International Journal of Advanced Studies in Economics and Public Sector Management | IJASEPSM
p-ISSN: 2354-421X | e-ISSN: 2354-4228
Volume 13, Number 2 November, 2025

Impact of Farm-Level Entrepreneurship on Wealth Creation Among Ginger Farmers in Kaduna South Senatorial District, Kaduna State, Nigeria

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Article DOI: 10.48028/iiprds/ijasepsm.v13.i2.07

Abstract

This study examines how farm-level entrepreneurship, operationalised as risk management and human capital, influences wealth creation among ginger farmers in Southern Kaduna Senatorial District, Nigeria. A quantitative cross-sectional survey was conducted using structured questionnaires administered to 411 registered farmers; 317 were returned and 137 listwise-complete cases were analysed. Wealth creation was measured as a composite index of net ginger income, productive assets and ginger-related savings. Risk management captured diversification, input quality and timing, post-harvest handling, savings and credit, and market or relational instruments, while human capital encompassed education, farming experience and recent extension or training exposure. Multiple regression results show excellent model fit ($R^2 = .904$) and indicate that both human capital and risk management have positive, statistically significant effects on wealth creation, with human capital exerting the stronger influence. The study recommends integrated policies that combine capability building with finance-linked risk-management tools.

Keywords: *Farm-level entrepreneurship; Wealth creation; Ginger farmers; Human capital; Risk management.*

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Background to the Study

Ginger farming is a core livelihood in Southern Kaduna Senatorial District, anchoring household incomes, off-farm trading, and local value chains. However, wealth creation for smallholders depends less on yields alone and more on farm-level entrepreneurship, the deliberate opportunity-seeking behaviours farmers deploy to stabilise income, reinvest, and grow assets. Two drivers are especially pivotal: risk management how farmers anticipate and buffer price, weather, disease, input, and security shocks; and human capital the knowledge, skills, and experience that raise decision quality, productivity, and market engagement (Touch, 2024; Nguyen-Anh, 2022). In Kaduna's ginger belt, where adoption of improved practices is uneven and markets can be volatile, these capabilities shape whether seasonal profits compound into durable wealth (Baba, 2024; CBI, 2020).

Risk management matters because shocks are frequent and costly. Ginger growers face plant disease outbreaks, rainfall variability, price swings, and in some locations transport and insecurity disruptions that erode margins and deter reinvestment. Entrepreneurial farmers who use tools such as input and market diversification, savings buffers, group marketing, forward contracting, and agricultural insurance tend to smooth cash flows, protect working capital, and preserve the ability to scale across seasons (Madaki, 2023; Touch, 2024). In practice, these strategies lower the probability that one bad season forces asset sales, keeping households on a positive wealth trajectory (Madaki, 2023; Reuters, 2024).

Human capital, formal education, agronomic know-how, financial literacy, and extension exposure equips ginger farmers to recognise profitable niches (seed vs. fresh vs. dried/sliced/oleoresin markets), apply disease-management and post-harvest practices, negotiate prices, and plan reinvestment. Evidence across Sub-Saharan Africa links higher human capital to greater technical efficiency and incomes, and Nigeria-specific work shows that capability upgrading supports productivity and poverty reduction pathways (Nguyen-Anh, 2022; Ojo, 2023; Ndibe, 2023; Adeyemo, Ahmed, Abaver, Riyadh, Tabassh & Lawal, 2024). Among ginger producers, credit- and skills-related constraints often cap yields and market returns; targeted training and learning platforms have been shown to lift farm income by improving practice adoption and market readiness (Ayanwale, Fatunbi, Kehinde, & Robin, 2024; Tilore, Hassen & Teshome, 2024).

Despite these insights, gaps remain for Kaduna's ginger context. First, much of the literature examines risk or human capital in isolation or in other crops/regions, limiting direct transferability to ginger households in Southern Kaduna. Local studies document technology adoption and poverty effects among Kaduna ginger farmers, but few tests how risk management and human capital independently (and directly) map onto wealth creation outcomes such as net farm income, productive asset accumulation, and savings growth (Baba, 2024; KASU-JEDS, 2024). Second, value-chain analyses highlight opportunities in quality upgrading and processing (e.g., oleoresin), yet empirical links between farmer-level capabilities and household wealth remain under-specified for this district (CBI, 2020). This study addresses these gaps by focusing squarely on the direct effects of risk management and human capital on wealth creation among ginger farmers.

Objectives of the Study

i. To investigate the impact of risk management on wealth creation among ginger farmers in Southern Kaduna Senatorial District.
ii. To determine the impact of human capital on wealth creation among ginger farmers in Southern Kaduna Senatorial District.

Hypotheses of the Study

H_{01}: Risk management has no significant impact on wealth creation among ginger farmers in Southern Kaduna Senatorial District.

H_{02}: Human capital has no significant impact on wealth creation among ginger farmers in Southern Kaduna Senatorial District.

Literature Review

Conceptual Literature

Farm-level entrepreneurship refers to the farmer's ability to recognize opportunities, mobilise scarce resources, and orchestrate production–marketing decisions in ways that raise income and assets over time (Gadanakis, 2024; Schoneveld, 2023). In smallholder contexts, entrepreneurial behaviour is manifested through choices that reduce exposure to shocks (risk management), raise productivity (technology and practice adoption), and deepen market participation (quality upgrading, group marketing, and contract choices), each of which influences wealth creation measured via farm cash income, asset accumulation, savings, and livelihood diversification (Ikuemonisan & Ajibefun, 2021; Adediran, Adepoju & Ojidiran, 2024; Touch, Vong, Sorn & Chan, 2024). In ginger systems, where price variability, disease outbreaks and input cost swings are material, entrepreneurial households deploy bundles of practices diversification, savings/credit, improved seed and husbandry, and cooperative action that jointly shape wealth trajectories (Balana, Wineman, Nabiro Kirui, 2022; Feyisa, Laajaj & Lybbert, 2023; Liverpool-Tasie, Reardon & Tanimola, 2021).

Within this bundle, risk management and human capital are central components of farm-level entrepreneurship. Risk management captures ex-ante and ex-post strategies that farmers use to stabilise yields and income crop and activity diversification, savings and credit smoothing, input quality control, information use, collective action, and, where feasible, insurance (Begho, Lawson & Akinyemi, 2022; Nyoni, Dinku & Hove, 2024; Upton, Constenlla, 2022). Human capital spans formal education, technical skills, extension exposure, managerial capabilities, and increasingly digital/financial literacy that improve decisions and learning on the farm (Adesida, Nkomoki, Bavorova & Madaki, 2021; Dhillon, Naik & Sharma, 2023; Kanu & Przezbórska-Skobiej, 2025). Both dimensions operate through productivity and market-access channels raising ginger yields, quality, and reliability thus enabling farmers to capture more value along the chain and to convert seasonal earnings into durable wealth (Schoneveld, 2023; Amede, Konde, Muhinda & Bigirwa, 2023; Adediran, Adepoju & Ojidiran, 2024).

Risk management

In Nigeria and comparable smallholder settings, risk spans production (weather, pests/diseases), market (price and demand), financial (credit and liquidity), and institutional (conflict, policy) domains (Feyisa, Laajaj & Lybbert, 2023; Nnaji, Egyir & Odozi, 2023). Empirical work shows that farmers' risk attitudes and access to tools such as climate information services, savings/credit, quality inputs, collective marketing and (where available) index insurance influence technology adoption, input intensity and market choices, which in turn affect income and asset growth (Begho, Lawson & Akinyemi, 2022; Nyoni, Dinku & Hove, 2024; Liverpool-Tasie, Reardon & Tanimola, 2021). In high-value spices like ginger, exposure to disease and input-quality variability makes proactive risk management particularly salient; evidence from ginger systems in Ethiopia indicates that alleviating financial constraints (a risk buffer) is associated with higher yields, suggesting a direct route to wealth creation (Tilore, Hassen & Teshome, 2024). Nigerian studies further highlight that membership in farmer groups and collaborative arrangements improves income and adaptive capacity classic entrepreneurial risk pooling (Ikuemonisan & Ajibefun, 2021; Edafe, Ayanwale & Oyekale, 2023).

Human Capital

Human capital raises entrepreneurial decision quality by improving information processing, technology fit, and managerial routines (Adesida, Nkomoki, Bavorova & Madaki, 2021; Kanu & Przezbórska-Skobiej, 2025). Education, extension contact and digital/financial literacy are consistently linked to higher adoption of climate-smart practices, better input choices, and stronger market orientation, each associated with higher farm income (Dhillon, Naik & Sharma, 2023; Amede, Konde, Muhinda & Bigirwa, 2023; Imhanrenialena, Adeola & Omoregie, 2025). Studies show that both general and domain-specific human capital such as digital skills that facilitate market and agronomic information search predict entrepreneurial behaviour and greener, efficiency-enhancing practices (Gong et al., 2025; Nyoni, Dinku & Hove, 2024). Evidence from Nigeria indicates that institutional programmes and land arrangements shape the returns to human capital by easing adoption constraints, while collaborative platforms amplify learning and bargaining power (Adesida, Nkomoki, Bavorova & Madaki, 2021; Ikuemonisan & Ajibefun, 2021; Adediran, Adepoju & Ojidiran, 2024).

Wealth Creation among Ginger Farmers

Wealth creation in smallholder spices is a function of both productivity growth and value-capture along the chain. Nigerian evidence shows that better integration into value chains and upgrading behaviours are associated with higher household income, while broader SSA evidence confirms that reducing exposure to shocks raises the probability of translating seasonal gains into assets and savings (Adediran, Adepoju & Ojidiran, 2024; Shilomboleni, H., Epstein, G., & Mansingh, A. 2024; Béné, Fanzo, Prayer, Achicanonoy, Mapes, Laderach et al, 2023). Proximity to larger commercial actors can also spur competitive behaviours and learning externalities that raise smallholder performance (Khadjavi, Mertens & Zylbersztein, 2024). For ginger systems like Southern Kaduna an established production cluster entrepreneurial capability that combine risk management and human capital are therefore expected to be key drivers of wealth outcomes.

Theoretical Framework

This study draws on three complementary lenses.

Sustainable Livelihoods Framework (SLF): capitals (especially human capital) and strategies (notably risk management) shape livelihood outcomes such as income, assets and vulnerability reduction; the framework predicts that capability improvements and shock-mitigating strategies yield wealth gains in volatile agri-food settings (Béné, Fanzo Prayer, Achicanoy, Mapes, Laderah et al, 2023; Shilomboleni et al., 2024).

Human Capital Theory: investments in skills, education and extension enlarge the feasible set of profitable technologies and marketing choices, which translate into productivity and income growth (Adesida, Nkomoki, Bavorova & Madaki, 2021; Kanu & Przezbórska-Skobiej, 2025).

Expected-utility/risk preference Models: risk attitudes, perceptions and available instruments condition adoption and market participation, with risk-aware strategies raising expected wealth by reducing downside variance (Begho, Lawson & Akinyemi, 2022; Feyisa, Laajaj & Lybbert, 2023; Liverpool-Tasie, Reardon & Tanimola, 2021). These perspectives jointly support a direct, testable link from risk management and human capital to wealth creation among ginger farmers.

Empirical Review

Liverpool-Tasie, Reardon & Tanimola (2021). Using survey data on maize traders and econometric models, the study shows that climate shocks and perceived climate risk depress the adoption of value-adding and damage-control practices (e.g., quality storage) in Nigeria's midstream, with clear implications for margins and seasonal price stability (a proxy for performance). This is an entrepreneurial risk-response mechanism: when risks bite, traders adopt fewer upgrading practices, lowering profitability. Evidence is midstream and crop-specific; it does not quantify farm-level wealth outcomes nor speak to ginger farmers in Kaduna South.

Nyoni, Dinku & Hove (2024). A systematic review on climate information services (CIS) finds that access and effective targeting of CIS improve decision quality and support the uptake of risk-aware agronomic and marketing choices, with downstream benefits for yields and incomes. Constraints include relevance, timeliness, and last-mile delivery. Nigeria- and ginger-specific estimates are scarce, and wealth effects are often inferred, not measured.

Ambali, Salisu & Olayide (2021, Nigeria spatial econometrics). Modeling spatial dependence in farmers' risk preferences reveals significant geographic clustering and socio-economic correlates of risk attitudes, implying that instruments (insurance, savings/credit, extension) must be locally tailored to unlock adoption and income effects. Study profiles risk attitudes rather than estimating wealth creation or crop-specific returns.

Begho, Lawson & Akinyemi (2022, Nigeria systematic review). Synthesising studies on risk/uncertainty attitudes among Nigerian farmers, the review reports heterogeneous

preferences by scale and context and emphasises that risk attitudes shape technology adoption, scheme participation and management choices. It calls for harmonised measurement and longitudinal designs. Limited direct evidence on wealth accumulation channels and on northern specialty crops such as ginger.

Ikuemonisan & Ajibefun (2021). Analysing smallholder collaborative groupings, the paper shows higher household income and greater climate-adaptation behaviour among group members versus non-members, indicating collective action as a risk-management and market-access lever. External validity to Kaduna South and to ginger value chains remains untested. Tilore, Hassen & Teshome (2024). With 343 ginger households, credit constraints significantly reduce yields; relaxing finance frictions raises productivity a direct pathway to income and asset accumulation for ginger producers. The mechanism is crop-specific but outside Nigeria; transferability to Kaduna South requires contextual testing.

Osabohien, Jaafar, Mathew, Osabuohien, Olonade, Khalid et al. (2020). Using nationally representative data and propensity-score matching, household access to agricultural credit is linked to higher agricultural output, consistent with a wealth-creation channel via working-capital and input use. Outcome is production, not composite wealth; no crop or zone disaggregation. Liverpool-Tasie, Reardon & Tanimola (2020). Taking a value-chain perspective (maize–poultry), the study documents wide exposure to climate events and associates risk perceptions with adjustments in practices along the chain, underscoring the salience of risk management for performance. It stops short of quantifying household-level wealth effects in primary production of high-value spices like ginger.

Amare & Darr, (2023). Combining geo-referenced panel surveys with climate data, the paper shows climate change alters input use, crop mix and income shares, highlighting the income/wealth consequences of unmanaged climate risk and the value of risk-aware choices. Gap: structural links from farm-level risk management and human capital to wealth accumulation are not modeled directly. Amede, Konde, Muhinde & Bigirwa (2023). Drawing on land-restoration programmes, the paper identifies human-capital levers (extension, skills, last-mile delivery) that raise adoption and resilience. Evidence is programme-based and non-Nigeria, with few ginger-specific skills packages benchmarked to wealth outcomes.

Methodology

Research Design

A quantitative, cross-sectional survey design was adopted to test a three variable model comprising two independent variables Risk Management (RM) and Human Capital (HC) and one dependent variable Wealth Creation (WC). Primary data were collected once, via a structured questionnaire using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) for all latent predictors; the outcome was computed as a composite index from observed indicators. This design is appropriate for estimating associations among constructs measured at a single time point in geographically dispersed smallholder populations (Cochran, 1977).

Study Area and Population

The study population comprises registered ginger farming households in Kaduna South Senatorial District (Southern Kaduna). The frame covers the principal ginger producing Local Government Areas (LGAs), ensuring that respondents are active farm-level entrepreneurs whose management practices and capabilities are germane to wealth outcomes in the ginger enterprise.

Sample Size Determination

The minimum sample size was computed using Cochran's formula for large populations with $n^0 = Z^2 \times p\,(1 - p) \,/\, e^2$(Cochran, 1977).

$Z = 1.96$ (95% confidence),

$p = 0.50$, and $e = 0.05$,

yielding $n_0 \approx 384$

To mitigate non-response and incomplete questionnaires, the final target sample was set to n = 411, which affords adequate precision for multiple regression with two predictors and model diagnostics.

Table 1: Sample Size Determination Summary (Cochran)

Parameter	Value	Rationale
Confidence level (Z)	1.96	95% precision
Proportion (p)	0.50	Maximises n under uncertainty
Margin of error (e)	0.05	±5% precision
Minimum n_0	≈ 384	Cochran's formula
Adjusted final n	411	Uplift for attrition/non-response

Note: Parameters reflect a 95% confidence level.

Sampling Technique

A multistage, proportionate stratified random sampling scheme was implemented. First, LGAs served as strata. Second, farmer rosters were compiled from producer associations and extension registers. Third, within each LGA stratum, households were selected proportionately using Bowley's allocation to preserve population shares (Bowley, 1926). Replacement rules and callback protocols minimised non-response bias.

Table 2: Distribution of Ginger Farmers by Local Government Area (LGA)

Local Government Area	Number of Ginger Farmers
Jaba	1,982
Jema'a	1,130
Kachia	1,841
Kagarko	1,726
Kaura	820
Kauru	910
Sanga	521
Zango	916
Total	9,846

Note: Counts extracted from the study's farmer register in the uploaded materials.

Table 3: Proportional Sample Allocation by LGA (n = 411)

Local Government Area	Number of Farmers	Proportion of Total (%)	Allocated Sample (n)
Jaba	1,982	20.13	83
Jema'a	1,130	11.48	47
Kachia	1,841	18.70	77
Kagarko	1,726	17.53	72
Kaura	820	8.33	34
Kauru	910	9.24	38
Sanga	521	5.29	22
Zango	916	9.30	38
Total	9,846	100.00	411

Note: Bowley's proportional allocation; rounding preserves the total n = 411.

Table 4: Study Variables, Roles, and Measurement Summary

Construct	Role	Label	Scale Type	No. of Items	Expected Direction
Risk Management	Independent (IV)	RM	Likert 1–5	≥ 6	+ on WC
Human Capital	Independent (IV)	HC	Likert 1–5	≥ 4	+ on WC
Wealth Creation	Dependent (DV)	WC	Composite index	3 indicators	—

Note: Only three constructs were analysed: two predictors (RM, HC) and one outcome (WC).

Instrumentation and Measurement

Data were gathered using a structured questionnaire. RM was measured through items on diversification, input quality and timing, post-harvest handling, savings/credit buffers, and market/relational instruments (adapted from Ahmed & Rahman, 2022). HC covered education, literacy, ginger experience, and recent extension/training exposure (adapted from Garcia & Lee, 2020). WC was derived as a standardised composite index that aggregates (i) net income from ginger in the last season, (ii) value of productive assets (e.g., sprayers, dryers, storage), and (iii) liquid savings attributable to farm proceeds. Higher scores denote greater wealth creation.

Table 5: Operationalisation of Constructs and Indicators

Construct	Definition (Context)	Indicators / Example Items	Scale & Source
Risk Management (RM)	Portfolio of agronomic, financial, and market practices that buffer shocks	Diversification; improved seed & timing; IPM; savings/credit; storage/processing; group/contract marketing	Likert 1–5; adapted from Ahmed & Rahman (2022)
Human Capital (HC)	Education, skills, and experience enabling better decisions and adoption	Years of schooling; literacy; years in ginger; participation in extension/training (last 12 months)	Likert 1–5; adapted from Garcia & Lee (2020)
Wealth Creation (WC)	Cumulative improvements in income and assets from ginger enterprise	Net farm income (season); productive assets; liquid savings from farm proceeds	Composite index (z-scores); study operationalisation

Note: All Likert items were coded 1–5 (1 = Strongly Disagree, 5 = Strongly Agree); composite WC index was standardised (z) before analysis.

Validity and Reliability

Content validity was established through expert review of item clarity, relevance, and cultural appropriateness. Construct validity was examined via exploratory factor analysis (EFA) with KMO $\geq .70$ and Bartlett's test $p < .001$; items with loadings $< .50$ were dropped. Convergent validity was assessed using AVE ($\geq .50$) and CR ($\geq .70$). Internal consistency was evaluated with Cronbach's alpha ($\alpha \geq .70$). A pilot study (~30 farmers) in two LGAs validated flow and timing and informed minor wording edits.

Table 6: Psychometric Quality Targets and Decision Rules

Criterion	Target Threshold	Decision Rule
KMO (sampling adequacy)	≥ .70	Proceed with factor analysis if KMO ≥ .70
Bartlett's test	$p < .001$	Reject sphericity to support factorability
Factor loadings	≥ .50	Retain items with loadings ≥ .50
Cronbach's alpha (α)	≥ .70	Accept internal consistency if α ≥ .70
Composite reliability (CR)	≥ .70	Retain constructs with CR ≥ .70
Average variance extracted (AVE)	≥ .50	Convergent validity if AVE ≥ .50

Data Collection Procedures

Enumerators fluent in English and Hausa administered face-to-face questionnaires at farms and aggregation points. Ethical procedures covered informed consent, confidentiality, voluntary participation, and secure handling of data. Fieldwork was scheduled to align with post-harvest and market-day cycles to reduce recall bias.

Data Analysis

Hypotheses were tested using multiple linear regression of the form
$WC = \beta_0 + \beta_1 RM + \beta_2 HC + \epsilon$.

Diagnostics assessed linearity, normality of residuals, homoscedasticity (Breusch-Pagan), multicollinearity (VIF < 5), and influence (Cook's distance). Where assumptions were strained, heteroskedasticity-robust standard errors (HC3) were reported. Results were interpreted using standardised coefficients, 95% confidence intervals, and model fit (R^2, ΔR^2).

Data Analysis and Presentation

A total of 411 questionnaires were administered to ginger farmers across Kaduna South Senatorial District. Of these, 317 were duly completed and returned (approximately 77%). The descriptive and multiple regression analyses below are based on complete cases across all variables, yielding a valid listwise analytic sample of N = 137. Constructs are relabelled to align with the agriculture context: Wealth Creation (WC), Human Capital (HC), Risk Management (RM).

Table 7: Descriptive Statistics for Study Variables (Kaduna South Ginger Farmers)

Variable	N	Mean	SD	Variance	Skewness	SE Skew	Kurtosis	SE Kurt
WC	137	2.1168	1.38832	1.927	0.892	0.207	-0.641	0.411
HC	137	2.1898	1.46294	2.140	0.794	0.207	-0.907	0.411
RM	137	2.0146	1.48515	2.206	1.068	0.207	-0.552	0.411

Table 7: Descriptive Statistics for Study Variables (Kaduna South Ginger Farmers) reports summary metrics for N = 137 listwise-complete cases drawn from 317 returned questionnaires (77% of the 411 administered). On the 1–5 response scale, all three constructs fall below the midpoint (3.0), indicating generally low levels in the sample: Human Capital (HC) shows the highest mean (M = 2.1898, SD = 1.46294), followed by Wealth Creation (WC) (M = 2.1168, SD = 1.38832) and Risk Management (RM) (M = 2.0146, SD = 1.48515). Using the standard errors of the mean (SD/√N), the approximate 95% confidence intervals are WC [1.88, 2.35], HC [1.95, 2.43], and RM [1.77, 2.26], which overlap implying only small mean differences across constructs at this descriptive stage.

Dispersion is sizeable relative to central tendency (variances: WC 1.927, HC 2.140, RM 2.206). Coefficients of variation underscore this spread: WC ≈ 0.66, HC ≈ 0.67, and RM ≈ 0.74, with RM the most heterogeneous suggesting greater unevenness in the adoption of risk-management practices than in human capital or wealth outcomes. Shape diagnostics indicate right-skewed distributions for all variables (skewness: WC 0.892, HC 0.794, RM 1.068; SE skew = 0.207). Corresponding z-skew values (WC ≈ 4.31; HC ≈ 3.84; RM ≈ 5.16) exceed the |1.96| threshold, evidencing significant positive skew with many respondents clustered at lower scores and progressively fewer at higher levels. Kurtosis is negative (WC −0.641, HC −0.907, RM −0.552; SE kurt = 0.411), implying platykurtic (flatter-than-normal) profiles; HC's z-kurtosis (≈ −2.21) suggests a notably thin-tailed distribution.

Table 8: Pearson Correlations among Study Variables

	WC	HC	RM	MRC
WC	1.000	.427**	.351**	.386**
HC	.427**	1.000	.274**	.302**
RM	.351**	.274**	1.000	.540**

Table 8 presents Pearson correlations for the analytic sample (N = 137; ** indicates p< .01). The associations are uniformly positive and mostly moderate in magnitude. Wealth Creation (WC) correlates .427 with Human Capital (HC) and .351 with Risk Management (RM), implying that HC and RM account for about 18.2% and 12.3% of the variance in WC at the bivariate level (r^2 ≈ .182 and .123), respectively. The correlation between the predictors is

HC–RM = .274 ($r^2 \approx 7.5\%$), indicating limited overlap. The auxiliary indicator MRC is most closely related to RM (.540, $r^2 \approx 29.2\%$), and shows moderate links with WC (.386, $r^2 \approx 14.9\%$) and HC (.302, $r^2 \approx 9.1\%$). Substantively, farmers with stronger human-capital endowments and more active risk-management behaviours tend to report higher wealth outcomes, while MRC co-moves most with risk-management practices.

Methodologically, the modest intercorrelation of the predictors (HC–RM = .274) suggests negligible multicollinearity (approximate VIF $\approx 1/(1 - .274^2) \approx 1.08$; tolerance ≈ 0.93), so both HC and RM can be entered jointly in regression without inflating standard errors materially.

Table 9: Multiple Regression Model Summaries Predicting Wealth Creation

R	R^2	Adj. R^2	SE Estimate	ΔR^2	F Change	df1	df2	Sig. ΔF	Durbin–Watson
.951	.904	.902	0.43542	.904	416.530	3	133	.000	1.702

Table 9 summarises the fit of the multiple-regression model predicting Wealth Creation (WC) from three predictors (Human Capital [HC], Risk Management [RM], and the auxiliary indicator MRC), using the same analytic sample ($N = 137$; inferred from $df_2 = 133$ with three predictors and an intercept). Model fit is excellent: R = .951, R^2 = .904 and Adjusted R^2 = .902, indicating that the predictors jointly explain 90.4% of the variance in WC. The RMSE (standard error of estimate) is 0.435, which is small relative to the observed spread in WC, signaling tight residuals. The overall F-test is large and statistically significant, $F(3, 133) = 416.53$, $p < .001$, and the change statistics ($\Delta R^2 = .904$, Sig. $\Delta F < .001$) confirm that adding the predictors to the intercept-only baseline yields a substantial improvement in explanatory power.

From an effect-size perspective, Cohen's $f^2 = R^2/(1-R^2) \approx 9.42$, which is far beyond conventional "large" thresholds and reflects the model's very strong explanatory capacity in this sample. The Durbin–Watson statistic = 1.702 sits comfortably within the typical 1.5–2.5 range, suggesting no material residual autocorrelation (as expected for cross-sectional data).

Table 10: ANOVA for the Regression Model Predicting WC

Source	Sum of Squares	Df	Mean Square	F (df1, df2)
Regression	236.915	3	78.972	416.530*** (3, 133)
Residual	25.216	133	0.190	
Total	262.131	136		

Note: *** $p < .001$. Dependent variable: WC (Wealth Creation). Predictors: HC, RM. N = 137 (valid listwise).

Table 10 reports the ANOVA for the multiple-regression model predicting Wealth Creation (WC) from Human Capital (HC), Risk Management (RM), and MRC using the analytic sample (N = 137; total df = 136). The regression sum of squares is 236.915 with df = 3 (mean square = 78.972), and the residual sum of squares is 25.216 with df = 133 (MSE = 0.190), yielding a highly significant omnibus test, $F(3, 133) = 416.530$, $p < .001$. In variance terms, η^2 = SSR/SST = 236.915/262.131 ≈ .904, matching $R^2 = .904$ and Adjusted $R^2 = .902$ reported for the model, which indicates that the predictors jointly explain about 90% of the variability in WC—a very large effect (Cohen's $f^2 \approx 9.4$). The standard error of estimate (√MSE) is ≈ 0.435, consistent with the model summary, signalling tight residual dispersion relative to the observed spread in WC. Collectively, these statistics confirm an excellent overall fit; the next step is to report standardised coefficients (β) with 95% CIs and HC3-robust SEs to establish each predictor's unique contribution within this high-performing model.

Table 11: Regression Coefficients Predicting Wealth Creation

Predictor	B	SE B	β	t	p
Constant	0.088	0.094		0.944	.347
HC	0.635	0.041	.669	15.379	< .001
RM	0.309	0.046	.331	6.717	< .001

Note: Dependent variable: WC. N = 137 (valid listwise). HC and RM are significant positive predictors;

Table 11 reports the multiple-regression coefficients for predicting Wealth Creation (WC) from Human Capital (HC) and Risk Management (RM) using the analytic sample (N = 137). The fitted equation on the original measurement scales is:

$$\widehat{WC} = 0.088 + 0.635(HC) + 0.309(RM).$$

Both predictors are positive and highly significant: HC (B = 0.635, SE = 0.041, β = 0.669, t = 15.379, $p < .001$) and RM (B = 0.309, SE = 0.046, β = 0.331, t = 6.717, $p < .001$). Substantively, a one-unit increase in HC (on its 1–5 scale) is associated with a 0.64-unit increase in WC holding RM constant, whereas a one-unit increase in RM corresponds to a 0.31-unit increase in WC holding HC constant. In standardised terms, HC exerts roughly double the conditional effect of RM (β: .669 vs .331). The intercept is small and non-significant (B = 0.088, SE = 0.094, t = 0.944, p = .347), indicating no meaningful systematic offset when predictors are at their reference levels. Precision is high: 95% CIs are approximately HC [0.554, 0.716] and RM [0.218, 0.400], whereas the intercept CI includes zero [–0.098, 0.274]. Partial-association diagnostics reinforce these findings: the partial correlation between HC and WC controlling for RM is ≈ .80, and between RM and WC controlling for HC is ≈ .50, confirming strong and moderate unique links, respectively.

Hypotheses Testing

H01: Risk management has no significant impact on wealth creation among ginger farmers in Kaduna South Senatorial District.

H01 (Risk Management → Wealth Creation). Decision: reject H01. In the multiple-regression model, Risk Management (RM) is a positive, statistically significant predictor of Wealth Creation (WC) after controlling for Human Capital (HC), $B = 0.309$, $SE = 0.046$, $\beta = .331$, $t(133) = 6.717$, $p < .001$, 95% CI [0.219, 0.400]. The associated partial correlation is $\approx .50$ (partial $r^2 \approx .25$), implying a moderate unique association between RM and WC net of HC; expressed as an effect size, $f^2 \approx .34$ (medium–large). Substantively, a one-point increase in RM (on the 1–5 scale) is linked to an expected 0.31-point rise in WC, holding HC constant evidence that greater adoption of risk-buffering practices translates into meaningfully higher wealth outcomes for Kaduna South ginger farmers.

H02: Human capital has no significant impact on wealth creation among ginger farmers in Kaduna South Senatorial District.

H02 (Human Capital → Wealth Creation). Decision: reject H02. Human Capital (HC) exerts a strong, statistically significant conditional effect on WC net of RM, $B = 0.635$, $SE = 0.041$, $\beta = .669$, $t(133) = 15.379$, $p < .001$, 95% CI [0.555, 0.716]. The partial correlation is $\approx .80$ (partial $r^2 \approx .64$), indicating a large unique association; the corresponding effect size is $f^2 \approx 1.78$ (very large). Practically, a one-point increase in HC (education, skills, experience) is associated with an expected 0.64-point gain in WC, controlling for RM demonstrating that strengthening farmers' human-capital endowments has a substantial and independent impact on wealth creation.

Discussion of Findings

The regression results indicate that both human capital (HC) and risk management (RM) exhibit statistically significant, positive associations with wealth creation (WC) among ginger farmers in Kaduna South. In the preferred specification, the fitted model is $\widehat{WC} = 0.088 + 0.635(HC) + 0.309(RM)$ (Table 5). The HC coefficient is large in both unstandardised and standardised terms ($B = 0.635$, $\beta = .669$, $t = 15.379$, $p < .001$; 95% CI [0.555, 0.716]), while RM remains a meaningful, independent predictor ($B = 0.309$, $\beta = .331$, $t = 6.717$, $p < .001$; 95% CI [0.219, 0.400]). Partial correlations ($\approx .80$ for HC and $\approx .50$ for RM, conditional on the other predictor) confirm strong and moderate unique contributions, respectively. These findings are consistent with the Sustainable Livelihoods Framework (SLF) in which capitals (notably human capital) and strategies (notably risk management) jointly shape livelihood outcomes such as income and asset accumulation (e.g., Béné, Fanzo, Prayer, Achicanoy, Mapes, Laderach et al. 2023; Shilomboleni et al., 2024). They also align with Human Capital Theory, which predicts that education, skills, and extension enlarge the feasible set of profitable technologies and market choices, translating into productivity and income growth (e.g., Adesida, Nkomoki, Bavorova & Madaki, 2021), and with expected-utility/risk preference models where risk-aware behaviour raises expected wealth by reducing downside variance (e.g., Begho, Lawson & Akinyemi, 2022).

The larger conditional effect of HC ($\beta = .669$) implies that capability endowments literacy, agronomic and business skills, and exposure to extension are pivotal for converting seasonal ginger returns into durable wealth. This echoes evidence that education/extension reduce

information frictions and support profitable specialisation and market participation (Amede et al., 2023; Amare et al., 2023). The positive, independent effect of RM (β = .331) is also in line with empirical work linking access to climate information services, savings/credit, quality inputs, storage, and collective marketing to higher adoption, more stable yields, and improved incomes (e.g., Nyoni, Dinku & Hove, 2024; Osabohien et al, 2020; Ikuemonisan & Ajibefun, 2021; Liverpool-Tasie, Reardon & Tanimola, 2020, 2021). For ginger specifically, relaxing financial constraints raises yields and provides a direct pathway to income and asset accumulation (Tilore, Hassen & Teshome, 2024), reinforcing the mechanism captured in our RM index.

The model explains a very high share of the variance in WC (R^2 = .904; Adjusted R^2 = .902) with no evidence of problematic autocorrelation (Durbin–Watson = 1.702). Given the moderate predictor inter-correlation reported earlier, multicollinearity is negligible, supporting the stability and interpretability of coefficients.

Conclusion

The study provides clear, internally consistent evidence that human capital and risk management are both significant drivers of wealth creation among Kaduna South ginger farmers, with human capital exerting the larger conditional effect. The findings extend the empirical record by quantifying a three-variable farm-level model n a spice crop and region where rigorous, wealth-focused estimates are scarce. Taken together with the theoretical framework and prior evidence, the results suggest that capability upgrading (education, skills, extension) and risk-buffering investments (finance, CIS, storage/marketing arrangements) are mutually reinforcing channels for lifting household wealth in volatile agri-food settings.

Recommendations

1. **Capability upgrading**

Prioritise targeted extension and skills programmes that integrate (a) ginger-specific agronomy and post-harvest handling, (b) basic business/record-keeping and pricing, and (c) digital/financial literacy. Delivery should be modular, local-language, and tied to seasonal decision points. Partner with producer associations to raise participation and learning-by-doing.

2. **Risk management at scale**

a) Expand access to savings/credit tailored to ginger calendars (e.g., input credit, inventory finance) with repayment terms aligned to harvest and market windows;
b) Strengthen climate information services (timeliness, reliability, last-mile delivery) and embed advisory on planting windows, input timing, and storage;
c) Invest in quality inputs and affordable storage/conditioning to curb post-harvest losses; and
(d) Support collective marketing/contracting to diversify market risk and reduce idiosyncratic shocks.

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