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Mohd Irfan Rais and Mohd Altaf Khan

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Identification and Assessment of Risk in the Dairy Farming Business

Mohd Irfan Rais*[1] and Mohd Altaf Khan[2]

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A B S T R A C T

The purpose of this study is twofold: First, to identify various risks pertinent in Indian dairy farming and second, to study the relationship between socio-economic characteristics of farmers and its relationship with risk impact. A detailed review of the literature was carried out to identify several risks. The identified risks were converted into a five-point Likert scale, and respondents were asked to rate the probability and severity of risks on a five-point scale. The respondents for the study were selected through systematic random sampling from western Uttar Pradesh. A total of 350 responses were received, and 33 responses were eliminated due to missing and ineligible entries; the final sample has 317 respondents. A regression analysis was also performed to test the linear relationship between socio-demographic characteristics and risk impact. The major risks which impact dairy farmers were health & mortality, price/market, and production risks. Linear Relationship Analysis shows that age, education, and years of experience negatively affect risk impact, whereas income and production have no relationship with risk impact. The present study provides valuable insight for the policymakers, researchers, and program implementing agencies in identifying the several risks and their impact on dairy farming so that appropriate measures can be taken for handling the risks.

***Key words*:** Dairy farming, Risk identification, Risk assessment, Risk impact

The word risk was originated from various languages. In Arabic, it was coined as “risq” or in Latin as “risicum” or in Greek as “rhiza” referring to hazardous sailing around the cliff. The French word “risque” has a surmise implication in "qui risque rien n'a rien" (nothing ventured, nothing gained. While in English, it is used in different contexts, leading to ambiguity and misunderstanding [1]. According to the definition of the Committee on Insurance Terminology proposed in 1966, the definition of risk is "Uncertainty as to the outcome of an event when two or more possibilities exist. "Risk is a pervasive phenomenon present in all walks of life, whether life, business, or agriculture. But dealing with it meticulously, whether for farmers, researchers, or anyone, is burdensome. One of the reasons for the difficulty is ambiguity and differences of opinion about what risk is and how it can be measured [2]. The agricultural sector is exposed to various risks that occur with high frequency. These include climate and weather risks, natural catastrophes, pests, and diseases, which cause highly variable production outcomes (NITI Ayog 2007-12). Similarly, Dairy farmers are also vulnerable to several risks that are synonymous with agriculture. The Indian dairy sector is the single largest contributor, 5% of the national economy, with a compound annual growth rate of 6.4% in the past five years. The industry is expected to grow by 9-11% in Financial Year 2022 (ICRA 2021). Despite being the largest milk producer in the world (Economic survey 2019), dairy farming is subjected to several risks that affect dairy farmers. The risks faced by farmers range from very low to very high impact. The most common risk sources in dairy farming are feed and milk price variability, production, ill-usage of drugs, health, and other epidemical diseases [3]. Investment in dairy farming stresses the expansion of herd dairy cows that affects the milk yield [4]. Stall bedding for accommodation is necessary for the welfare and hygiene of cows [5]. The affliction of climate change adversely impacts milk production due to drought [6]. The consequences of climate change and other factors can lead to health issues in dairy like Brucella infection [7], Mastitis [8], reproduction [7], usage of antibiotics [9], M1 aflatoxin [10] and Covid- 19 [11]. Milk production can vary from season to season, so their cost [12] exposes farmers to production and financial risks. The volatility in the quality of milk [13] gives rise not only to the quality risk but price or market risk (Perez et al. 2021) and technological risk [14]. The current literature is restricted only to the specific risks in dairy farming that directly or indirectly affects the dairy farmers, which failed the dairy farmers in understanding these risks. Additionally, the extant literature does not answer how socio-demographic characteristics impact risks. Therefore, a comprehensive study is required which covers the several risks pertinent in India and their impact on dairy farming.

* **Mohd Irfan Rais**
✉ irfanrais919@gmail.com

[1-2] Department of Commerce and Business Studies, Jamia Millia Islamia (Central University), New Delhi - 110 025

MATERIALS AND METHODS

Questionnaire development

The questionnaire was developed based on an existing literature survey identifying various risk sources. The risks with probability and severity are converted into a 1 to 5 scale where 1 refers to very low probability, 2 is low, 3 is neutral, 4 is high and 5 very high probability while in severity 1 means very low severity, 2 is low, 3 is neutral, 4 is serious, and 5 is catastrophic.

Population and data sources

The area selected for the study is the western region of Uttar Pradesh, as it is the largest producer of milk (Ministry of Food Processing Industries 2021). The study is based on primary data sources, and the respondents of the study are dairy farmers; the data was collected from July 2021 to October 2021. The questionnaire was designed in compliance with the objectives of the study and was divided into two parts. The first part consists of the questions related to the socio-demographic aspects of the customers. The second part includes the responses related to the probability and severity of risks.

Sample selection

There are 30 districts in the western region of Uttar Pradesh (District wise development indicators 2019, UPDES). The list of districts in the sample was selected using systematic sampling. The first district was selected randomly, and every 6th district at a fixed interval from the first selected district was included in the sample. 70 respondents were personally interviewed from each district, taking a total sample size of 350.

Data cleaning

After the data collection process, a data cleaning exercise was carried out to identify missing entries and either ineligible or ambiguous responses. In the final editing, 33 responses were deleted; thus, the final sample size is 317.

Data analysis

The final data set was coded based on scales set for probability and severity. For risk impact, the researcher developed the scale, taking product values of probability and severity into account. Therefore, the scale for risk impact is 5 to 25 where less than 5 refers to very low impact, 5 to 10 is low, 10 to 15 is neutral, 15 to 20 is high, and 20 to 25 is very high impact. The descriptive part is represented through mean and for the inferential part, regression analysis was performed to test the linear relationship between socio-demographic characteristics and risk impact. The data was analyzed by SPSS. With the help of the following equation-

$$Y = a + bx_1 + x_2 + x_3 + x_4 + x_5$$

Where;
Y= Risk impact
a= Constant
b= Slope
x_1= Age
x_2= Education
x_3= Income
x_4= Years of Experience
x_5= Production

RESULTS AND DISCUSSION

The (Table 1) shows demographic profile of the (n=317) respondents. Out of the total sample size, 75.40% were male, and 24.60% were female [15]. The majority of the participants in this survey were in the age group of 45 years and 55 years (34.06%), followed by the age group of 35 and 45 (27.12%), 25 to 35 (18.28%), above the age of 55 was 14.18% and below the age of 25 were 6.36%. Most of them were Illiterates (43.21%), followed by high school education (30.92%), Intermediate (23.98%), and the number of graduates respondents were (1.89%), and there were not any postgraduates [16]. About 37% of respondents have daily milk production of less than 30 liters followed by 24.51% of production in between 30 to 50 liters, 15.78% in between 50 to 80 liters, 13.88% among 80 to 110 liters, and more than 110 liters show the percentage of 8.83%. The Economic dimensions were measured reveals that most of the respondent's monthly income was less than Rs. 50,000 (33.75%) followed by monthly income ranging from Rs. 50,000 and Rs. 1,00,000 (23.66%), between Rs. 1,00,000 and Rs 1,50,000 was 21.77%, among Rs. 1,50,000 and Rs. 2,00,000 was 12.30%, and above Rs. 2,00,000 shows 8.52% [17]. The maximum percentage of farmers (38.80%) who has the year of experience between 30 and 40 years succeeded by 10 to 20 years (25.86%); among 30 to 40 years of experience, the percentage was 17.98. Respondents having more than 40 years of experience shows a share of 11.68%, and 5.68% of respondents have less than 10 years of experience [18].

Table 1 Sample Characteristics

Characteristics	No.	Percent
Gender		
Male	239	75.40
Female	78	24.60
Age group		
<25	20	6.36
25-35	58	18.28
35-45	86	27.12
45-55	108	34.06
>55	45	14.18
Educational level		
Illiterate	137	43.21
Up to high school	98	30.92
Intermediate	76	23.98
Graduate	6	1.89
Post Graduate	-	-
Daily milk production (Litre)		
<30	117	36.90
30-50	78	24.61
50-80	50	15.78
80-110	44	13.88
>110	28	8.83
Monthly income		
<50,000	107	33.75
50,000-1,00,000	75	23.66
1,00,000- 1,50,000	69	21.77
1,50,000-2,00,000	39	12.30
>2,00,000	27	8.52
Years of experience		
<10	18	5.68
10-20	82	25.86
20-30	123	38.80
30-40	57	17.98
>40	37	11.68

As shown in (Table 2), the probability of investment risk is neutral, serious severity, and the impact is neutral. While accommodation risk shows neutral probability, severity is serious, but the resultant impact is neutral. Health and mortality risks have a neutral probability, with catastrophic severity and high impact [19]. The probability of climate change risk is low,

the severity is catastrophic, but the impact is low. Productions risk shows the neutral probability; the severity is catastrophic, which ended up in the neutral impact. The quality and safety risk probability are neutral, but the severity is serious, and the impact is neutral. Price/Market risk represents the neutral probability; however, severity is catastrophic, which shows a high impact of price/market risk [20].

Table 2 Risk matrix

Risks	Probability	Severity	Impact (Probability × Severity)
Investment	3	4	12
Accommodation	3	4	12
Health and mortality	3	5	15
Climate change	2	5	10
Production	3	5	15
Quality and safety	3	4	12
Price / market	3	5	15
Financial	3	4	12
Technology	1	3	3
Human	3	3	9
Legal and social	1	3	3
Institutional	1	3	3
Provender / feed	3	4	12
Consolidated mean score	2.46	4	10.23

On the other hand, financial risk shows a neutral probability, but the severity is serious, and the impact is neutral. The technological, legal and social, and institutional risk shows a similar probability is very low, neutral, severity, and very low impact of these risks. Human risk's probability is neutral; severity also results in a low-risk impact [21]. The last risk is the risk of provender/feed, which represents the probability of referring as neutral, but the severity is serious, and the risk impact is neutral. The consolidated mean score of risk's probability shows low probability, whereas risk's severity is serious and impact is low [22].

The value of R square is 0.480, which means that the independent variables explain 48% of the variability in the dependent variable. R-value is 0.693, and the P-value is 0.000, which means the model is statistically significant. The standard beta value between age and risk impact is -0.407, and P-value is less than 0.05; therefore, it can be implicated that there is a significantly negative relationship between age and risk impact. An increase in age by 1 unit will decrease risk impact by 0.407 units [23]. Since the P-value is less than 0.05, Ho_1 is rejected at a 5% level of significance. Similarly, the standard beta value for the relationship between education and risk impact is -0.312, and P-value is less than 0.05 so, it can be assumed that education significantly impacts risks and also there is a negative relationship between education and risk impact as there is an increase in age by unit 1 will result in a decrease in risk impact by 0.311 [24]. As the P-value is less than 0.05, Ho_2 is rejected at a 5% level of significance. The standardized beta value for the relationship between income and risk impacts is 0.012, and P-value is more than 0.05, which means that income does not significantly impact risks. Since the P-value is more than 0.05, Ho_3 is accepted at a 5% level of significance [25]. The standard beta value for the relationship between years of experience and risk impact is -0.517, and P-value is less than 0.05; hence, it can be surmised that years of experience significantly impact risks. There is a negative relationship between years of experience and risk impact as there is an increase in age by unit 1 will result in a decrease in risk impact by 0.516. As the P-value is less than 0.05, Ho_4 is rejected at a 5% level of significance [26-28]. The standardized beta value between milk production and risk impact is 0.104, and P-value is more than 0.05, showing that production has no significant impact [29-30]. Since the P-value is more than 0.05, Ho_5 is accepted at a 5% level of significance (Table 3).

Table 3 Summary of regression analysis performed to test the risk impact on socio-demographic characteristics

Socio-demographic characteristics	Risk impact			Decision	Impact?
	Beta value	t- value	P- value		
Age	-0.407	11.172	0.000	Ho_1 is rejected	Yes
Education	-0.312	7.114	0.004	Ho_2 is rejected	Yes
Income	0.012	1.173	0.109	Ho_3 is accepted	No
Years of experience	-0.517	14.029	0.000	Ho_4 is rejected	Yes
Production	0.104	1.339	0.093	Ho_5 is accepted	No

R: 0.693
R-square: 0.480
Constant: 1.129
F-value: 21.441 (0.000*)

Policy implications

This study only covers the area of western Uttar Pradesh, but the results can be generalized for overall India. The present study provides valuable insight for the policymakers, researchers, and program implementing agencies in identifying the several risks and their impact on dairy farming so that appropriate measures can be taken for handling the risks. It is clear from the study that health and mortality, price/market, and production risks were major sources; therefore, the government provides certain measures to improve health facilities because health is directly proportionate to production. Healthy animals will increase production and vice versa. Similarly, appropriate institutional measures for price riskare also the need of an hour to deal with the price volatility in the market. As it is evident from the study that education will lead to better handling of risk, the government should encourage dairy farmers to have at least primary education to understand and deal with the risk efficiently.

CONCLUSION

The present study has identified numerous risks that impact dairy farmers. These risks were identified through the extensive literature survey. Many risks affect the dairy farmers, including investment, accommodation, health and mortality, climate change, production, quality and safety, price/market, financial, technology, human, legal and social, institutional, and provender/feed. Health & mortality, production and, price/ market risk have a high-risk impact on dairy farmers. The linear relationship between socio-demographic characteristics and risk impact disclose that age, education, and years of experience have a significant negative impact on risk. In contrast, income

and production have no risk impact. This study provides implications for policymakers and practitioners to understand the risks from the context of the socio-economic profile of the farmers. A comprehensive understanding of risks and their mitigation through training and education will go a long way in preventing them from causing severe consequences.

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