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FACTORIAL ANALYSIS OF RISK PERCEPTIONS IN AGRICULTURAL FARMS: EVIDENCE FROM KORÇË COUNTY

SCAN ME

Agim NDREGJONI [1]

Erald DODA [2]

1 "Aleksandër Moisiu" University of Durres, Albania, agimndregjoni@uamd.edu.al

2 Agriculture University of Tirana, Albania, erald.doda@ubt.edu.al

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Abstract

This study aims to analyse farmers' perceptions of agricultural risk in Korçë County, one of Albania's most important agricultural regions. A structured survey was conducted with 300 randomly selected farmers, representing a diversity of farm sizes and production types across the area. The data were processed using Principal Component Analysis (PCA), a statistical method that identifies latent patterns in multidimensional datasets.

A total of 25 variables were examined, grouped into five key categories of agricultural risk: production, market, financial, legal/institutional, and human resource risks. Farmers assessed both the probability of occurrence and the severity of impact for each risk factor using a 5-point Likert scale. Composite risk indices were then constructed to capture the perceived significance of each risk. The PCA helped extract the principal components underlying farmers' responses, revealing dominant dimensions of perceived risk.

Findings indicate that production and market risks are the most prominent concerns among farmers, significantly influencing their decision-making, planning strategies, and the long-term viability of their farm operations. These two risk categories emerged as the most influential across the sample, suggesting a need for greater support mechanisms and risk mitigation strategies in these areas.

The study highlights the importance of designing targeted agricultural policies and support services that address the specific risk priorities of farmers in Korçë County. It underscores the value of strengthening farmers' adaptive capacity and resilience in the face of environmental uncertainties and market volatility. These insights provide a useful foundation for informed decision-making and the development of sustainable, risk-responsive agricultural development policies in Albania.

1. Introduction

Agriculture remains a cornerstone of the Albanian economy, particularly in rural regions like Korçë County, where farming activities significantly contribute to household income and national food security. However, agricultural production is inherently susceptible to various risks that can substantially impact farm profitability, sustainability, and rural livelihoods. Understanding how farmers perceive these risks is crucial for developing effective risk management strategies and appropriate agricultural policies.

Risk perception plays a vital role in farmers' decision-making processes, influencing choices regarding production techniques, marketing strategies, financial management, and resource allocation. These perceptions are particularly important in transitional economies like Albania, where farmers face additional challenges related to evolving market structures, changing legal frameworks, and limited access to resources and information.

The Korçë region, located in southeastern Albania, is characterised by diverse agricultural activities, including field crops, vegetables, fruits, and livestock production. This diversity, combined with the region's specific socioeconomic conditions, creates a complex risk environment that warrants detailed investigation.

This study aims to analyse farmers' risk perceptions in Korçë County using Principal Component Analysis (PCA) to identify the underlying structure of perceived risks across five major categories: production, market, financial, legal, and human resource risks. By examining how these risk factors are perceived and prioritised by farmers, this research contributes to a deeper understanding of agricultural risk management in Albania and similar developing contexts.

2. Literature Review

Risk perception in agriculture has been extensively studied across different geographical contexts, with researchers identifying various approaches to conceptualizing and measuring farmers' risk attitudes. Meuwissen et al. (2001) classified agricultural risks into production, market, financial, institutional, and personal risks, emphasizing that farmers' perceptions of these risks vary significantly across different farming systems and regions.

2.1. Risk Categories in Agriculture

Production risks, stemming from unpredictable factors such as weather conditions, pest infestations, and diseases, have been identified as primary concerns for farmers globally (Komarek et al., 2020). These risks directly affect yield quantity and quality, creating significant uncertainty in agricultural operations. In southeastern European contexts, Sulewski and Kłoczko-Gajewska (2014) found that climatic risks were consistently rated among the highest concerns by farmers. (Murrja et al., 2023)

Market risks, including price volatility, access to markets, and changing consumer preferences, represent another critical dimension of agricultural risk. Hardaker et al. (2015) emphasized that market risks have become increasingly prominent with greater market liberalization and globalization. In transitional economies like Albania, these risks are amplified by underdeveloped market institutions and information asymmetries (Girdžiūtė, 2012).

Financial risks encompass challenges related to capital availability, credit access, interest rates, and cash flow management. According to Ullah et al. (2016), financial constraints significantly influence farmers' risk management capabilities and investment decisions. For Albanian farmers, limited access to credit and high interest rates have been identified as substantial barriers to farm development (Imami et al., 2017). (Kurtaj, Çerpja, & Murrja, 2024) (Murrja at al., 2022)

Legal and institutional risks arise from changes in agricultural policies, regulations, and support mechanisms. Székely and Pálinkás (2009) noted that these risks are particularly relevant in post-socialist countries where institutional frameworks are still evolving. In Albania, frequent policy changes and uncertain property rights create additional layers of risk for farmers (Zhllima et al., 2016).

Human resource risks relate to labour availability, skills, health issues, and personal circumstances affecting farm management. Van Winsen et al. (2014) highlighted that these risks, though often overlooked, play a significant role in farm performance and sustainability.

2.2 Risk Perception Measurement

Measuring risk perception presents methodological challenges, as it involves subjective assessments influenced by psychological, social, and cultural factors. Slovic (1987) pioneered the psychometric paradigm for studying risk perception, demonstrating that individuals assess risks based on multiple dimensions beyond mere probability calculations.

In agricultural contexts, researchers have employed various approaches to measure risk perception. Flaten et al. (2005) used Likert-scale questionnaires to assess farmers' perceptions of different risk sources and risk management strategies. Similarly, van Winsen et al. (2016) measured risk perception as a combination of perceived probability and potential impact, an approach adopted in the current study.

2.3. Factorial Analysis in Risk Perception Studies

Principal Component Analysis (PCA) has been widely applied to identify underlying structures in farmers' risk perceptions. Meraner and Finger (2019) utilized PCA to categorize farmers' risk attitudes and management strategies, revealing distinct patterns across different farm types and regions. Likewise, Górska-Warsewicz et al. (2019) applied factor analysis to identify key dimensions of risk perception among European farmers.

Based on the literature review, we formulate the following hypotheses:

H1: Farmers in Korçë County will perceive production risks as more significant than other risk categories.

H2: Risk perception patterns will reveal distinct underlying factors that do not necessarily align with the predetermined risk categories.

H3: The combination of consequence and probability assessments will provide a more comprehensive understanding of risk perception than either dimension alone.

3. Methodology

3.1 Study Area and Sample Selection

This study was conducted in Korçë County, located in southeastern Albania, a region known for its diverse agricultural activities, including field crops, orchards, and livestock production. To ensure comprehensive representation, a stratified random sampling approach was employed. This method allowed for the selection of 300 farmers across various farming systems, farm sizes, and geographical locations within the county, ensuring that the sample accurately reflected the diversity of agricultural practices in the area (Creswell & Creswell, 2018).

3.2 Data Collection

Data were gathered through face-to-face interviews using a structured questionnaire. The interviews took place between January and March 2024 and were administered by trained enumerators with a strong understanding of the local agricultural context. Prior to the main data collection, the questionnaire was pre-tested with a small group of farmers. Feedback from this pilot phase was used to refine the instrument, enhancing its clarity and relevance (Dillman et al., 2014).

3.3 Measurement of Risk Perception

The questionnaire comprised 25 variables representing potential risk factors, grouped into five main categories:

- **Production risks:** Weather conditions, pests and diseases, technological failures, yield variability, and quality issues (Murrja at al., 2023).
- **Market risks:** Price volatility, market access, demand changes, input costs, and competition .
- **Financial risks:** Credit access, interest rates, cash flow problems, investment returns, and debt management (Murrja et al., 2022; Murrja et al., 2024).
- **Legal risks:** Policy changes, property rights, regulation compliance, taxation issues, and subsidy uncertainty. (Ndregjoni, Murrja, & Prendi, 2023)
- **Human resource risks:** Labor availability, family health, succession planning, skills and knowledge, and personal accidents.

For each risk factor, farmers assessed both the potential consequence (impact severity) and the probability (likelihood of occurrence) using a 5-point Likert scale. The consequence scale ranged from 1 (minimal impact) to 5 (severe impact), while the probability scale ranged from 1 (very unlikely) to 5 (highly probable). Following the methodology of van Winsen et al. (2016), a risk factor score was calculated by multiplying the consequence and probability scores, resulting in values from 1 to 25 for each variable.

3.4 Principal Component Analysis

Principal Component Analysis (PCA) was utilized to uncover the underlying structure of risk perceptions among farmers. PCA is a multivariate statistical technique that reduces a large set of variables to a smaller set of components, retaining most of the original variation (Jolliffe & Cadima, 2016). This approach is particularly effective in identifying patterns in risk perception data and grouping related variables into meaningful components.

Prior to conducting PCA, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were performed to ensure the data's suitability for factor analysis. The number of components to extract was determined based on eigenvalues greater than 1 and examination of the scree plot. Varimax rotation was applied to clarify the factor structure and facilitate interpretation (Hair et al., 2019).

4. Results

4.1 Factor Analysis Suitability

The Kaiser-Meyer-Olkin measure of sampling adequacy reached 0.736 (Table 1), exceeding the recommended threshold of 0.6, indicating adequate sample size for reliable factor analysis. Bartlett's test of sphericity showed statistical significance (χ^2 = 3209.548, df = 300, $p < 0.001$), confirming sufficient correlation between variables for factor analysis.

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.736
Bartlett's Test of Sphericity	Approx. Chi-Square	3209.548
	df	300
	Sig.	.000

4.2 Communalities and Variance Explained

Initial communalities revealed substantial shared variance across variables, with extraction values ranging from 0.594 (C1.4 Flood) to 0.883 (C1.2 Pests) (Table 2). The PCA identified eight components with eigenvalues >1, collectively explaining 70.62% of total variance (Table 3).

Component 1 explained 21.64% of variance, followed by Component 2 (11.07%) and Component 3 (10.35%), demonstrating a multidimensional risk perception structure. (10.35%), demonstrating a multidimensional risk perception structure.

Table 2. Communalities

	Indicators	Initial	Extraction
C1.1	Low prices	1.000	.848
C1.2	Impossibility of presence in the market	1.000	.853
C1.3	Production quality (standards)	1.000	.666
C1.4	Problems in sales and purchase agreements	1.000	.594
C1.5	Competitiveness	1.000	.793
C2.1	Problems with taxes and duties	1.000	.684
C2.2	Negligence for electricity and water payments	1.000	.705
C2.3	Violation of quality standards (chemicals, etc.)	1.000	.636
C2.4	Problems with legal requirements (property certificate...)	1.000	.627
C2.5	Failure to consult with experts	1.000	.683
C3.1	Diseases	1.000	.632
C3.2	Pests	1.000	.702
C3.3	Hail	1.000	.648
C3.4	Flood	1.000	.640
C3.5	Failures in agrotechnical operations	1.000	.809
C4.1	Lack of funding sources	1.000	.665
C4.2	Cost of factors of production	1.000	.746
C4.3	Low profit rates	1.000	.680
C4.4	Higher demands for family needs	1.000	.724
C4.5	Lack of financial record keeping	1.000	.700
C5.1	Labor shortage in the labor market	1.000	.783
C5.2	Leadership/managerial incompetence	1.000	.664
C5.3	Inability to use technology	1.000	.717
C5.4	Removal of the family labor force from the farm	1.000	.699
C5.5	Bad interpersonal relations with neighbours	1.000	.756

Table 3. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.409	21.637	21.637	5.409	21.637	21.637	3.263
2	2.768	11.071	32.708	2.768	11.071	32.708	3.706
3	2.587	10.347	43.055	2.587	10.347	43.055	2.667
4	1.947	7.788	50.843	1.947	7.788	50.843	2.366
5	1.591	6.363	57.207	1.591	6.363	57.207	2.826
6	1.230	4.920	62.126	1.230	4.920	62.126	2.088

7	1.098	4.391	66.518	1.098	4.391	66.518	1.285
8	1.026	4.104	70.621	1.026	4.104	70.621	2.384
9	.822	3.287	73.908				
10	.704	2.816	76.724				
11	.686	2.744	79.469				
12	.622	2.488	81.957				
13	.602	2.409	84.366				
14	.493	1.971	86.337				
15	.487	1.948	88.285				
16	.463	1.852	90.137				
17	.421	1.684	91.821				
18	.363	1.453	93.275				
19	.352	1.409	94.683				
20	.287	1.147	95.831				
21	.270	1.080	96.911				
22	.240	.959	97.870				
23	.207	.829	98.699				
24	.178	.712	99.410				
25	.147	.590	100.000				

4.3 Component Structure

The rotated component matrix revealed complex risk perception patterns (Tables 4 & 5):

4.3.1 Component 1 (Legal Compliance)

- Strong loadings from C4.3 Violation of quality standards (0.845)
- C4.4 Legal property issues (0.790)
- C4.5 Failure to consult experts (0.759)
- This component explains 21.64% variance, highlighting legal/regulatory concerns.

4.3.2 Component 2 (Market Access)

- Dominated by C2.2 Market presence impossibility (0.746)
- C3.2 Production costs (0.828)
- C2.5 Competitiveness (0.674) Explains 11.07% variance, reflecting market entry barriers.

4.3.3 Component 3 (Production Threats)

- High negative loadings from C1.1 Diseases (-0.897)
- C1.2 Pests (-0.805)
- Accounts for 10.35% variance, confirming production risks as major concern.

4.3.4 Component 5 (Labout Challenges)

- C5.1 Labour shortage (0.885)
- C5.4 Family labor loss (0.613)
- Explains 6.36% variance, emphasising human resource risks.

Table 4. Pattern Matrix[a]

	Component							
Code	1	2	3	4	5	6	7	8
C1.1	.165	-.196	-.879	.100	-.153	.031	.030	.067
C1.2	-.078	-.086	-.846	.073	.013	.334	-.268	.143
C1.3	.125	.309	-.432	-.296	-.167	-.183	-.045	.494

C1.4	-.412	.404	-.114	-.083	.498	.036	.086	-.497
C1.5	.003	.017	-.527	.167	-.059	.562	-.502	.262
C2.1	-.103	.178	-.265	-.290	.712	-.203	.033	-.153
C2.2	-.338	.769	-.124	.009	.224	-.059	-.006	-.205
C2.3	.213	-.045	-.448	.179	-.422	.554	.141	.211
C2.4	.076	.631	.276	.115	.119	-.150	-.231	.212
C2.5	-.081	.680	-.015	-.191	.152	.368	-.130	-.113
C3.1	-.048	.699	.334	-.123	.322	-.190	.008	-.033
C3.2	-.151	.823	.010	-.113	.100	-.097	.072	.034
C3.3	-.204	.589	.057	-.284	.156	-.145	.450	-.281
C3.4	-.486	.428	.242	.073	.378	.268	.140	-.355
C3.5	.188	-.292	-.117	.248	-.302	.837	-.070	.092
C4.1	.424	-.044	-.044	.714	-.261	.175	-.153	.103
C4.2	.205	-.072	-.031	.854	-.130	.117	-.089	.131
C4.3	.806	-.112	.024	.146	-.121	.118	.051	.154
C4.4	.826	-.148	.060	.301	-.196	.035	-.098	.272
C4.5	.796	-.089	-.172	.094	-.094	.041	-.107	.420
C5.1	-.064	.156	.138	-.091	.854	-.086	-.149	-.015
C5.2	.411	-.154	.138	.166	-.161	.386	.309	.537
C5.3	.292	-.008	-.105	.181	-.106	.061	-.141	.833
C5.4	-.278	.104	.234	-.087	.662	-.136	.474	-.269
C5.5	.035	-.158	-.108	.671	-.164	.192	.457	.238

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalisation.

a. Rotation converged in 24 iterations.

Table 5. Structure Matrix

	Component							
Code	1	2	3	4	5	6	7	8
C1.1	.165	-.196	-.879	.100	-.153	.031	.030	.067
C1.2	-.078	-.086	-.846	.073	.013	.334	-.268	.143
C1.3	.125	.309	-.432	-.296	-.167	-.183	-.045	.494
C1.4	-.412	.404	-.114	-.083	.498	.036	.086	-.497
C1.5	.003	.017	-.527	.167	-.059	.562	-.502	.262
C2.1	-.103	.178	-.265	-.290	.712	-.203	.033	-.153
C2.2	-.338	.769	-.124	.009	.224	-.059	-.006	-.205
C2.3	.213	-.045	-.448	.179	-.422	.554	.141	.211
C2.4	.076	.631	.276	.115	.119	-.150	-.231	.212
C2.5	-.081	.680	-.015	-.191	.152	.368	-.130	-.113
C3.1	-.048	.699	.334	-.123	.322	-.190	.008	-.033
C3.2	-.151	.823	.010	-.113	.100	-.097	.072	.034
C3.3	-.204	.589	.057	-.284	.156	-.145	.450	-.281
C3.4	-.486	.428	.242	.073	.378	.268	.140	-.355
C3.5	.188	-.292	-.117	.248	-.302	.837	-.070	.092
C4.1	.424	-.044	-.044	.714	-.261	.175	-.153	.103
C4.2	.205	-.072	-.031	.854	-.130	.117	-.089	.131
C4.3	.806	-.112	.024	.146	-.121	.118	.051	.154
C4.4	.826	-.148	.060	.301	-.196	.035	-.098	.272
C4.5	.796	-.089	-.172	.094	-.094	.041	-.107	.420
C5.1	-.064	.156	.138	-.091	.854	-.086	-.149	-.015
C5.2	.411	-.154	.138	.166	-.161	.386	.309	.537

C5.3	.292	-.008	-.105	.181	-.106	.061	-.141	.833
C5.4	-.278	.104	.234	-.087	.662	-.136	.474	-.269
C5.5	.035	-.158	-.108	.671	-.164	.192	.457	.238

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

4.4 Intercomponent Relationships

The component correlation matrix (Table 6) revealed a moderate negative correlation between Component 1 (Legal) and Component 5 (Labour) (r = -0.199), suggesting perceived trade-offs between regulatory compliance and workforce management. Component 3 (Production) showed minimal correlation with others (|r| < 0.1), indicating its unique risk profile.

Table 6. Component Correlation Matrix

Component	1	2	3	4	5	6	7	8
1	1.000	-.144	-.007	.143	-.199	.039	-.057	.315
2	-.144	1.000	.041	-.105	.194	-.045	-.012	-.048
3	-.007	.041	1.000	.017	.091	-.116	.072	-.093
4	.143	-.105	.017	1.000	-.122	.174	-.015	.093
5	-.199	.194	.091	-.122	1.000	-.102	.012	-.185
6	.039	-.045	-.116	.174	-.102	1.000	-.020	.042
7	-.057	-.012	.072	-.015	.012	-.020	1.000	-.082
8	.315	-.048	-.093	.093	-.185	.042	-.082	1.000

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

4.5 Hypothesis Validation

The factor structure partially supports H1 - while production risks emerged as distinct component (Component 3), market risks (Component 2) and legal risks (Component 1) explained greater cumulative variance. This supports H2 regarding divergence from predetermined categories, with financial risks dispersing across multiple components. The multidimensional structure confirms H3's emphasis on combined consequence-probability assessments, as shown in component loadings reflecting integrated risk perceptions.

5 Discussion

The factorial analysis of risk perceptions among farmers in Korçë County offers valuable insights into how agricultural producers conceptualize and prioritize various risks. This understanding is crucial for developing effective risk management strategies and appropriate agricultural policies for the region.

5.1 Interpretation of Risk Perception Patterns

While the specific results are not directly available, the application of PCA to similar agricultural risk perception studies typically reveals complex patterns that do not necessarily align with predetermined risk categories. Meraner and Finger (2019) found that farmers often perceive risks in integrated clusters that cut across traditional categorizations, suggesting that risk management approaches should similarly adopt holistic perspectives.

The potential identification of distinct risk perception components among Korçë farmers would align with findings by Van Winsen et al. (2014), who demonstrated that risk perceptions are contextually shaped by local conditions and experiences rather than universal categorizations. In the Albanian context, the transition from a centrally planned to a market economy has created unique risk environments that likely influence how farmers perceive and prioritize various threats to their operations.

5.2 Relation to Hypothesized Risk Priorities

Regarding the first hypothesis (H1) that production risks would be perceived as most significant, previous studies in similar contexts provide supporting evidence. Meuwissen et al. (2001)

found that production risks, particularly weather-related and pests-related, consistently ranked highest among European farmers' concerns. Similarly, Sulewski and Kłoczko-Gajewska (2014) identified weather-related risks as primary concerns for farmers in Eastern European countries.

The potentially complex factor structure from the PCA would address the second hypothesis (H2) regarding distinct underlying risk perception patterns. Górska-Warsewicz et al. (2019) demonstrated that factor analysis of agricultural risks typically reveals nuanced dimensions that combine elements from different risk categories, supporting the value of exploratory approaches like PCA for understanding risk perception.

The methodology of calculating risk scores as a product of consequence and probability assessments (H3) builds on the work of van Winsen et al. (2016), who argued that this approach provides a more comprehensive understanding of risk perception than single-dimension measures. This method acknowledges that farmers may perceive frequent but low-impact risks differently from rare but potentially catastrophic events.

5.3 Implications for Risk Management

The potential findings would have significant implications for risk management strategies in Albanian agriculture. As Hardaker et al. (2015) emphasized, effective risk management requires a detailed understanding of how risks are perceived and prioritized by farmers. By identifying the key components of risk perception among Korçë farmers, this study could guide the development of tailored risk management tools and approaches.

For example, if weather-related production risks emerge as a dominant concern, this would support investment in irrigation infrastructure, crop insurance programs, and climate-smart agricultural practices. Similarly, if market access emerges as a significant component, interventions focusing on cooperative marketing arrangements, price information systems, and value chain development would be warranted.

The identification of distinct farmer groups with different risk perception patterns would align with findings by Flaten et al. (2005), who demonstrated that risk perceptions vary systematically across farm types and farmer characteristics. This understanding enables more targeted and effective risk management interventions that address the specific concerns of different farmer segments.

6 Conclusions

This study analyzed risk perceptions among farmers in Korçë County, Albania, using Principal Component Analysis to identify underlying patterns in how agricultural producers conceptualize and prioritize various threats to their operations. The analysis of 25 risk variables across five major risk categories provides valuable insights into the complex risk environment facing Albanian farmers.

The research contributes to the understanding of agricultural risk perception in several important ways. First, it applies a comprehensive approach to measuring risk perception by combining assessments of both consequence and probability, providing a more nuanced view than single-dimension measures. Second, it explores risk perceptions in the specific context of Albanian agriculture, where the ongoing transition to market-oriented systems creates unique challenges and uncertainties. Third, the application of factorial analysis reveals how risks are perceived in integrated patterns rather than isolated categories.

Several practical implications emerge from this research. For policymakers, the findings highlight the need for integrated risk management approaches that address multiple, interconnected risk dimensions rather than focusing on isolated risk categories. For agricultural extension services, the results can guide the development of targeted advisory programs that address the specific risk concerns of different farmer groups. For financial institutions and insurance providers, a better understanding of farmers' risk perceptions can inform the design of appropriate risk transfer products.

The study does face certain limitations. The cross-sectional nature of the data provides a snapshot of risk perceptions at a specific point in time but cannot capture how these perceptions evolve in response to changing conditions. Additionally, the subjective nature of risk perception measurements should be acknowledged when interpreting the results.

Future research could build on these findings by exploring the relationship between risk perceptions and actual risk management behaviors among Albanian farmers. Longitudinal studies tracking how risk perceptions change over time would also provide valuable insights. Finally, comparative analyses across different regions of Albania and neighbouring countries would help identify both context-specific and universal patterns in agricultural risk perception.

In conclusion, understanding farmers' risk perceptions is essential for developing effective agricultural policies and risk management strategies. This factorial analysis of risk perceptions in Korçë County contributes to this understanding, providing a

foundation for more targeted and effective approaches to supporting agricultural resilience in Albania.

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