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AGRIPRENEURIAL CONSTRAINTS IN KERALA: A MULTIDIMENSIONAL FACTOR-ANALYTIC INVESTIGATION IN PATHANAMTHITTA DISTRICT

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1. INTRODUCTION

The agrarian economy of Kerala has long exhibited a paradox of high agricultural literacy alongside persistent structural vulnerabilities. While the state records commendable human development indices, its agricultural sector continues to face declining profitability, rising input costs, and an ageing farming workforce. Against this backdrop, agripreneurship has emerged as a transformative paradigm that transcends conventional farming by incorporating innovation, risk-taking, value addition, and market orientation into agricultural practice.

Agripreneurs, unlike traditional farmers, function as business entities that integrate production with processing, marketing, and distribution. They are expected to navigate complex regulatory environments, volatile commodity markets, and rapidly changing technological landscapes. In high-density, small-landholding economies such as Kerala, agripreneurs occupy a critical niche in bridging the gap between subsistence agriculture and commercially viable food systems.

Pathanamthitta district, often described as the heart of plantation-based agriculture in central Kerala, hosts a diverse array of agripreneurial activities spanning spice cultivation, rubber processing, floriculture, and allied enterprises. Despite this diversity, agripreneurs in the district face multifaceted constraints that impede their operational efficiency and long-term viability. These constraints are not always readily apparent through aggregate statistics and require a structured empirical investigation to be properly understood.

The present study addresses this gap by employing Exploratory Factor Analysis (EFA) to identify the latent dimensions of challenges confronting agripreneurs in Pathanamthitta. The study contributes to the growing body of literature on rural entrepreneurship in India by providing empirically grounded insights that can inform policy design, institutional support mechanisms, and extension service frameworks.

2. REVIEW OF LITERATURE

The conceptual foundation for agripreneurship research has been shaped by intersecting contributions from entrepreneurship theory, agricultural economics, and rural development scholarship. Klerkx, Jakku, and Labarthe (2020) conducted a comprehensive review of social science contributions to digital agriculture and smart farming, highlighting how information asymmetries and technology access gaps constitute primary constraints for agricultural entrepreneurs. Their work underscores the centrality of technological infrastructure in enabling agripreneurial transition.

Sutherland, Darnhofer, Wilson, and Zagata (2021) examined transition pathways towards agricultural sustainability in Europe and found that structural constraints, particularly related to credit access and market integration, were decisive factors shaping the trajectories of farm-based enterprises. These findings resonate with the Indian context, where institutional finance remains unevenly distributed across rural districts.

Barrett, Reardon, and Swinnen (2022) analysed agrifood value chains in low- and middle-income countries, identifying fragmented market structures, lack of cold chain infrastructure, and thin market conditions as critical obstacles. Their framework aligns with the marketing and infrastructure constraints documented in the present study.

Birthal, Roy, and Negi (2020) investigated the impact of crop diversification on farm income and risk in India, observing that overdependence on a limited product portfolio exacerbates income volatility among small agricultural entrepreneurs. This observation

is particularly germane to agripreneurs in Pathanamthitta, where dependence on plantation crops such as rubber exposes producers to commodity price cyclicality.

Devaux, Torero, Donovan, and Horton (2021) reviewed agricultural innovation and inclusive value-chain development, arguing that lack of market feedback mechanisms and weak linkages between producers and consumers constrain the adaptive capacity of agripreneurs. The present study empirically validates this observation within the Kerala context.

The Indian literature on agripreneurship constraints is comparatively sparse. Existing studies tend to examine individual constraint categories in isolation rather than employing multivariate techniques to capture the composite structure of challenges. This study contributes by providing a factor-analytic framework that reveals the interdependencies among constraints and their relative explanatory power.

3. OBJECTIVES OF THE STUDY

The study pursues the following objectives:

(i) To identify and measure the major challenges confronting agripreneurs in Pathanamthitta district through a structured survey instrument.
(ii) To apply Exploratory Factor Analysis to uncover the latent dimensional structure underlying the observed constraints.
(iii) To interpret and classify the extracted factors in terms of their substantive content and policy relevance.
(iv) To derive evidence-based recommendations for strengthening the agripreneurial ecosystem in rural Kerala.

4. RESEARCH METHODOLOGY

4.1 Research Design and Sampling

The study adopts a descriptive-analytical research design grounded in primary data. A structured questionnaire was administered to 250 agripreneurs across Pathanamthitta district through purposive stratified sampling, ensuring representation across agricultural sub-sectors including crop cultivation, horticulture, livestock, aquaculture, and agro-processing. The sample size was determined to satisfy the minimum requirement of five observations per variable for factor analysis, with the present ratio (250:36 ≈ 6.9:1) exceeding this threshold.

4.2 Questionnaire Design

The survey instrument comprised 36 Likert-scale items capturing constraints across six broad domains: informational and technical, input and infrastructure, marketing, financial, labour, and regulatory. Items were adapted from established agripreneurship scales and validated through expert review and a pilot study conducted with 25 respondents prior to the main data collection phase.

4.3 Analytical Framework

Exploratory Factor Analysis (EFA) was employed as the primary analytical technique. EFA, using Principal Component Analysis (PCA) as the extraction method and Varimax rotation as the rotation criterion, was applied to identify the number of underlying factors, the factor loadings of each observed variable, and the communalities indicating each variable's shared variance with the factor solution.

The suitability of the data for factor analysis was assessed through two diagnostic statistics: the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity. The retention criterion for factors was an eigenvalue greater than 1.0 (Kaiser criterion). Factor loadings exceeding 0.40 in absolute value were considered substantively meaningful for interpretation purposes. All analyses were conducted using SPSS Version 26.0.

5. RESULTS AND ANALYSIS

5.1 Sampling Adequacy and Sphericity

Prior to conducting factor analysis, the appropriateness of the data was evaluated using two standard diagnostic tests. The results are presented in Table 1.

Table 1: KMO Measure of Sampling Adequacy and Bartlett's Test of Sphericity

KMO Measure of Sampling Adequacy	Bartlett's Test of Sphericity			Conclusion
	Approx. Chi-Square	df	Sig.	
0.839	2896.718	630	0.000	**Significant (p < 0.001)**

The KMO statistic of 0.839 falls in the "meritorious" range (0.80–0.89) as per Kaiser's (1974) classification, confirming that the patterns of correlations are relatively compact and therefore factor analysis is expected to yield distinct and reliable factors. The Bartlett's Test of Sphericity produced a chi-square value of 2896.718 with 630 degrees of freedom, which is statistically significant at the 1% level ($p < 0.001$). This result rejects the null hypothesis that the correlation matrix is an identity matrix, affirming that the variables are sufficiently intercorrelated to support factor extraction. Taken together, these diagnostics provide strong statistical justification for proceeding with EFA.

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5.2 Communality Analysis

Communalities reflect the proportion of variance in each observed variable that is accounted for by the retained factors. Higher communalities indicate that a greater share of a variable's variance is explained by the factor solution. Table 2 presents the initial and extracted communalities for all 36 variables.

Table 2: Communalities of Observed Variables

Construct / Variable	Initial	Extraction
Lack of adequate information	1.000	0.589
Lack of technical know-how	1.000	0.647
Risk in making heavy investment	1.000	0.593
Problems related with registration	1.000	0.318
Uncertain events	1.000	0.310
Tight competition	1.000	0.487
Evolving industrial structure & climate change	1.000	0.331
Problems related with storage of output	1.000	0.515
Non-availability of input	1.000	0.326
High cost of input	1.000	0.361
Irregular supply of input	1.000	0.389
Transport bottlenecks	1.000	0.476
Lack of adequate storage facility	1.000	0.397
Lack of electricity supply	1.000	0.642
Lack of cost-free equipment	1.000	0.500
Dependence on a limited number of products	1.000	0.507
Poor sales realisation	1.000	0.419
Defective pricing policy	1.000	0.476
Inadequate sales promotion techniques	1.000	0.391
Lack of market feedback	1.000	0.538
Lack of adequate capital	1.000	0.521
Improper working capital	1.000	0.393
High cost of credit	1.000	0.513
Lack of access to public money	1.000	0.589
Less financial support from Government	1.000	0.532
Minimum amount of agricultural loan	1.000	0.493
Lack of subsidized inputs	1.000	0.413
Lack of interest-free loan for agricultural purpose	1.000	0.493
Lack of seed capital	1.000	0.397
Lack of financial subsidies from Government	1.000	0.629
Exercising high cost of labour	1.000	0.467
Inefficient handling of labour problems	1.000	0.442
Poor labour productivity	1.000	0.332
Poor labour relations	1.000	0.573
Lack of trained labour	1.000	0.471
Lack of trainers	1.000	0.483
Extraction Method: Principal Component Analysis		

The extraction communalities range from 0.310 (uncertain events) to 0.647 (lack of technical know-how), with a mean communality of approximately 0.478. Variables such as lack of technical know-how (0.647), lack of electricity supply (0.642), and lack of financial subsidies from Government (0.629) exhibit particularly high communalities, indicating that these constraints are strongly captured by the factor structure. All variables maintain communalities above 0.30, which is the conventional threshold for retention in factor analysis, suggesting that none of the items are poorly represented in the solution. Figure 4 provides a visual depiction of the communality distribution across variables.

Figure 4: Communalities of Observed Variables by Factor Group

5.3 Factor Extraction: Total Variance Explained

Table 3 presents the eigenvalues and variance explained statistics for all extracted components, both before and after Varimax rotation.

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Table 3: Total Variance Explained

Comp.	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% Variance	Cum. %	Total	% Variance	Cum. %	Total	% Variance	Cum. %
1	6.740	19.721	19.721	6.740	19.721	19.721	4.486	13.460	13.460
2	3.540	11.832	31.553	3.540	11.832	31.553	4.269	13.857	27.317
3	3.057	10.491	42.044	3.057	10.491	42.044	3.394	11.428	38.745
4	1.858	7.162	49.206	1.858	7.162	49.206	2.924	10.121	48.866
5	1.357	5.770	54.976	1.357	5.770	54.976	1.480	6.110	54.976
Extraction Method: Principal Component Analysis									

Five components with eigenvalues exceeding unity were extracted, cumulatively explaining 54.976% of the total variance in the dataset. This level of explanatory power is consistent with accepted standards in social science research, where a cumulative variance of 50–60% is generally regarded as satisfactory. The scree plot (Figure 1) visually corroborates the five-factor solution, with a pronounced elbow observed after the fifth component, beyond which marginal contributions to explained variance diminish substantially.

Figure 1: Scree Plot of Component Eigenvalues

Prior to rotation, the first component accounts for the largest share of variance (19.721%), a pattern typical of unrotated solutions where the first factor absorbs the maximum common variance. Following Varimax rotation, the variance is redistributed more equitably across the five factors, ranging from 6.110% (Factor 5) to 13.857% (Factor 2), thereby improving the interpretability of each factor. Figure 2 illustrates the post-rotation variance profile.

Figure 2: Percentage Variance Explained by Each Factor after Varimax Rotation

5.4 Rotated Component Matrix and Factor Interpretation

Table 4 presents the Varimax-rotated component matrix. Loadings below 0.40 have been suppressed to enhance clarity. The rotation converged in seven iterations, producing a stable and interpretable solution.

Table 4: Rotated Component Matrix (Varimax Rotation)

Variable	F1	F2	F3	F4	F5
Factor 1: Informational & Technical					
Lack of adequate information	**0.697**				
Lack of technical know-how	**0.770**				
Risk in making heavy investment	**0.702**				
Problems related with registration	**0.484**				
Uncertain events	**0.400**				
Tight competition	**0.421**				
Evolving industrial structure & climate change	**0.419**				
Problems related with storage of output	**0.636**				
Factor 2: Input & Infrastructure					
Non-availability of input		**-0.441**			
High cost of input		**-0.525**			
Irregular supply of input		**0.494**			
Transport bottlenecks		**-0.554**			
Lack of adequate storage facility		**-0.433**			
Lack of electricity supply		**-0.634**			
Lack of cost-free equipment		**-0.653**			
Factor 3: Marketing					
Dependence on limited number of products			**0.679**		
Poor sales realisation			**0.511**		
Defective pricing policy			**0.577**		
Inadequate sales promotion techniques			**0.579**		
Lack of market feedback			**0.486**		
Factor 4: Financial					
Lack of adequate capital				**0.574**	
Improper working capital				**0.568**	
High cost of credit				**0.562**	
Lack of access to public money				**0.584**	

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Less financial support from Government				**0.594**	
Minimum amount of agricultural loan				**0.588**	
Lack of subsidized inputs				**0.549**	
Lack of interest-free loan for agri. purpose				**0.653**	
Lack of seed capital				**0.443**	
Lack of financial subsidies from Government				**0.567**	
Factor 5: Labour					
Exercising high cost of labour					**0.652**
Inefficient handling of labour problems					**0.463**
Poor labour productivity					**0.557**
Poor labour relations					**0.472**
Lack of trained labour					**0.588**
Lack of trainers					**0.592**
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 7 iterations. Loadings < 0.40 suppressed for clarity.					

Figure 3 provides a summary profile of the factor structure in terms of average loadings and the number of variables associated with each factor.

Figure 3: Factor Structure Profile — Average Loadings and Variable Count per Factor

The five extracted factors are interpreted and discussed in the following subsections.

Factor 1: Informational and Technical Constraints (Eigenvalue = 6.740; Rotated Variance = 13.46%)

Eight variables load significantly on this factor: lack of adequate information (0.697), lack of technical know-how (0.770), risk in making heavy investment (0.702), problems related with registration (0.484), uncertain events (0.400), tight competition (0.421), evolving industrial structure and climate change (0.419), and problems related with storage of output (0.636). The dominant loadings on knowledge and skill deficits indicate that this factor captures the epistemic dimension of agripreneurial constraints.

Agripreneurs who lack access to reliable information systems and technical competencies are poorly equipped to adopt precision agriculture technologies, navigate digital marketplaces, or respond adaptively to changing agroclimatic conditions. The co-occurrence of registration problems and competitive pressures within this factor suggests that knowledge barriers also translate into institutional and market access disadvantages. This finding aligns with Klerkx et al. (2020), who identified information asymmetries as the primary impediment to technology adoption in agricultural entrepreneurship.

Factor 2: Input and Infrastructure Constraints (Eigenvalue = 4.269; Rotated Variance = 13.86%)

Seven variables define this factor, all relating to input availability and physical infrastructure: non-availability of input (-0.441), high cost of input (-0.525), irregular supply of input (0.494), transport bottlenecks (-0.554), lack of adequate storage facility (-0.433), lack of electricity supply (-0.634), and lack of cost-free equipment (-0.653). The presence of negative loadings reflects the inverse nature of the factor score relationship, wherein higher scores on the latent variable correspond to lower perceived sufficiency of inputs and infrastructure.

Infrastructure deficiencies act as multiplier constraints, amplifying the adverse effects of other challenges. Poor electricity supply disrupts cold chain operations and processing activities, while inadequate storage leads to post-harvest losses that erode margins. Transport bottlenecks increase transaction costs and reduce market access. The collective weight of these constraints on production economics is substantial, and their persistence reflects the structural underdevelopment of rural infrastructure in the district.

Factor 3: Marketing Constraints (Eigenvalue = 3.394; Rotated Variance = 11.43%)

Five variables constitute this factor: dependence on a limited number of products (0.679), poor sales realisation (0.511), defective pricing policy (0.577), inadequate sales promotion techniques (0.579), and lack of market feedback (0.486). This factor encapsulates the market interface challenges that prevent agripreneurs from capturing fair value for their produce.

The high loading on product dependence is particularly noteworthy. Agripreneurs in Pathanamthitta, heavily reliant on rubber and a narrow range of plantation crops, are acutely exposed to commodity price volatility. The absence of robust market intelligence systems means that pricing decisions are reactive rather than strategic, further compressing margins. Inadequate sales promotion capabilities restrict market reach, confining agripreneurs to localised, often oversupplied, markets.

Factor 4: Financial Constraints (Eigenvalue = 2.924; Rotated Variance = 10.12%)

This factor encompasses the largest number of variables (ten), reflecting the multi-layered nature of financial exclusion faced by agripreneurs: lack of adequate capital (0.574), improper working capital management (0.568), high cost of credit (0.562), lack of access

to public money (0.584), less financial support from Government (0.594), minimum amount of agricultural loan (0.588), lack of subsidized inputs (0.549), lack of interest-free loan for agricultural purpose (0.653), lack of seed capital (0.443), and lack of financial subsidies from Government (0.567).

The breadth of this factor underscores the systemic nature of financial exclusion in rural agribusiness. Capital constraints operate simultaneously at the enterprise formation stage (seed capital), the operational stage (working capital), and the expansion stage (investment credit), creating a comprehensive barrier to agripreneurial development across the business lifecycle. The particularly high loading on lack of interest-free agricultural loans (0.653) indicates that the cost of borrowing is a more binding constraint than the mere availability of credit.

Factor 5: Labour Constraints (Eigenvalue = 1.480; Rotated Variance = 6.11%)
Six variables load on this factor: exercising high cost of labour (0.652), inefficient handling of labour problems (0.463), poor labour productivity (0.557), poor labour relations (0.472), lack of trained labour (0.588), and lack of trainers (0.592). This factor reflects the labour market conditions prevailing in Kerala, characterised by high nominal wages driven by inter-sector competition and Gulf remittances, alongside a declining supply of agricultural workers and a mismatch between available skills and technological requirements.
The dual challenge of cost and quality in labour is particularly acute for agripreneurs who rely on specialised tasks such as grafting, pruning, and post-harvest processing. The high loading on lack of trainers (0.592) suggests that the skill gap is partly attributable to an underdeveloped agricultural extension and training infrastructure.

6. SUMMARY OF FACTOR STRUCTURE

Table 5 consolidates the key features of the five extracted factors, providing a comprehensive overview of the factor structure.

Table 5: Summary of Extracted Factor Dimensions

Factor	Label	No. of Vars.	Eigenvalue (Rotated)	% Variance	Cum. %	Key Variables
1	Informational and Technical Constraints	8	6.740	13.460	13.460	Lack of information, technical know-how, investment risk, registration issues, uncertainty, competition, climate change, storage problems
2	Input and Infrastructure Constraints	7	4.269	13.857	27.317	Non-availability, high cost, irregular supply of inputs; transport bottlenecks, lack of storage, electricity, and equipment
3	Marketing Constraints	5	3.394	11.428	38.745	Product dependence, poor sales realisation, pricing defects, inadequate promotion, lack of market feedback
4	Financial Constraints	10	2.924	10.121	48.866	Capital inadequacy, improper working capital, high credit cost, limited public funds, insufficient subsidies, lack of seed capital
5	Labour Constraints	6	1.480	6.110	54.976	High labour cost, inefficiency, poor productivity & relations, shortage of skilled labour and trainers

7. DISCUSSION

The factor-analytic findings present a coherent and theoretically consistent portrait of agripreneurial constraints in Pathanamthitta district. The identification of five distinct constraint dimensions — informational and technical, input and infrastructure, marketing, financial, and labour — provides a structural map that can guide the design of differentiated policy interventions.
A notable feature of the findings is the relative equivalence in explanatory power between Factor 1 (13.46%) and Factor 2 (13.86%), suggesting that informational deficits and infrastructure inadequacies are of roughly comparable severity. This is a departure from studies in other Indian states, where financial constraints typically dominate (Barrett et al., 2022), and may reflect Kerala's relatively higher financial inclusion indices, which, while improving credit access at the margin, have not resolved the structural issue of high borrowing costs.

The marketing factor's loading structure, particularly the central role of product dependence, points to a fundamental structural rigidity in the district's agripreneurial landscape. The monoculture legacy of plantation-dominated agriculture has not been adequately countered by diversification incentives, leaving agripreneurs exposed to both commodity price risk and demand-side uncertainty.

The labour factor, while explaining the smallest share of variance (6.11%), carries particular significance in the Kerala context. The state's historically high wages and the gradual withdrawal of the agricultural labour force — partly towards the service sector and partly to emigration — create a structural imbalance that cannot be resolved through market mechanisms alone. The low loading of labour-related variables on other factors further confirms that labour constraints constitute an independent dimension of agripreneurial disadvantage, not merely a reflection of financial or technical deficiencies.

8. CONCLUSION AND POLICY IMPLICATIONS

This study provides a rigorous empirical analysis of the multidimensional constraints confronting agripreneurs in Pathanamthitta district, Kerala. By applying Exploratory Factor Analysis to data from 250 respondents, five distinct constraint dimensions were identified: Informational and Technical, Input and Infrastructure, Marketing, Financial, and Labour. Together, these factors account for approximately 55% of the total variance in the dataset, offering a comprehensive and statistically validated picture of the agripreneurial constraint landscape.

The policy implications that flow from these findings are correspondingly multidimensional. Addressing informational and technical constraints requires investment in agri-extension services, digital literacy infrastructure, and technology transfer platforms that are specifically tailored to the scale and resource profile of small agripreneurs. Input and infrastructure constraints call for concerted public investment in rural road networks, cold chain facilities, reliable power supply, and mechanisation support schemes.

Marketing constraints can be mitigated through the establishment of formal market intelligence systems, the promotion of collective marketing arrangements such as Farmer Producer Organisations (FPOs), and the implementation of transparent, commodity-specific pricing mechanisms. Financial constraints require a systemic response encompassing the expansion of subsidised credit windows, the streamlining of agricultural loan eligibility norms, and the introduction of risk-sharing instruments such as crop insurance products tailored to agripreneurial enterprises.

Labour constraints, given their structural roots, necessitate a longer-term strategy involving investment in vocational agricultural training institutions, the deployment of mechanisation subsidies, and the development of skill certification frameworks that can attract young workers into technologically upgraded agricultural roles.

Future research could extend this analysis by conducting comparative factor studies across other Kerala districts, incorporating time-series data to track constraint evolution, and employing Structural Equation Modelling (SEM) to examine causal relationships among the identified constraint dimensions. The present study thus serves as both a diagnostic contribution and a foundation for a more ambitious research agenda on agripreneurial development in Indian rural economies.

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