toppinen et al. (2019), achieving a deeper understanding of the external and internal environments is crucial for companies to operate effectively, as it enables them to comprehend the market, consider strategic options, and compare optimal business strategies.

In a business environment that continues to evolve, entrepreneurs should ideally continue to enhance their entrepreneurial competence, innovation, and financial management skills. Entrepreneurial competence is essential for entrepreneurs because it enables them to advance their business, particularly in terms of business quality, coworker satisfaction, and forms of business cooperation with other parties (Kowal and Roztocki, 2015). Entrepreneurial competence plays a crucial role in

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implementing strategic business planning, including creating a vision and developing long-term priorities. Strategic business focuses on resource management, which can strengthen operations and adjust the company's direction according to environmental changes (Renfors, 2019). Furthermore, Nikitina and Lapiņa (2019) stated that entrepreneurial competence is a primary factor for effective business management in modern times, and this competence should be aligned with the interests of all stakeholders to have a positive impact on the business. In addition to entrepreneurial competence, innovation is a crucial factor in a business's progress. Innovation is closely related to the discovery of new combinations of resources that are generally more effective than existing ones (Tammekivi et al., 2024). Through business innovation, entrepreneurs can create more economic value by adding extra value to their innovations (Anokhin et al., 2016). The positive impact of innovation on the company is holding several dominant market positions, achieving long-term monopoly profits, generating substantial profits, and securing additional marginal market profits. The impact of innovation varies significantly by company, depending on the types of innovation they implement (Crowley and McCann, 2015). In addition, innovation plays a strategic role in business performance, as it can trigger increased business survival, facilitate significant business growth, and serve as a dynamic step in supporting business growth policies (Surya et al., 2021). In innovating, entrepreneurs should consider strategies that align with the aim of the business targets (Jo and Jang, 2022).

Financial management plays a crucial role in determining a business's stability. Effective financial management can significantly predict compulsive purchasing behavior in a business and lessen the impact of materialistic values on purchases (Alemis and Yap, 2013). An effective financial management system is essential for controlling costs in businesses, as it typically involves multiple parties (Xiao, 2016). Chen et al. (2023) stated that financial management offers practical benefits for policymakers, as it can be an effective way to enhance company performance and foster a sustainable business environment through proper implementation.

Poultry meat, particularly chicken, is an essential source of high-quality animal protein (Vlaicu et al., 2024). Chicken meat is superior to red meat because it contains less cholesterol and more vitamins, as well as balanced nutrients such as amino acids, energy, and micronutrients (Ali et al., 2019). Additionally, Household chicken farming helps to meet food security and nutrition goals (Ibrahim, 2020). On a broader scale, chicken meat production is more accessible, faster, and affordable than mammalian meat production (Chunga et al., 2023; Connolly and Campbell, 2023). With the growing global population, there is a greater demand for high-quality protein sources; hence, maintaining food supplies, especially chicken meat, is crucial (Pius et al., 2021; Castro et al., 2023). Therefore, the availability of stable and affordable chicken meat is critical to preventing malnutrition and nutritional deficiencies in society. Consequently, chicken farming should be efficiently managed to ensure sustainability and to provide high-quality chicken meat (Gržinić et al., 2022). Sustainable chicken farming can be achieved by producing high-quality livestock that is consumer-friendly, financially rewarding for farmers, and has lower environmental effects (Castro et al., 2023). Internal and external factors, such as chicken genetics, breeding techniques, farmers' skills, financial management, processing and packaging, transportation and distribution, marketing, consumer preferences, and regulations, all affect the sustainability of chicken farming (Zielińska-Chmielewska et al., 2021; Yang et al., 2024). Farmers' entrepreneurial skills, experience, and farm management competence are critical factors influencing the sustainability of the poultry business (Ramukhithi, 2023). Furthermore, a positive relationship exists between entrepreneurial competence and both financial performance and operational efficiency in farming (Nieuwoudt et al., 2017). Poultry farming integrates all the critical aspects of business principles, environmental awareness, competence, innovation, and financial management while also serving as a sector with high economic, nutritional, and social importance.

The present study aimed to enhance the performance of chicken farming enterprises in Penebel District, Indonesia, by investigating the mediating roles of entrepreneurial skills, innovation, and financial management links to internal and external environmental dynamics and business outcomes, to analyze and simulate these mediating factors to develop a comprehensive model for enhancing business performance.

MATERIALS AND METHODS

Study area

Penebel district is located at coordinates 8°26′13.718″ S 115°8′32.791″ E, Indonesia. The Penebel district borders the Baturiti district and Marga district to the east, Buleleng Regency to the north, Pupuan district, Selemadeg district, and Selemadeg Timur district to the west, and Kerambitan district and Tabanan district to the south (Figure 1). The Penebel district is renowned for its successful agricultural and livestock sectors. Agricultural sector commodities, especially fertile rice farming, as well

as plants such as coffee, vegetables, and fruits, are also widely cultivated in this area. At the same time, the potential of the livestock sector is chicken, cattle, and pig farming. Overall, the Penebel district is an area rich in natural and cultural potential, which provides a calm and comfortable atmosphere. In February 2024, the population of Penebel village was 4,326 people with 1,528 heads of families, most of whom were farmers and ranchers (Statistical Agency of Tabanan Regency, 2024).

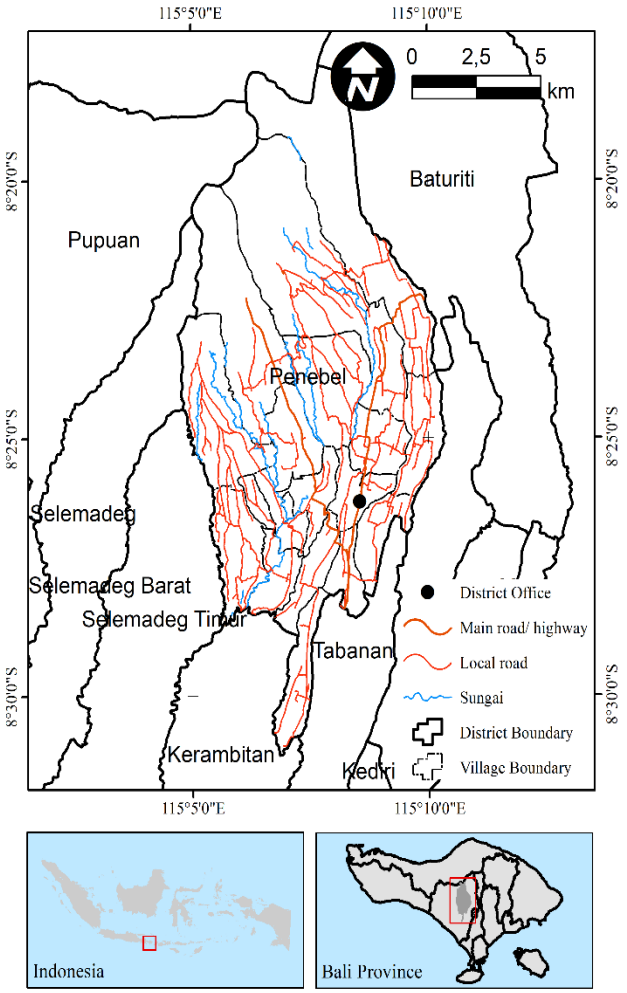

Figure 1. Study location in the Penebel district, Indonesia

Population and samples

The population in the present study comprised poultry farmers in the Penebel district who possessed more than 3,000 chickens. The population was primarily concentrated in three villages with the highest number of farmers, namely Jatiluwih, Senganan, and Babahan. According to the 2022 livestock business report (USPET) of Tabanan Regency, all 51 farmers were included as respondents for the present study; consequently, a census sampling method was employed, whereby the entire population served as the sample.

Data collection

The present study employed interviews as the primary data collection method, involving a process of direct communication through verbal questions and answers with the chicken farm owners. Two interview methods were employed, including structured interviews using a prepared questionnaire and in-depth interviews. The purpose of these interviews was to collect information that would address the study's objectives through in-person interactions between the interviewer and the chicken farm owner.

Out of the 17 villages in the Penebel district, three villages with the highest number of farmers (Jatiluwih, Senganan, and Babahan) were selected as the study sites. The villages were chosen because of their high density of poultry farming activities, which provided a comprehensive overview of the actual conditions and primary challenges in the Penebel district, Indonesia. Additionally, a survey was conducted using a questionnaire to collect data on internal and external environmental conditions, entrepreneurial competence, innovation, financial management, and business performance of chicken farm businesses in the district. The documentation method and literature study were then employed to collect data and literature related to chicken farming businesses in the district. All participants involved in the survey provided informed consent before their participation. The data was collected anonymously and used solely for academic and study purposes.

Variables

The present study employed six study variables measured through 49 indicators (Table 1). Each variable was assessed using a Likert scale, a rating instrument designed to capture respondents' opinions, attitudes, and motivations. Respondents could choose from a range of answers, including strong agreement, strong disagreement, and a neutral option in between (Tanujaya et al., 2022). The Likert scale consisted of statements or questions with response options of very good (VG), good (G), fairly good (FG), not good (NG), and not very good (NVG). Scores for each question ranged from one (not very good) to five (very good), based on the six study variables and 49 indicators. Respondents were asked to select the option that best suited their condition in relation to the statements or questions presented in the questionnaire.

Table 1. Variables and indicators for the simulation of multiple mediations in the chicken farming business performance in Indonesia

Variable (Code)	Indicator (Code)
Internal environment (LI)	Functional management (IS 1.1) Marketing (IS 1.2) Finance/accounting (IS 1.3) Production operations (IS 1.4) Research and development (LI1.5)
External environment (LE)	Bargaining power of buyers (LE 1.1) Product substitutes (LE 1.2) Economic power (LE 1.3) Social power (LE 1.4) Cultural power (LE 1.5) Demographic power (LE 1.6) Political power (LE 1.7) Governmental and legal power (LE 1.8) Technological power (LE 1.9)
Entrepreneurship competence (KW)	Making decisions under uncertainty (KW 1.1) Process adding value (KW 1.2) Ability to cope with failure (KW 1.3) Desire to grow (KW 1.4) Detecting and exploiting opportunities (KW 1.5) Self-concept (KW 1.6) People management skills (KW 1.7) Logical analytical skills (KW 1.8) Intellectual skills (KW 1.9) Interpersonal skills (KW 1.10) Adaptability skills (KW 1.11)
Innovation (I)	Product quality (I 1.1) Product development (I 1.2) Cost savings (I 1.3) New business (I 1.4) Marketing techniques (I 1.5) New marketing media (I 1.6) Developing new services (I 1.7) Creating new customer interactions (I 1.8)
Financial management (MK)	Planning (MK 1.1) Budgeting (MK 1.2) Management (MK 1.3) Searching (MK 1.4) Fund retention (MK 1.5) Controlling (MK 1.6) Auditing (MK 1.7) Financial reporting (MK 1.8)
Business Performance (KU)	Business scale level (KU 1.1) Profitability (KU 1.2) Market share (KU 1.3) Employment growth (KU 1.4) Sales growth (KU 1.5) Timeliness (KU 1.6) Cost-effectiveness (KU 1.7) Market growth (KU 1.8)

Data analysis

The respondents' answers were analyzed using descriptive statistical methods. The percentage of respondents who selected each indicator was calculated using Formula 1, where the proportion (P) is obtained by dividing the number of respondents in a given category (fi) by the total number of respondents (∑fi) and multiplying by 100.

$$P = fi/ \Sigma fi \times 100\% \quad \text{Formula 1}$$

Furthermore, to measure the variability of responses, the standard deviation (δ) was computed using Formula 2 (Curran-Everett, 2008). This formula accounts for the distribution of individual values (X) from the mean (x) in relation to the total number of samples (n).

$$\delta = \sqrt{\Sigma(X-x)^2/ (n-1)} \quad \text{Formula 2}$$

The criteria for interpreting the scores were calculated using the class interval method (de la Rubia, 2024). The lowest score was one, and the highest was five, yielding a range of R = 5 – 1 = 4. From this, the interval width was calculated as w = 4/5 = 0.8. The interpretation of questionnaire responses, categorized by interval and category, is presented in Table 2. Subsequently, respondents' answer scores were measured using Formula 3.

$$R = (Rs/ n) \times 100\% \quad \text{Formula 3}$$

Rs represents the average respondent's answer score, and n represents the maximum respondent's answer score.

The criteria for interpreting respondents' answer scores were calculated using the class interval method (de la Rubia, 2024). The lowest value was 0% and the highest was 100%. The interpretation of questionnaire responses, presented by percentage scores and categories, is shown in Table 3.

The effectiveness of simulating entrepreneurial competency models, innovation, and financial management as mediating variables between the internal and external environments on the performance of chicken farming businesses in the Penebel district, Indonesia, was analyzed using generalized structured component analysis (GSCA). The first stage in the SEM model analysis was to test the feasibility of the initial model. If any discrepancies were identified, the model was adjusted and testing resumed until an adequate level of feasibility was reached, based on overall goodness-of-fit criteria. The next step involved examining the relationships among variables, including mediators, using the structural model evaluation. The GSCA analysis in the present study was conducted through several stages (Jung et al., 2012; Ramadhani et al., 2023). The process began with collecting interview results from chicken farm owners in the Penebel district, Indonesia, regarding internal and external environmental conditions, entrepreneurial competence, innovation, financial management, and business performance. The

interview data were then converted into ordinal data using a 5-point Likert scale, entered into Microsoft Excel, and grouped according to analytical requirements. Subsequently, a GSCA model was constructed using GSCA Pro Windows 1.2.1.0 software. The tabulated data from Excel were imported into the GSCA program, where a path diagram of the variables, including internal and external environmental conditions, entrepreneurial competence, innovation, financial management, and business performance, was compiled. Indicator estimates were generated for each variable, and the variables were connected through an Add Path process to establish the GSCA model framework.

Mediation testing was then performed by examining coefficient differences (Hwang et al., 2023). This procedure involved assessing the direct and indirect effects of independent variables on dependent variables, both with and without the mediation of intervening variables. The role of the mediation variables was classified into four categories, namely, complete mediation, partial mediation, non-mediation, or no mediation, depending on the significance and comparative strength of coefficients. If the significance test was not valid, the analysis returned to the path diagram stage for re-specification, after which the subsequent steps were repeated (Hermanu et al., 2024). Finally, the model was tested and its overall fit evaluated. The model framework representing the three objectives of the present study is presented in Figure 2.

Structural model evaluation was conducted using path coefficients and their significance levels. Path coefficients (Pij) indicated the direct effect of exogenous variables (j) on endogenous variables (i), ranging from −1 to +1, with values closer to the extremes reflecting stronger relationships (Chaitanya et al., 2024; Haji-Othman et al., 2024). The study framework is shown in Figure 3.

Table 2. Intervals and categories for the questionnaire in the present study

No	Interval	Category
1	1.0 – 1.8	Not very good
2	1.8 ≥ 2.6	Not good
3	2.6 ≥ 3.4	Fairly good
4	3.4 ≥ 4.2	Good
5	4.2 ≥ 5.0	Very good

Table 3. Scores, percentages, and categories for the questionnaire in the present study

No	Score (%)	Category
1	20 - 36	Not very good
2	36 - 52	Not good
3	52 - 68	Fairly good
4	68 - 84	Good
5	84 - 100	Very good

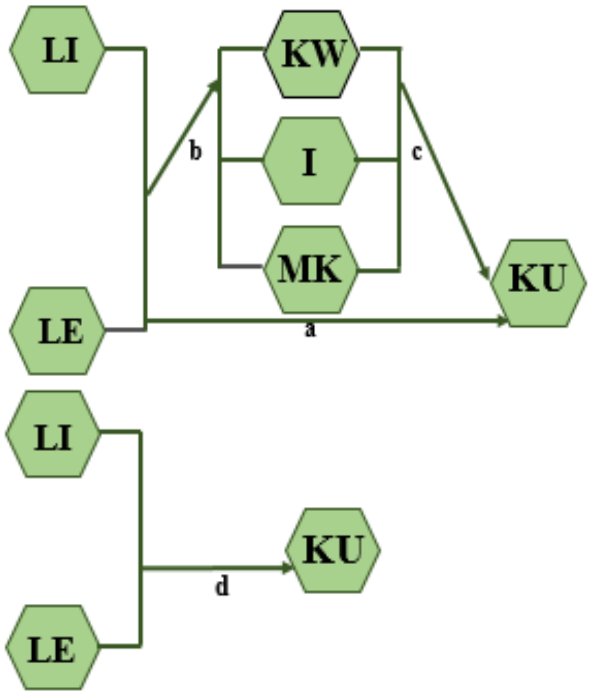

Figure 2. The generalized structured component analysis method was used in the present study. On the left: The GSCA model framework is successfully mediated by entrepreneurship, innovation, and financial management competencies. On the right: The GSCA model framework is not mediated by entrepreneurship, innovation, and financial management competencies. LI: Internal environment, LE: External environment, KW: Entrepreneurial competence, I: Innovation, MK: Financial management, KU: Business performance.

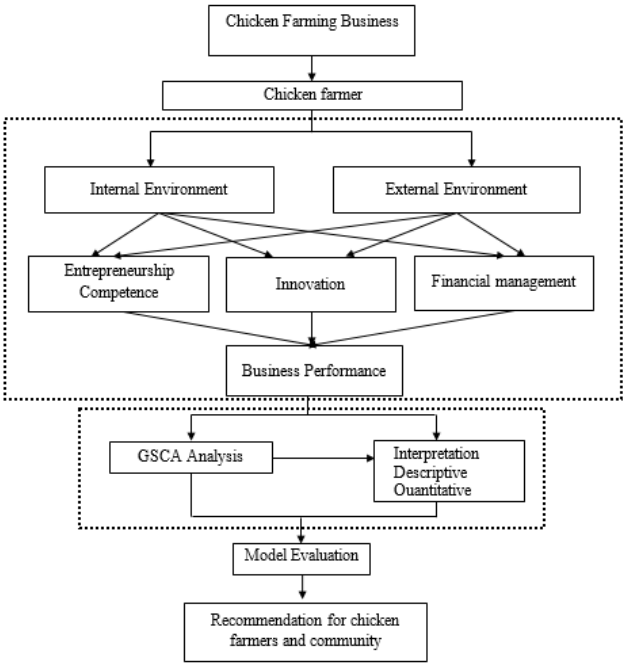

Figure 3. Study diagram

RESULTS AND DISCUSSION

Table 4 presents the descriptive statistics of the internal environment indicator in chicken farming in the Penebel district, Indonesia. The highest mean score among the internal environment indicators was for the marketing indicator (LI1.2), indicating that chicken farmers could effectively sell their eggs without concern for unsold stock. Marketing was often handled through intermediaries, with distribution reaching beyond Tabanan to places such as Denpasar. Conversely, the lowest mean score was in the development indicator (LI1.5), indicating limited efforts in this area. Farmers generally relied on traditional methods, and financial constraints, along with concerns about possible failure, discouraged investment in research and development. Consistent with the present findings, Khan et al. (2024) observed that financial barriers and risk considerations limited farmers' willingness to pursue innovation.

Table 5 indicates descriptive statistics of the external environment. An average standard deviation of 0.58 with a score of 55.47%, categorized as poor. External environmental management in chicken farming was still limited. The highest average score was recorded in the government and legal strength indicator (LE1.8), with a score of 4.31 or 86.27%, categorized as good. This result reflected the government's role in setting regulations related to animal health, safety, and environmental guidelines for livestock businesses, as well as its efforts to socialize these regulations. Most chicken farmers had successfully implemented the required guidelines in their operations. Conversely, the lowest average score was found in the social strength indicator (LE1.4), with a score of 1.47 or 29.41%, categorized as poor. Social strength referred to cooperation or partnerships with other local farmers. Field conditions indicated that such partnerships were still minimal, as many farmers preferred to operate independently, believing their businesses could continue effectively despite several challenges.

Table 6 demonstrates the standard deviation, mean score, and categories of Entrepreneurship in the Penebel district, Indonesia. An average standard deviation of 0.66 with an average score of 76.86%, categorized as sufficient. Chicken farmers demonstrated adequate entrepreneurial competence, with several aspects of entrepreneurship being applied in managing their businesses. The highest average score was found in the ability to make decisions under uncertainty (KW1.1), with a score of 4.75 or 94.90%, categorized as very good. Uncertainty in chicken farming included price fluctuations, pest and disease outbreaks, weather variability, and other external factors. Farmers generally considered their decisions effective in addressing these challenges. For instance, the farmers routinely administered vaccines and medicines to manage disease risks. To mitigate the impact of price fluctuations, farmers prepared savings or took loans to avoid bankruptcy. In contrast, the lowest average score was observed in the value-added process indicator (KW1.2), with a score of 1.92 or 38.43%, categorized as poor. Adun et al. (2024) describe value-added as enhancing a product's worth through activities such as processing, relocation, or storage. However, chicken farmers in the Penebel district, Indonesia, did not participate in additional processing of primary or by-products.

Table 7 illustrates the descriptive statistics of financial management in the Penebel district, Indonesia. An average standard deviation of 0.66 with an average score of 68.48%, categorized as sufficient. The highest score was found in the financial control indicator (MK1.6), with a score of 4.73 or 94.51%, categorized as very good. Financial control was implemented by identifying and addressing financial deviations that occurred in chicken farming operations. Farmers considered financial control a crucial aspect, and the majority consistently applied it to anticipate potential problems in their businesses. Conversely, the lowest score was recorded in the fund storage indicator (MK1.5), with a score of 2.80 or 56.08%, categorized as poor. Farmers faced difficulties in saving funds from their chicken businesses due to frequent fluctuations in egg prices, which resulted in unstable income and limited their ability to save consistently. As noted by Kalangi et al. (2024), volatile egg prices made it difficult for farmers to maintain regular savings from their profits.

Table 8 presents the standard deviation, mean score, and categories of innovation in the Penebel district, Indonesia. The average standard deviation was 0.47, with an average score of 43.33%, categorized as poor. Chicken farming businesses in the Penebel district still lacked innovation, as most farmers managed their operations conventionally and followed established practices. The highest score was recorded in the product quality indicator (I1.1), which reached 100% in the very good category. Farmers considered product quality, particularly chicken eggs, the most critical aspect of their businesses, and they continued to make improvements in producing high-quality products. In contrast, the lowest score was in the new business indicator (I1.4), at 21.57%, categorized as poor. The indicator assesses the development of novel farming techniques, but farmers demonstrated minimal

innovation, largely adhering to traditional methods (Molina, 2021).

Table 9 demonstrates the standard deviation, mean score, and categories of business performance in the Penebel district, Indonesia. The average standard deviation was 0.71, with an average score of 54.85%, categorized as poor. Overall, chicken farmers faced significant challenges, particularly fluctuations in feed and egg prices, which led to instability in their business performance. The highest score was found in the timeliness indicator (KU1.6), which reached 4.53 or 90.59%, categorized as very good. The present results reflected the ability of farmers to maintain timely production processes, such as ensuring proper chicken care so that hens began laying eggs within the expected age range of 18 to 22 weeks. Conversely, the lowest score was recorded in the sales growth indicator (KU1.5), at 1.53 or 30.59%, categorized as poor. Limited capital and highly variable income made it difficult for farmers to expand their flocks, thereby restricting the growth of egg sales (Tenza et al., 2024).

Although farmers may possess adequate entrepreneurial competencies, external factors such as fluctuations in feed and egg prices have more substantial and immediate influences on business performance. These external challenges directly affected production costs and revenue streams, thereby undermining the stabilizing role of internal mechanisms. In these contexts, leadership abilities, financial strategies, and innovation cannot fully protect farmers from market-driven risks. Smallholder chicken farms are structurally vulnerable, meaning that external market conditions, such as fluctuating prices, can easily outweigh the benefits of their internal skills and efficiencies.

Table 10 presents the path coefficients for each variable. A coefficient is considered statistically significant when the absolute critical ratio (CR) value exceeds 1.96, corresponding to the significance level ($p < 0.05$). This threshold indicates that there is less than a 5% probability that the observed relationship occurred by chance, thereby supporting the reliability of the estimated effect (Di Leo and Sardanelli, 2020). Conversely, CR values below this threshold suggest that the relationship is not statistically significant, implying that the corresponding path does not contribute meaningfully to the model. In the simulation model, there were 11 path relationships among variables, with five path coefficients showing significant effects and six showing insignificant effects.

The path coefficient from the internal environment to entrepreneurship was 2.792, indicating a positive effect. The Internal environment significantly influenced entrepreneurship ($p < 0.05$). Marketing functions in livestock businesses, such as customer analysis, product or service sales, product and service planning, pricing, distribution, marketing research, and opportunity analysis, support the development of self-concept, people management skills, and intellectual abilities. Additionally, marketing and financial/accounting activities in chicken farming have shaped farmers' entrepreneurial traits, including decision-making, leadership, and knowledge.

The path coefficient from the external environment to entrepreneurship was 4.051, showing a positive and significant effect ($p < 0.05$). Factors such as product substitution, economic strength, and demographic strength significantly impacted farmers' self-concept, management skills, and intellectual abilities. These external factors impact the resilience of chicken farming, prompting farmers to enhance their entrepreneurial skills in order to sustain their operations. The dynamic economic conditions of the chicken farming sector, particularly price fluctuations, demand variations, and supply shifts, motivate farmers to enhance their intellectual and managerial capacities to adapt to market conditions. The path coefficient from the internal environment to innovation was 3.321, indicating a positive and significant effect ($p < 0.05$). The internal environment, shaped by marketing and financial/accounting indicators, significantly impacted farmers' ability to develop marketing techniques and create new services ($p < 0.05$). Market conditions drive innovation in techniques that meet industry needs. At the same time, financial factors influence decisions to offer new services such as forming partnerships, investing, joining groups, or developing alternative payment systems. For example, downturns in financial conditions often lead farmers to form partnerships to reduce risks. In contrast, the path coefficient from the external environment to innovation was -4.017, showing a significant negative influence ($p < 0.05$).

External factors, such as product substitution, economic, and demographic strength, tend to restrict rather than promote innovation in marketing and services. Finally, the path coefficient from the internal environment to financial management was 2.333, indicating a positive and significant effect ($p < 0.05$). Internal conditions, particularly marketing and financial factors, play a crucial role in shaping financial management practices, including planning, budgeting, sourcing, and saving.

The analysis indicated that entrepreneurship did not function as a mediating variable. Both internal and

external environments significantly influenced farmers' entrepreneurial competencies, but these competencies did not translate into improved business performance. Similarly, the internal and external environments significantly affected innovation, yet innovation had no impact on performance. Innovation in chicken farming in the Penebel district, Indonesia, has remained limited, particularly in terms of technology adoption, as most farmers continue to rely on conventional practices. This finding aligns with the results of Wang et al. (2023) and Majeed et al. (2023), who suggested that innovation in renewable technology remains limited due to farmers' financial constraints in adopting technologies. The present study revealed that financial management did not affect business performance. Some farmers did not practice effective financial management in their operations, instead managing their farms informally.

Table 4. Descriptive statistics of the internal environment indicator in chicken farming in the Penebel district, Indonesia (2024)

Indicator	Standard deviation	Average score*	Score (%)	Score category
Internal environmental				
Function management (li1.1)	0.84	3.24	64.71%	Moderate
Marketing (li1.2)	0.73	3.47	69.41%	Moderate
Finance/accounting (li1.3)	0.48	2.35	47.06%	Poor
Operation production (li1.4)	0.42	3.16	63.14%	Fair
Research and development (LI1.5)	0.61	1.71	34.12%	Poor
Average	0.62	2.78	55.69%	Fair

Table 5. Descriptive statistics of the external environment indicator in chicken farming in the Penebel district, Indonesia (2024)

Indicator	Standard deviation	Average score*	Score (%)	Score category
External environment				
Buyer bargaining power (LE1.1)	0.50	3.57	71.37%	Moderate
Product substitution (SP; LE1.2)	1.44	2.14	42.75%	Poor
Economic strength (KE; LE1.3)	0.60	3.20	63.92%	Fair
Social strength (KS; LE1.4)	0.88	1.47	29.41%	Poor
Cultural strength (KB; LE1.5)	0.50	3.47	69.41%	Moderate
Demographic strength (KD; LE1.6)	1.06	3.39	67.84%	Moderate
Political strength (KP; LE1.7)	1.25	2.04	40.78%	Poor
Government and legal strength (KPH; LE1.8)	0.47	4.31	86.27%	Good
Technological strength (KT; LE1.9)	0.99	1.88	37.65%	Poor
Average	0.86	2.83	56.60%	Fair

Table 6. Descriptive statistics of the entrepreneurship indicator in chicken farming in the Penebel district, Indonesia (2024)

Indicator	Standard deviation	Average score*	Score (%)	Score category
Entrepreneurship				
Decision-making under uncertainty (KW1.1)	0.52	4.75	94.90%	Very Good
Value-adding process (KW1.2)	1.68	1.92	38.43%	Poor
Failure management (KW1.3)	0.66	4.37	87.45%	Good
Growth orientation (KW1.4)	0.63	4.25	85.10%	Good
Opportunity detection and exploitation (KW1.5)	1.08	4.14	82.75%	Good
Self-concept (KW1.6)	0.87	4.08	81.57%	Good
People management skills (KW1.7)	0.84	4.25	85.10%	Good
Analytical logic skills (KW1.8)	0.42	3.78	75.69%	Moderate
Intellectual ability (KW1.9)	0.57	2.57	51.37%	Poor
Interpersonal skills (KW1.10)	0.52	4.23	85.10%	Good
Adaptability skills (KW1.11)	0.70	3.90	78.04%	Moderate
Average	0.77	3.84	76.86%	Moderate

Table 7. Descriptive statistics of the financial management indicator in chicken farming in the Penebel district, Indonesia, 2024

Indicator	Standard deviation	Average score*	Score (%)	Score category
Financial management				
Planning (MK1.1)	0.74	2.88	57.65%	Fair
Budgeting (MK1.2)	0.83	2.84	56.86%	Fair
Management (MK1.3)	0.51	3.76	75.29%	Moderate
Funding disbursement (MK1.4)	0.24	4.06	81.18%	Good
Fund storage (MK1.5)	0.69	2.80	56.08%	Fair
Control (MK1.6)	0.57	4.73	94.51%	Very good
Auditing (MK1.7)	0.66	3.14	62.75%	Fair
Financial report (MK1.8)	0.99	3.18	63.53%	Fair
Average	0.66	3.42	68.48%	Moderate

Table 8. Descriptive statistics of the innovation indicator in chicken farming in the Penebel district, Indonesia, 2024

Indicator	Standard deviation	Average score*	Score (%)	Score category
Innovation				
Product quality (I1.1)	0.00	5.00	100.00%	Very good
Product development (I1.2)	0.80	1.63	32.55%	Poor
Cost-saving measures (I1.3)	0.66	2.92	58.43%	Fair
New business (I1.4)	0.34	1.08	21.57%	Poor
Marketing technique (I1.5)	0.81	2.10	41.96%	Poor
New marketing media (I1.6)	0.40	1.20	23.92%	Poor
Developing new services (I1.7)	0.73	1.41	28.24%	Poor
Engaging with new customers (I1.8)	0.00	2.00	40.00%	Poor
Average	0.47	2.17	43.33%	Poor
Business performance				
Business scale level (KU1.1)	0.69	2.86	57.25%	Fair
Profitability (KU1.2)	0.56	2.35	47.06%	Poor
Market share (KU1.3)	0.81	2.47	49.41%	Poor
Workforce growth (KU1.4)	0.50	2.10	41,96%	Poor
Sales growth (KU1.5)	0.92	1.53	30.59%	Poor
Timeliness (T; KU1.6)	0.50	4.53	90.59%	Very good
Cost-effectiveness (C; KU1.7)	0.80	3.27	65.49%	Moderate
Market growth (PPR; KU1.8)	0.91	2.82	56.47%	Fair
Average	0.71	2.74	54.85%	Fair

Table 10. Path coefficients

Number	Path coefficients	Estimate	SE	CR
1	LI→KW	0.402	0.144	2.792*
2	LE→KW	0.474	0.117	4.051*
3	LI→I	0.744	0.224	3.321*
4	LE→I	-0.711	0.177	-4.017*
5	LI→MK	0.385	0.165	2.333*
6	LE→MK	-0.207	0.236	-0.877
7	LI→KU	-0.054	0.237	-0.228
8	LE→KU	0.111	0.283	0.392
9	KW→KU	-0.243	0.266	-0.914
10	I→KU	0.043	0.238	0.181
11	MK→KU	-0.191	0.154	-1.240

LI: Internal environment, LE: External environment, KW: Entrepreneurial competence, I: Innovation, MK: Financial management, KU: Business performance, SE: Standard error, CR: Critical ratio. Notes: *: Significant at level of 5% ($p < 0.05$).

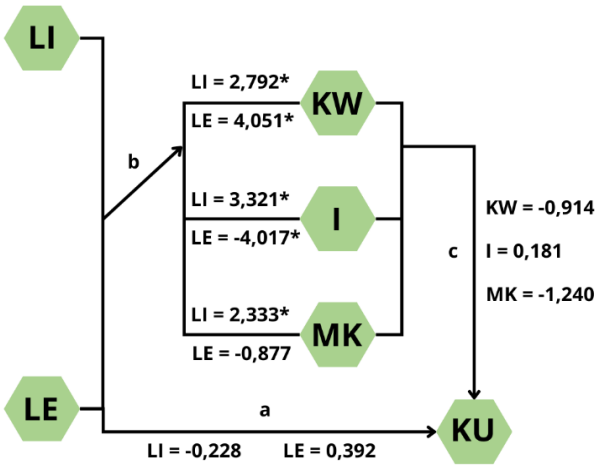

Figure 4. Mediating variables, internal and external environments of chicken farming business in the Penebel district, Indonesia, 2024. LI: Internal environment, LE: External environment, KW: Entrepreneurial competence, I: Innovation, MK: Financial management, KU: Business performance.

The simulation of the entrepreneurial competency model, with innovation and financial management as mediating variables between the internal and external environments and the performance of chicken farming businesses in the Penebel district, is illustrated in Figure 4. The effectiveness of the mediating variables in the model was assessed by examining the significance of each variable's path coefficient value, and they were then grouped into perfect mediation, partial mediation, or non-mediating variables.

The test results on the effectiveness of entrepreneurship as a mediating variable revealed that entrepreneurship was not a mediating variable for either the internal or external environments (Liu et al., 2024). The CR value of criterion b from the internal environment to entrepreneurship indicated a significant difference at 2.792 ($p < 0.05$), while criterion b from the external environment to entrepreneurship indicated a significant difference at 4.051 ($p < 0.05$). However, in criterion c, the CR value from entrepreneurship to business performance was insignificant at -0.914. Thus, although criterion b was significant, the insignificance of criterion c indicated that entrepreneurship was not a mediating variable for the relationship between the internal and external environments.

Entrepreneurship indicated no significant effect on the performance of chicken farming businesses. Field study revealed that the entrepreneurial competence of farmers in managing their businesses had not been sufficient to drive performance. While the internal and external environments greatly influenced entrepreneurial competence, entrepreneurship still had a limited impact on improving performance. The performance of chicken farming businesses was significantly affected by price fluctuations, particularly in feed and egg prices. Although entrepreneurial competence had improved, it was insufficient to counteract these fluctuations. Although the internal and external environments significantly influenced entrepreneurial competence, the mediating effect of entrepreneurial competence on business performance was not established.

The current outcome was primarily due to the absence of a significant relationship between entrepreneurial competence and business performance. In the Penebel district of Indonesia, poultry farming offers opportunities to develop entrepreneurial skills and enhance decision-making. However, these improvements have not yet resulted in noticeable improvements in business performance. The external shocks, especially fluctuations in egg and feed prices, appeared to overshadow the potential contributions of entrepreneurial competence. These market fluctuations had a greater impact on performance outcomes, rendering the role of entrepreneurial competence a statistically insignificant mediator. This finding suggests that, while competence is essential, its impact on performance is highly contingent upon stable market conditions and complementary support, such as access to capital, innovation, and technology adoption.

The current results on the effectiveness of innovation as a mediating variable were conducted through significance testing of the CR value. The CR value of criterion b from the internal environment to innovation was significant at 3.321, while criterion b from the external environment to innovation was significant at -4.017 ($p < 0.05$). However, in criterion c, the CR value from innovation to business performance was insignificant at 0.181. Therefore, innovation was not a mediating variable between the internal and external environments. Innovation demonstrated no significant effect on the performance of chicken farming businesses. Innovation was minimal in the Penebel district, Indonesia, particularly in technology adoption. Field interviews and observations revealed that nearly all farmers continued to rely on conventional methods. Innovation in renewable technology was rare due to farmers' limited capital. Production processes generally adhered to traditional practices, as farmers avoided the risks linked to new methods. Consequently, innovation had less influence on performance. It was necessary to enhance innovation, knowledge sharing, and technology transfer in the chicken farming industry. The current results on the effectiveness of financial management as a mediating variable also

relied on significance testing using the CR value. The CR value of criterion b, from the internal environment to financial management, was significant at 2.333 ($p < 0.05$), whereas the CR value of criterion b, from the external environment to financial management, was insignificant at -0.877. The CR value of criterion c, from financial management to business performance, was also insignificant at -1.240. Therefore, financial management was not a mediating variable between the internal and external environments. Additionally, financial management indicated no significant effects on business performance. Some farmers did not engage in financial practices such as bookkeeping and instead performed their businesses informally. Other farmers applied financial management such as planning, recording, controlling, and saving, but only at a basic level. This basic form of financial management was not enough to enhance the financial performance of chicken farming businesses. Overall, the simulation results indicated that entrepreneurial competence, innovation, and financial management did not function as mediating variables between the internal and external environments and business performance in the Penebel district, Indonesia. Furthermore, the internal and external environments did not have a direct and significant impact on performance. Other external factors strongly influenced outcomes, especially fluctuations in egg and feed prices. Farmers in the Penebel district struggled to improve performance due to these price changes, as they acted as price takers with no influence over market rates. Rising feed costs increased production expenses, while unstable egg prices resulted in significant fluctuations in income. The entrepreneurial skills, innovation, and financial management of farmers were not enough to overcome these fluctuations and therefore did not provide a solution for improving the performance of chicken farming businesses.

CONCLUSION

The present study indicated that the performance of chicken farming businesses in the Penebel district, Indonesia, remained weak, particularly due to minimal innovation and limited financial capacity. Entrepreneurial competence, innovation, and financial management did not function as mediating variables among internal and external environments and business performance. Furthermore, performance was not significantly affected by either internal or external environments. Instead, the primary factors influencing performance were external market conditions, particularly changes in feed and egg prices. These findings suggested that future efforts should prioritize strengthening innovation capacity, improving financial resilience, and developing strategies to mitigate market volatility, thereby enhancing the sustainability of chicken farming businesses. Future studies should explore adaptive strategies that strengthen farmers' innovation capacity, enhance financial resilience, and mitigate market volatility. Comparative studies across different regions and production systems could also provide broader insights into effective models for sustainable chicken farming.

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Competing interests

The authors declare no conflict of interest.

Authors' contributions

Dwi Putra Darmawan was responsible for conceptualization, methodology, supervision, funding acquisition, and manuscript review and editing. Gede Mekse Korri Arisena contributed to methodology, and original draft preparation. Putu Perdana Kusuma Wiguna handled software development, data interpretation and visualization. Ni Luh Made Indah Murdyani Dewi carried out formal analysis, project administration, data curation, and drafting. Anak Agung Istri Agung Peradnya Dewi, Gede Wisnu Sahatmana, and Ni Nyoman Ayu Prapti Rahayu contributed to validation and data curation. Anak Agung Keswari Krisnandika supported analysis and manuscript revision. All authors read and approved the final edition of the manuscript before submission.

Ethical considerations

All authors have contributed to the preparation of this original paper. The authors observed the final edition of the finished paper and evaluated any corrections and

updates. The authors checked the similarity index and plagiarism of the article.

Availability of data and materials

All data generated or analyzed during this study are included in the manuscript. Additional datasets are available from the corresponding author upon reasonable request.

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