Risk perception and risk coping strategies for typical and entrepreneurial dairy farms in Narok-Bomet and Nyandarua counties, Kenya

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ABSTRACT

Dairy farming in Kenya faces multiple risks that impact production performance. Risk perception is likely to differ between typical and entrepreneurial farms, and the difference likely manifests in their choice of risk coping strategies. This study examined how typical and entrepreneurial farms perceive and cope with risks in Nyandarua County - representing a more developed dairy sector, and Narok-Bomet Counties, representing a less developed dairy sector. It is assumed that typical and entrepreneurial farms perceive and cope with risks differently with entrepreneurial farms adopting sophisticated and resource intensive strategies. Using stratified sampling method, cooperatives were identified and a list of farmers selling to the cooperatives were categorized as typical if they sold up to 50 litres of milk with no increase over the last 5 years. Otherwise were entrepreneurial farmers if they consistently sold over 50 litres of milk with growth over the same period. A cross sectional survey was done across 120 farmers out of whom 56 were typical and 64 entrepreneurial where each farmer was asked to list top three severe risks and the coping strategies per risk. Data analysis used Microsoft Excel and SPSS version 23. Risk perception indices revealed that both typical and entrepreneurial farmers considered market price volatility (0.375, 0.346) the most significant risk, followed by production-related threats such as disease (0.116, 0.143), feed scarcity due to limited land (0.158, 0.078) and due to extreme weather (0.0833, 0.1016), poor genetics and reproduction (0.027, 0.094) and difficulties in accessing inputs and services (0.131, 0.125). Through Principal Component Analysis (PCA), key coping strategies to these risks were identified in typical farms to reflect reliance on modest innovations, local network and practical responses aligned with available assets. In contrast, coping strategies in entrepreneurial farms were proactive investment in technologies, innovations and partnerships.

Keywords: Dairy Growth Stages, Marketing Risks, Production Risks, Risk Perception Index, Risk Coping

I. INTRODUCTION

Dairy farming in tropical production environments is pervasively exposed to multiple risks, which adversely impact on production performance. This necessitates options for enhancing resilience; the ability of farmers to effectively respond to multiple risks, which are increasing in frequency and intensity with the changing and variable climate (Darnhofer, 2014). In a review of sources of risks in dairy farms, Gebreegziabher and Tadesse (2014) categorized six types of risks: production, technological, institutional, personnel, financial, and marketing risks. In Kenyan dairy farming, Odero-Waitituh (2017) enumerated corresponding risks as including feed scarcity, poor technical and technological skills, limited access to veterinary services and artificial insemination, poor infrastructural development, limited access to financial resources and price fluctuations. Faced with these multiple risks, dairy farmers have to implement responsive strategies to remain afloat.

Financial risk in dairy farming refers to the uncertainty farmers face in securing sufficient capital to cover essential inputs and services and aggravated by lack of access to formal credit and insurance (Shee et al., 2015). Such risks are heightened by irregular income dependent on milk and other on farm activities, market volatility and high operational costs versus the expenditures and debt level (Furey et al., 2016). Perception to financial risks varies in different where farmers who perceive financial risks to be high invest on pro-active financial risk management practices including savings, diversification and insurance (Meraner & Finger 2019). Small holder dairy in Kenya perceive financial risks as input costs fluctuation and mil market price instability (Waweru et al., 2019). Marketing risks related to fluctuations in demand and prices is perceived to be the most significant risks in dairy farms (Duguma 2022; Mbichi & Maina 2024). The dairy sub-sector in Kenya is characterized by weak market linkages and unreliable market outlets due to pronounced seasonal fluctuations in milk output and prices, poor rural infrastructure (roads and electricity), as well as lack of management and business skills, and inefficiencies in the post-harvest segment of the dairy value chain (Njarui *et al.*, 2016). Unstable milk prices, limited buyer options and weak bargaining power have been cited to be the cause of marketing risks in small holder dairy farms in Kenya which consequently affect their livelihood diversification and income (Kihoro et al., 2024).

Feed scarcity in dairy farming is defined as the inadequate provision of both quantity and quality of feed required to sustain optimal animal health and productivity, including deficits in energy, protein, and essential micronutrients (Mutura et al., 2016). Seasonal feed scarcity accounts for 40% reduction of milk yield per cow (Hobbs & Svetlichnaya, 2020). Livestock disease reduces yields and causes mortality – impacting on savings, reducing herd sizes and increasing risks for poor households (Onono et al., 2013). Diseases affecting dairy cattle can be classified as metabolic diseases, infectious, chemical/mechanical conditions and parasitic infestation (both external and internal parasites) (Blood et al., 1989). Reproductive performance and genetic composition in dairy herds critically influence productivity and resilience, particularly in smallholder systems. Prolonged calving interval and low rates of conception characterize poor reproductive efficiency as reported in Ethiopia cross bred herds where calving interval of 460 days have been reported resulting to reduced milk yield and income (Mesele & Hadgu, 2024). Reproductive performance of the cows has continued to remain poor in developing countries, with a majority of the dairy farmers not achieving a calf/cow/year, and milk production has remained under 10 kg/cow/day (Kabaka et al., 2013). Test-day milk yield evaluations in Kenya indicated low genetic variability and productivity revealing unrestricted cross breeding and lack of structured breeding (Ojango et al., 2019). Silvi et al. (2021) reported that dairy farms perceive technological risks as uncertainty on complexity of technology, return on investment and compatibility of technology being adopted with the older systems.

Use of technologies has been noted to increase farm productivity, resource efficiency, easy farm management, reduced cost of labour and environmental management (Kozina & Semkiv 2020). Reproductive technologies such as artificial insemination, precision feeding, investment of feed processing and milk cooling equipment are among the commonly used technologies in Kenya (Kirimi et al., 2024). Inadequate risk assessments coupled with lack of alignment with farm specific needs, insufficient trainings and weak regulatory framework and lack of technical support have been reported to result to poor integration of new technologies within dairy farms (Lombardo et al., 2017). In farming, institutional risk refers to unpredictable changes in the provision of services from institutions that support farming. Such institutions can be both formal and informal and include banks, cooperatives, marketing organizations, input dealers and government extension services. These institutions provide regulatory frameworks and policies within which dairy enterprise operates (Wairimu et al., 2022). Regulatory risks affecting dairy farms include changes in regional, national or international policy, laws and regulation, property rights, changes in government laws and policies, changes in local bodies laws and regulations, changes in producer board policies (Garrido & Biezla 2008). Other institutional risk is the uncertainty of government policy affecting farming, such as price support and subsidies (Kahan *et al.*, 2013). Personnel or human risks on dairy farms refer to uncertainties related to labor availability, skill levels, health, and household dynamics that directly affect farm operations and productivity (Ndirangu et al., 2016). Dairy labour is labor-intensive and smallholder farmers often lack access to mechanized tools, raising vulnerability to fatigue, injury, and labor shortages during peak seasons (Ondiek et al., 2025). Entrepreneurial farmers, who invest in training and semi-skilled labor, are more likely to perceive personnel risk as manageable and plan for contingencies (Chelang'a et al., 2025). They also tend to integrate hired labor and mechanization to mitigate human risk and boost productivity (Mwangi et al., 2021). In contrast, typical farmers, constrained by capital, rarely hire labor and often rely on overburdened family members, making their systems fragile (Wanyoike et al., 2021)

Farmers' response to risks is what is referred to as coping strategy. Fufa *et al.* (2024) observed that dairy farmers in Ethiopia were using a wide variety of coping strategies including use of supplementary feed, crop residues and non-conventional feeds. Other coping strategies include use of veterinary services to address risks of diseases infections, improving the production of feed, and harvesting water for use during the dry season (Thompson et al., 2023). The coping strategy that a dairy farmer implements has implications on sustainability of the dairy enterprise. Ojango et al. (2016) reported that smallholder dairy farms in East Africa and beyond mitigate poor reproduction and genetics by increasing access to Artificial Insemination (AI) and crossbreeding strategies. Obtaining earlier market information on demand and supply, forward contract beforehand is considered important in dealing with market risks (Shadbolt et al., 2016). According to Alemu et al. (2015), infrastructural improvements, adequate market information, proper links between traders, farmers and cooperatives are prerequisites for improving market access to farmers. Farmer organization into farmers' groups and joining cooperatives also provide market for their product and also increase their bargaining power (Ahsan, 2011). Establishment of financial reserves, managing adequate savings, securing reliable lines of credit and optimizing debt structures were the essential strategies in managing financial risks in dairy farms in USA dairy farms (Wolf & Karsez, 2023). A study by Ullah et al. (2016) highlighted that dairy farms maintain on farm savings, diversify income sources, access formal credit and insurance to buffer against income shocks. In Kenya, a study by Njeri (2021) identified key financial risk management used by dairy marketing cooperatives in Kenya include strict credit appraisal procedures, timely debt collection and setting credit limit to farmers to minimize default risks.

The majority of smallholder dairy farmers can be described as typical, that is they realize minimal growth in milk sales and limited adoption of external inputs. In contrast, some farmers can be described as entrepreneurial, who are characterized by a gradual but consistent increase in both milk sales and the utilization of external inputs (Vehkamäki et al., 2011). Entrepreneurial behavior may mean different risk perceptions from those of typical farmers, which will manifest in different risk coping strategies (Darnhofer, 2014). Similarly, typical and entrepreneurial farmers tend to exhibit different strategies for coping with risks (Fufa et al., 2024). Both typical and entrepreneurial dairy farmers can be found across the different dairy growth stages. It is hypothesized that these two contrasting farmer groups differ in the way they perceive and respond to the risks they face. To test the hypothesis, this study aimed at comparing risk perception and risk coping strategies of typical and entrepreneurial dairy farmers in regions at different stages (less and more) of dairy development. Scanning dairy industry in Kenya, the regions selected that typify more developed stage of dairy development is Nyandarua County and the region typifying less developed stage of dairy development are Narok-Bomet counties (Otieno et al., 2021).

1.1 Statement of the Problem

Typical and entrepreneurial dairy farms pervasively confront multiple and recurrent risks, including feed shortages, disease outbreaks, market volatility, and climate-related stresses. However, they are likely to respond differently based on their risk perception, resource endowments, managerial skills, and production objectives. Greater capital investment, market orientation and higher risk tolerance of entrepreneurial farms are presumed to have higher resilience capacities than typical farms (Fufa et al., 2024). Empirical gaps demonstrating how entrepreneurial traits confer to them higher resilience index is different ecological context is lacking. While most studies focus on vulnerability of smallholder farms in totality, few goes to specificity of farm typologies and into context specific coping strategies. Variations in extension services, infrastructural endowment, markets orientations and cooperative frameworks persisting across the farm types further complicates the resilience discourse of these dairy farms to risks and shocks (Jones, 2020). Comprehensive understanding of these typologies and their coping mechanisms would gear towards customized interventions to stabilize dairy livelihoods and enhance long-term sustainability.

1.2 Research Objectives

i. To identify the risks perceived most important on typical and entrepreneurial dairy farms
ii. To characterize the risk coping strategies in typical and entrepreneurial dairy farms.

II. LITERATURE REVIEW

2.1 Theoretical Review

Farmer's experience, environmental conditions, economic status and institutional contexts shapes risk perception in dairy farms (Darnhofer, 2014). Bishu et al. (2018) using Expected Utility Theory (EUT) and Protection Motivation Theory (PMT) explain how farmers assess threats and decide on adaptive actions. While EUT explains that farmers coping strategies are based on perceived utility and uncertainty, PMT in cooperates psychological components such as fear, efficacy and response costs. Gebreegziabher and Tadesse (2014) categorized risks in dairy farms into production, market, financial, institutional all of which influence farm performance. Typical and entrepreneurial farmers perceive risks differently due differences in resource availability, access to information and scale of operation and consequently respond to risks differently (Rehman & Khan 2019). This supports that adaptive capacity and innovation adoption are key to managing risks (Njarui et al., 2016). Resilience theory emphasize on the need for diverse strategies to absorb and adapt to shocks in dairy production (Darnhofer 2014).

2.2. Empirical Review

Empirical evidence show risk perception by dairy farmers varies from production scale and regional development. Both typical and entrepreneurial farmers in Kenya perceive market risk as the top risk which is driven by high perishability of milk and seasonal fluctuations (Thompson et al., 2019: Asravor 2018). Entrepreneurial farmers perceive diseases and genetics to have higher risks than on typical farms due to their dependence on high-yield breeds and intensive system (Kiptot et al., 2014). While typical farmers adopt reactive coping strategies, entrepreneurial farmers utilize collective sales and contract agreements (Odero-waitituh 2017). Entrepreneurial farms engage in group input purchases and formal supply contracts whereas typical farmers rely on local suppliers and check-off systems (Van der Lee et al., 2016). Typical farmers use traditional disease control measures with veterinary services while entrepreneurial farmers prioritize vaccination and advanced veterinary interventions (Rehman, 2019). Leasing land, intercropping or converting grazing land to fodder are coping strategies used to cope with feed scarcity due to weather and land with entrepreneurial farms making greater use of feed conservation strategies (Gachuiri et al., 2012). Entrepreneurial farmers adopt more proactive and structured coping strategies than typical farmers who are constrained by resources. Additionally, access to financial services significantly influences risk coping, with entrepreneurial farmers more likely to secure loans or insurance to hedge against shocks (Chamberlin & Jayne, 2013). Extension service use is also higher among entrepreneurial farms, facilitating informed decision-making and improved resilience (Raina et al., 2016). Social capital through cooperative membership enhances marketing efficiency and collective bargaining power, particularly among market-oriented farms (Rivera et al., 2019). Moreover, information asymmetry remains a major challenge for typical farms, impeding timely responses to risk and market dynamics (Shadbolt et al., 2010).

III. METHODOLOGY

3.1 Study Areas

Nyandarua County is in the Central part of Kenya and represents areas with medium and high potential dairy production that have reached a stage of more developed dairying. It experiences temperatures in the ranges of 6°C to 9°C (43°F to 48°F) in July at minimum and 18°C to 25°C (64°F to 77°F) in December, maximum and an altitude between of 2,000-3,900 meters. The county has two rainy seasons, with the long rain season from March to May (1700 mm rain), and a short rainy season from October to December (700 mm rain).

Narok and Bomet Counties are located in the Southwestern part of Kenya and are representative for areas with dairy farms in the inception stage of dairy development, in areas with low production potential. Here, temperatures range from a minimum of 8ºC to a maximum of 28ºC. The counties experience two rainy seasons: the long rains from March to May and the short rains from October to December, with an average annual rainfall ranging from 1,000 to 1,400 mm and two dry seasons separating the two. A few respondents were sampled in Bomet County, close to the Narok-Bomet county border, with similar less-developed dairy cooperatives and market access. Typical dairy farmers are smallholders who have shown minimal growth in milk sales and limited adoption of external inputs over the past five years. In contrast, entrepreneurial smallholder dairy farmers are characterized by a gradual but consistent increase in both milk sales and the utilization of external inputs during the same period.

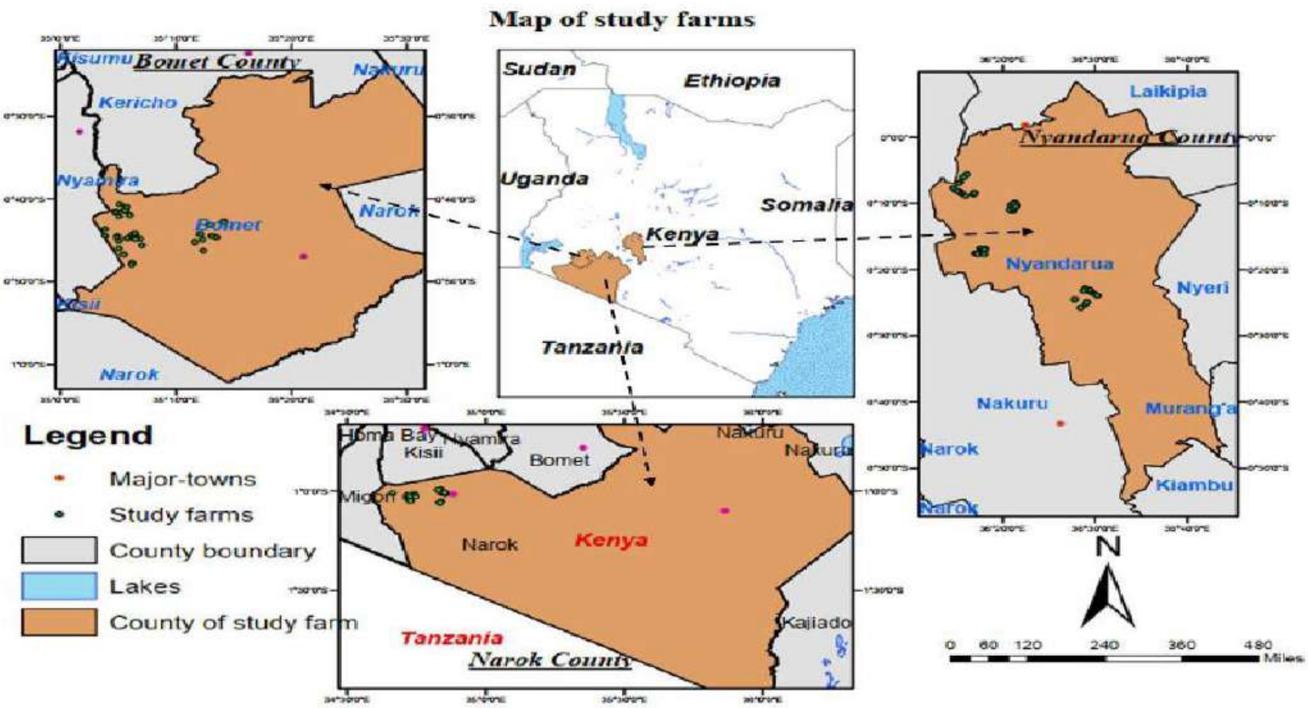

Figure 1
Location of Study Areas in Kenya and Sampling Sites

3.2. Research Design

The study adopted a comparative cross-sectional design, aiming to explore differences in risk perception and coping strategies between typical and entrepreneurial dairy farmers. Both qualitative and quantitative data were collected using structured questionnaires and analyzed statistically. The research was grounded in identifying significant patterns in risk types and strategic responses, using descriptive statistics and Principal Component Analysis

(PCA). This design enabled in-depth understanding of both farmer categories across different agro-ecological zones. The methodology was suitable for comparing farmer behavior under varied dairy development stages.

3.3 Targeted Population

The target population comprised smallholder dairy farmers in the two counties, particularly those affiliated with cooperatives, milk processors, or milk collection centers. Farmers were categorized as typical if they sold up to 50 liters of milk per day with no production increase over five years, and entrepreneurial if they sold more than 50 liters daily with consistent growth. The distinction ensured that participants represented contrasting production intensities and investment behaviors. The population included men and women, farming under diverse socio-economic and environmental conditions. These groups were ideal for understanding how varying risk exposures influence adaptive strategies.

3.4 Sampling and Sample size

Dairy farms at sampling were stratified by stage of dairy development (less and more). Lists of farmers were obtained from local dairy cooperatives and milk marketing channels in the target counties. Using Arsham's (2005) formula for determining sample size with a standard error of 0.04562 and 95% confidence interval, a sample of 120 farmers was selected: 60 from Nyandarua (27 typical, 33 entrepreneurial) and 60 from Narok-Bomet (29 typical, 31 entrepreneurial). This selection ensured fair representation across both dairy development stages and farmer categories. Final respondents were randomly selected from categorized lists, ensuring statistical validity and minimized selection bias.

To assess perceived risks, each respondent farmer was asked to name the three risks that pose the greatest threat to his/her dairy farm starting from the most severe risk ranked risk 1, followed by risk 2 and risk 3. Farmers were allowed to choose from a list of risks that emanate from studies described in Van der Lee *et al.* (2018). The risks ranked first by the farmers were assigned weight 3, second ranked risks were assigned weight 2, and third ranked risks were assigned weight 1. Risk perception index was computed as shown in Table 1 below.

Table 1

Calculations of the Risk Perception Indices

Risk	Ranking 1 (×3)	Ranking 2 (×2)	Ranking 3 (×1)	Risk Perception Score
Risk a	xai × 3	xaii × 2	xaiii × 1	((xai×3)+(xaii×2)+(xaiii×1))/((ni×3)+(nii×2)+(niii×1))
Risk b	xbi × 3	xbii × 2	xbiii × 1	((xbi×3)+(xbii×2)+(xbiii×1))/((ni×3)+(nii×2)+(niii×1))
Risk j	xji × 3	xjii × 2	xjiii × 1	((xji×3)+(xjii×2)+(xjiii×1))/((ni×3)+(nii×2)+(niii×1))

Note:
- xai, xbi, xji... represent the number of respondents ranking each risk at position 1, 2, or 3.
- ni, nii, niii represent the total number of respondents assigning rank 1, 2, and 3 across all risks.

The risk perception index for risk j (RPIj) equals the number of farmers ranking risk j as first risk (xji) multiplied by weight 3, plus the number farmers ranking risk j as second severe risk (xjii) multiplied by weight 2, plus the number of farmers ranking risk j as the third severe risk (xjiii) multiplied by weight 1; divided by total number of farmers $n_i*3+n_{ii}*2+n_{iii}*1$ selecting these risks, as shown below. The maximum risk index is 1.

$RPIj = (xji *3 + xjii*2 + x_{iii}j*3)/(n_i*3 + n_{ii}*2 + n_{iii}*1)$.

Farmers were requested to list the risk coping strategies for each of the 3 risks mentioned above. Since each risk is associated with several coping strategies, Principal Component Analysis (PCA) using SPSS version 23 was used to reduce dimensionality by identifying underlying patterns, grouping correlated strategies into principal components thereby capturing the most significant variance in the coping strategies. Sampling adequacy was measured by Kaiser-Meyer-Olkin criterion (KMO), which varies from 0 to 1, where KMO higher than 0.7 was considered being good (Shrestha, 2021). Orthogonal varimax rotation was used to maximize the variance of squared loadings for each component to obtain clear distinction among the principal component and their associated coping strategies.

IV. FINDINGS & DISCUSSIONS

4.1 Risk Perception by Typical and Entrepreneurial Farmers

The risk indices were computed to compare risk perception between typical and entrepreneurial farms. A risk index towards zero means less severity and towards 1 means more risk severity.

Table 2
Risk Ranking among Typical and Entrepreneurial Dairy Farms

Farm Type	Typical			Entrepreneurial			Risk Index	
Risk Ranking	**1**	**2**	**3**	**1**	**2**	**3**	**Typ**	**Ent**
Agrochemical Side Effects	0	0	1	0	0	0	0.003	0.000
Difficulties - Access To Inputs & Services	2	12	14	1	17	11	0.131	0.125
Diseases, Parasites And Pests	7	7	4	10	8	9	0.116	0.143
Feed Shortage –Extreme Weather	4	5	6	1	12	12	0.083	0.102
Feed Shortage Due To Land Shortage	11	9	2	5	6	3	0.158	0.078
Insecurity (Such As Theft)	0	1	0	0	0	0	0.006	0.000
Poor Infrastructure Limiting Access To Market	0	0	1	0	0	1	0.003	0.003
Issues Of Poor Genetics & Reproduction	1	1	4	7	2	11	0.027	0.094
Labour Scarcity	0	0	2	0	0	2	0.006	0.005
Market Fluctuations -Demand For / Price Of Milk	28	18	6	31	17	6	0.375	0.346
Others - Poor Infrastructure – Weather	0	0	0	2	0	0	0.000	0.016
Others - Poor Infrastructure – Milk Markets	0	0	0	2	0	0	0.000	0.016
Water Shortage	1	1	7	5	0	5	0.036	0.052
Working Capital Shortage	2	2	9	0	2	4	0.057	0.021
	56	**56**	**56**	**64**	**64**	**64**	**1.0000**	**1.0000**

Farmers perceived market risks as a priority and production risks over institutional risk. The high perception of market risk has been attributed to high perishability of milk, seasonal insufficiency and poor infrastructural nature as explained by Thompsom et al. (2019). The fluctuation of the prices and demand of milk is perceived higher in typical farms (0.375) than entrepreneurial farms (0.346). Similarly, Rademaker et al. (2016), found consistent results with these which suggested that the limitation of access to the cold storage facilities and mobile refrigeration, intensifies milk post harvests losses in farms, hence minimizing their bargaining power in the market. Lack of these facilities force farmers to sell their milk at extremely low prices below their production cost leading to losses as recorded by Odero Waititu (2017).

Findings from this study, indicate that diseases, parasites and pests, pose higher risks in dairy farms with the entrepreneurial farms perceiving them to have higher risk (0.143) compared to a typical farm (0.116). The study by Ferreira el al. (2024), showed entrepreneurial farms mostly rear their herds in intensive systems and with high producing animals making them more susceptible to disease outbreaks as compared to typical farms. Similarly, as noted by Lukuyu el at (2019), the entrepreneurial farmers' experiences greater losses due to diseases as a result of the best breeds of dairy animals kept which require a lot of intensive veterinary care and once affected by diseases suffer great loss in terms of milk production.

The typical farms perceived access to inputs and services as more challenging (0,131) compared to the entrepreneurial farms (0.125) Similar findings were obtained by Tagba et al. (2024) who reported that smallholder farmers are overwhelmed by high costs of input and veterinary costs affecting their dairy business. In Ethiopia the study
by Diao et al (2023) showed that, smallholder farmers categorized the access to inputs among the primary problems facing them. Similarly, in Bangladesh, small-scale farmers consider the limitations of inputs, points out at production risks in which the market access to the remains a greater obstacle when it comes to the agricultural economies, findings by Ahsan (2011).

Poor genetics and reproduction risks were higher in entrepreneurial farms (0.094) than on typical farms (0.027). The investment on high yielding dairy breeds among the entrepreneurial farms was reported to increase their vulnerability to reproductive challenges and genetic deficiencies as opposed to the typical farms who rear hardy, low maintained breeds managed with low inputs (Raut et al 2014). Similarly, targeting of high production traits among the entrepreneurial farms makes them perceive genetics and production risks higher because they target high yielding animals which are more susceptible to diseases. While typical farmers go for natural breeding methods, they have less direct costs and therefore lower perceived risks compared to entrepreneurial farms who invest on modern and costly reproduction technologies which may cost them a lot should anything goes wrong (Kiptot et al., 2014).

Typical farms rated (0.158) feed scarcity due to diminished lands higher than entrepreneurial farms (0.078). The extensive production system in typical dairy farms who rely on fodder is adversely affected by land fragmentation which limits fodder availability as opposed to entrepreneurial farms who rely on semi-intensive and intensive production system and can substitute the fodder with concentrates (Njarui et al., 2016). Feed scarcity due to extreme weather was also rated as significant in both farms with entrepreneurial farms ranking it higher (0.1016) than typical (0.0833) farms. Similarly, Shabani et al. (2018) noted that regardless of their types, smallholder dairy farmers have less adoption of alternative feed production and conservation strategies due to limited technical knowledge and financial resources making them susceptible to feed scarcity due to extreme weather. In addition, Sub Saharan Africa face extreme weather patterns and coupled with poor resources and knowledge increase their susceptibility to weather induced production risks like feed shortages (Kasulo et al., 2019).

Water scarcity was rated among top 5 risks with entrepreneurial farms rated water scarcity higher (0.052) than typical farms (0.036). Similarly, Birhan et al. (2022) reported that limited access of water among the small scale dairy farms negatively affect production and animal health. Al-Atiyat (2014) recorded that smallholder dairy farming are constrained by water shortage which exacerbate production challenges and increases farm vulnerability. Restricted water intake directly affects milk yields and compromised herd health emphasizing the pivotal role and need for water management strategies (Daros et al., 2019).

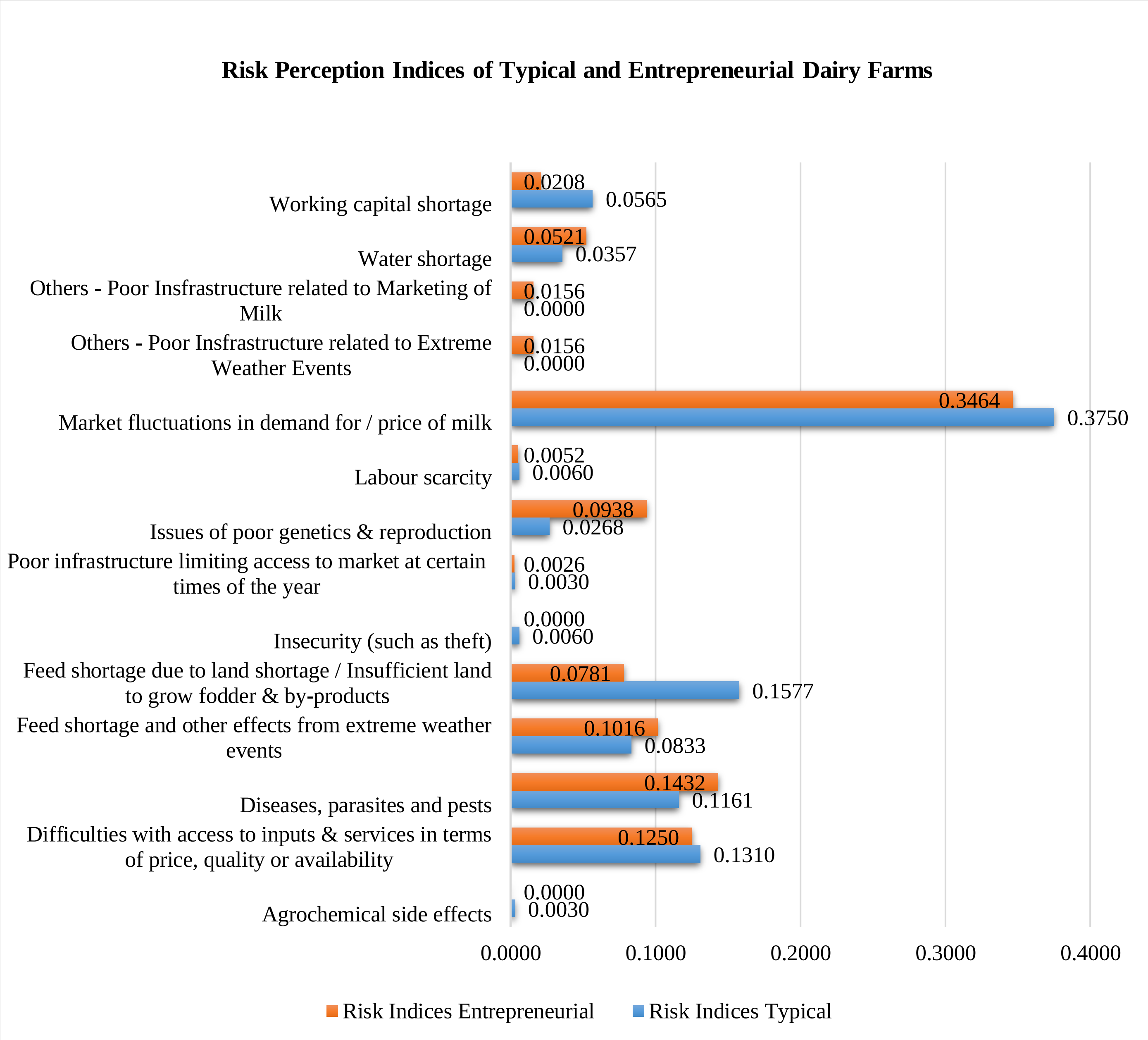

Figure 2
Risk Perception Indices in Typical Versus Entrepreneurial Far

4.2 Coping with Risks in Typical and Entrepreneurial Farms

Principal Component Analysis (PCA) was used to identify and characterize the risk coping strategies employed by typical and entrepreneurial farmers. Seven distinct groups could be identified as reflected in seven Principal Components (PCs) extracted (Table 2).

Table 2
Coping Strategies for High-Risk Threats in Typical and Entrepreneurial Dairy Farms

Entrepreneurial Dairy Farms							**Typical Dairy Farms**							
PCs	**1**	**2**	**3**	**4**	**5**	**6**	**PCs**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Coping strategies to fluctuation in demand and price of milk														
Buyer with Better Prices	0.924						Adjust milking time	0.909						
Sell to Trader	0.886						On farm cooling	0.897						
On Farm Cooling		0.823					Collective milk sales	-0.686						
Adjust Milking Time		0.804					Sell to trader		0.851					
Milk Hygiene Handling			0.875				Divide milk to buyers		0.777					
Recording of Milk sales			0.83				Record milk sales			0.902				
Other				0.821			Buyer with better price			-0.693				
Contract Buyer				0.777			Sell evening milk				0.862			
Evening Milk sales					0.889		Contract buyer					0.966		
Sell to Processors						0.819	Others						0.944	
							Sell to processors							0.838
Rotation Method: Varimax with Kaiser Normalization.0.559							*Rotation Method: Varimax with Kaiser Normalization. 0.518*							
Coping strategies to poor access to inputs														
Check off	0.92						Good Relationship with supplier	0.94						
Good relationship with suppliers	0.897						Check off	0.888						
Buy from authorized dealers	0.896						Reduce use of External inputs	0.874						
Ask for advice	0.881						Buy from authorized dealers	0.793						
Keep Records	0.847						Input subsidy		0.915					
Contract input suppliers		0.887					Keep records		0.838					
Input subsidy			0.949				Credit from milk trader			0.902				
Other				0.971			Other				0.856			
Collective purchase of inputs					0.938									

Rotation Method: Varimax with Kaiser Normalization 0.751							*Rotation Method: Varimax with Kaiser Normalization, 0.595*							
Coping strategies to Disease Pests and Parasite														
Spraying	0.925						Vet services	0.939						
Deworming using commercial Drugs	0.925						Vaccination	0.931						
Vet services	0.894						Deworm using commercial Drugs	0.912						
Vaccination	0.853						Spraying	0.894						
Animal Nutrition	0.803						Animal Nutrition	0.818						
Improved Housing		0.848					Crossbreeding	0.758						
Barn Hygiene		0.797					Deworm traditional Medicine		0.994					
Culling			0.791				Traditional curative Medicine		0.994					
Crossbreeding			0.752				Traditional preventive Medicine		0.994					
Other				0.882			Culling			0.881				
Dipping					0.966		Dipping			0.839				
							Barn Hygiene				0.93			
							Improved Housing				0.846			
							Other					0.881		
Rotation Method: Varimax with Kaiser Normalization.							*Rotation Method: Varimax with Kaiser Normalization.*							
Coping strategies to poor genetics and reproduction														
Exotic Breeds	0.906						Use of Exotic Breeds	0.995						
AI Private Technician	0.718						Records Breeding Calving	0.995						
AI Government		0.986					AI Private Technician	0.784						
Sexed Semen		0.986					Bull Selection		0.889					
Synchronized Heat			0.939				Use of Bulls		0.825					
Cross Breeding				0.864			Cross Breeding		0.766					
Bull Selection					0.975		Calving Assistance			0.908				

Use Bulls					0.793		Heat Detection							
AI from Cooperatives						0.937								
Rotation Method: Varimax with Kaiser Normalization.							*Rotation Method: Varimax with Kaiser Normalization.*							
Coping strategies to feed scarcity due to insufficient land														
Rent or lease land	0.899						Change Breeds	0.763						
Change of breeds	0.838						Graze Land to Fodder		0.863					
Paddock to fodder	0.721						Change to Other Crops			0.769				
Graze land to paddocking		0.871					Paddock to Fodder			0.767				
Graze land to fodder		0.801					Graze Land to Paddock				0.901			
Crop land to fodder		0.779												
Change to other crop			0.862											
Intercropping				0.904										
Rotation Method: Varimax with Kaiser Normalization. 0.261							*Rotation Method: Varimax with Kaiser Normalization. 0.552*							
Coping strategy to feed scarcity due to extreme weather conditions														
Reduce Herd	0.829						Other	0.892						
Plant drought tolerant crops	0.768						Reduce Herd size	0.843						
Store extra fodder	0.728						Store External Fodder	0.787						
Build Structures		0.803					Build Structures	0.725						
Early Maturing Variety		0.744					Plant Early Maturing Variety		0.904					
							Weather Forecast		0.743					
Rotation Method: Varimax with Kaiser Normalization. 0.734							*Rotation Method: Varimax with Kaiser Normalization. 0.650*							

4.2.1 Coping with Fluctuations in Demand and Milk Price

Coping strategies to fluctuation in demand and price of milk for typical farms included adjusting of the milking time (0.909), on farm cooling (0.897) under Principle Component (PC) 1, followed by selling to different traders (0.851) in PC2. It was noted that collective mlk sales among typical farms had negative effect on coping with this risk. This suggest that extending marketability of milk and milk preservation are a priority in dealing with this risk among typical farms. In entrepreneurial farms, selling to buyers with better prices (0.924) and selling to different traders were prioritized under PC1, whereas on farm cooling (0.823) and adjusting milking time (0.804) were prioritized under PC2. Altering milk delivery schedules coupled with diversifying buyers were similarly employed by smallholder dairy farmers in Jimma Zone, in Ethiopia (Duguma, 2016). On farm cooling are observed by Gebreegziabher & Tadesse (2014) is frequently used by farmers in Ethiopia to enhance storage capacity and secure higher market prices. Among the Kenya dairy farms, Odero-Waitituh (2017) noted that to secure better milk prices, smallholder dairy farms engage many traders and subscribe to milk collection centres.

4.2.2 Coping with Difficulties Accessing Inputs and Services

Coping with difficulties in accessing inputs among the typical dairy farms prioritized maintaining of good relationship with supplier (0.940), checking items off (0.888), reduce use of external inputs and buying from authorized dealers all under PC1. Among the entrepreneurial dairy farms, check off strategies topped the list (0,92), good relationship with suppliers (0.897), buying from authorized dealers (0.896), asking for advise (0.881) and keeping records (0.847) were prioritized under PC1 in dealing with access to inputs and services risk indicating structured approach in acquiring inputs and services. Similarly, Rao et al. (2011) agreed that check off systems and reliance of supplier networks were preferred to manage inputs constraints. Similarly, Van der lee et al. (2020) suggested that collective actions are used by entrepreneurial farms to improve efficiency. Karanja et al (2023) indicated that structured suppliers’ relationship and formal agreements are used by entrepreneurial dairy farms to enhance access to inputs.

4.2.3 Coping with Disease, Parasites and Pests

Reliance on conventional disease prevention and treatment methods were evident in typical dairy farms where use of veterinary services (0.939), vaccination (0.931) and deworming using commercial drugs (0.912), spraying (0.894), good animal nutrition and cross-breeding (0.758). A study by Fufa et al., (2024) had similar findings where veterinary services and vaccination were listed as primary disease control methods among smallholder dairy farms in Ethiopia. On the other hand, entrepreneurial dairy farms demonstrated reliance on professional veterinary services and modern disease control strategies such as spraying (0.925), deworming with commercial drugs (0.925), veterinary services (0.894), vaccination (0.853) and animal nutrition (0.803) were prioritized in coping with disease pests and parasites. This was in addition to improved housing (0.848) and barn hygiene (0.797) under PCA2. Strong preference to veterinary care and curative services were noted to be employed by entrepreneurial dairy farms in Muranga’a county (Okello et al., 2021)

4.2.4 Coping with Issues of Poor Genetics and Reproduction

Selective breeding was prioritized by typical farms in coping with issues of poor genetics and reproduction where use of exotic breeds (0.995), good recordings on breeding and calving (0.995), use of private AI technician (0.784) were listed under PC1. These findings agree with Mwanga et al. (2019) who observed that detailing breeding and calving records alongside bull selection enhance reproduction performance among dairy farms. In entrepreneurial dairy farms, reliance on reproduction technologies and structured breeding programs such as use of exotic breeds (0.906), use of private AI technician (0.718) under PC1 coupled with use of government AI (0.986), sexed semen (0.986) and synchronized heat (0.939) were prioritized under PC2. These findings agree with Sagwa et al. (2019) who indicated that reproductive efficiencies and herd improvement among dairy farms can be achieved through structured breeding programs. This was emphasized by Kathambi et al. (2025) who suggested that genetic gains can be achieved through cross breeding and advanced reproductive technologies such as AI.

4.2.5 Coping with Feed Scarcity due to Insufficient Land

Reliance on rotational grazing and land optimization were prioritized by typical farms in dealing with risks due to insufficient land which ranked change of breeds (0.763) under PC1 and conversion of grazing land to fodder production (0.863) under PC2. Similar findings were reported in farms in Nyandarua and Nakuru counties where optimization of land through paddocking were adopted to ensure sustainable pasture availability (Otieno et al., 2021). In entrepreneurial farms, more resource intensive approaches and structured grazing systems such as renting land for fodder production (0.899), change of breeds (0.838) and changing of paddocking to fodder production land were prioritized under PC1. Diversified feed production through intercropping and improving land productivity were similarly reported among entrepreneurial farms in Kenya to counter feed scarcity due to insufficient land (Lukuyu et al., 2019). Study by Van der Lee et al. (2016) supported these findings by indicating that land renting, intercropping and implementation of structured grazing systems have been used to enhance feed production by entrepreneurial farms where land sizes are limited.

4.2.6 Coping with Feed Scarcity due to Extreme Weather

Coping strategies of feed scarcity due to extreme weather among the typical farms focused on minimizing feed demand and ensuring availability of feed reserves alongside adaptive approaches including reduction of herd sizes (0.843), external storage of fodder (0.787), building of structure under PC1 followed by planting early maturing crops varieties (0.904) and weather forecasting (0.743) in PC2. These findings agree with findings of Odhiambo et al. (2019) who highlighted reduction of herd sizes, storage of external fodder and planting of early maturing crops to cope with feed scarcity due to extreme weather. Entrepreneurial farms prioritized pro-active approaches like adopting climate resilient fodder production and herd management practices including reducing of herd size (0.829), planting drought tolerant crops, storing extra fodder under PC1 alongside building of structures (0.803) and planting early maturing fodder varieties. Practices such as planting drought tolerant plants and controlled grazing have been cited by Njarui et al. (2016) to be the commonly used practices in addressing feed scarcity due to land.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusions

Market risks was predominantly high among both typical and entrepreneurial farms followed by disease outbreaks and difficulties in accessing input and poor genetics and reproduction indices. While entrepreneurial farmers pro-actively employ resource intensive strategies to cope with risks, typical farms employ less resources and strategies. Improving veterinary services coupled with strengthened market systems are crucial for mitigating both production and market risks in typical and entrepreneurial dairy farms. Smart agricultural practices like planting early maturing and drought tolerant fodder species coupled with structured grazing management and fodder conservation practices improve sustainable access to feeds.

5.2 Recommendations

Strengthening market systems through stabilization of milk prices and adoption of cooperative models to act as incentives to access markets and bulk inputs would confer high resilience to market and input access risks which adversely affect dairy farms. Entrepreneurial mindset and drive could be enhanced through capacity building frameworks and technological know-how which will enable the smallholder typical farmers evolve from subsistence based farming to more commercialized. Institutional support from government and development partners would support growth in dairy sector through enabling policies and environment, subsidies and partnerships. Contextual policies aligning with developmental stage and risk profile would contribute to a more inclusive and sustainable dairy sector in Kenya.

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