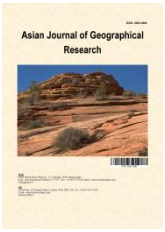

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Livestock Farmers' Willingness to Pay for Farming Insurance in Four Divisions of the West Region of Cameroon

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Livestock farming insurance is essential for the protection of farmers. This study examines poultry and pig farmers' willingness and determinants to pay for livestock farming insurance in the Mifi, Koung-Khi, Bamboutos and Upper-Plateau Divisions of the West Region of Cameroon, a context in which livestock insurance is absent. A quantitative design was employed in which data were collected from 430 poultry and pig farmers using structured questionnaires administered through cluster and snowball sampling techniques. Data were analysed quantitatively using the Chi-Square, the Binary Logistic Regression and the Integrated Value Mapping Tests. This study revealed that only 33.5% were willing to get farming insurance, 51.2% were unwilling and 15.2% were unsure.

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More farmers in the Mifi Division were willing to get livestock farming insurance than farmers in other sample divisions. The Chi-Square Test highlighted several variables influencing farmers' willingness to get farming insurance. Among these variables, the Binary Logistics Regression Test revealed that monthly household income and source of labour were significant determinants of poultry farmers' willingness to get insurance, while years of experience, monthly household income, total size of the flock and division were significant determinants for pig farmers. Overall, socioeconomic factors influenced pig farmers' willingness to subscribe to a livestock insurance scheme more than production factors. The Integrated Value Mapping (IVM) combining the predictive effects of both factors was 35.1%, thus implying that 64.9% variability was not accounted for. For poultry farmers, production factors predicted willingness to subscribe to a livestock insurance scheme more than socioeconomic characteristics. The Integrated Value Mapping (IVM) combining the predictive effects of both components was 51.2%, implying that 48.8% variability was not accounted for. This study recommends that the government set up a National Livestock Insurance Policy and for insurance companies to sensitise farmers on the need and importance of livestock farming insurance.

Keywords: Determinants; insurance; livestock; poultry; pig and willingness.

1. INTRODUCTION

The poultry and pig farming sectors are essential to society's global food system and socioeconomic fabric. Globally, the demand for pork and poultry meat will increase by 43 % and 121 %, respectively, and the demand for eggs will increase by 65 %, with a huge demand in Sub-Saharan Africa [1]. The yearly demand for pork in Cameroon is at 42,000 tons, with an annual local production of 30,000 tons and an annual importation of $68 million mainly from Tchad to supplement annual production (MINEPIA, [2] Dieumou, Tandzon, Nagaraju, [3] Ebanja, Ghogomu, & Paeshuyse [4].

The capacity of the poultry and pig sectors to meet local demand is affected partly by production, marketing, transportation, human, natural, government policy and financial risks. These risks equally hinder the potential of the livestock sector to alleviate poverty [5]. In Cameroon, the Newcastle disease, African Swine Fever, Foot and Mouth disease, and Highly Pathogenic Poultry Influenza (H5N1) are endemic [6]. Between 2005 to 2015, pig farmers lossed an average of $3.4 million, while poultry farmers lossed an average of $15.7 million due to disease outbreaks (OIE, MINEPIA / EPA, 2013, cited in PARM, [7]. In 2012, the highest livestock losses (39%) were registered in the poultry sector, while the pig sector registered minor losses (9%). Farmers in the North-West, Littoral, Center, and West Regions experienced the most significant losses because they are the leading poultry and pig production areas [7]. Between 1990 and 2015, epidemics were Cameroon's most frequent disaster affecting livestock (PARM, 2016). According to local media reports, losses due to the 2016 outbreak of H5N1 added up to an estimated $20 million (Food and Agricultural Organisation, 2016). According to the Cameroonian Poultry Association (French acronym IPAVIC) cited in Mbodiam [8], the poultry sector lost about $26 million due to the poultry flu of 2016 and 2017. Due to COVID-19, poultry farmers in the West and North-West Regions lossed about $11 million.

Mahul and Stutley [5] stated that the combination of technical know-how and financial mechanisms is an optimal comprehensive livestock risk management strategy, as farmers can manage minor but recurrent losses through risk mitigation (disease prevention) and self-insurance tools (savings and contingent credit) while transferring significant but less frequent losses to insurance companies.

In Cameroon, much emphasis has been placed on increasing local production to meet demand and risk mitigation measures, with little attention given to insurance as a risk management measure. The country does not have a national livestock insurance policy, and index-based insurance is limited to the northern region of Cameroon. There is no indemnity insurance to protect poultry and pig farmers in the West Region. Furthermore, no information is known about poultry and pig farmers' willingness to get livestock farming insurance (LFI). This study examines poultry and pig farmers' willingness and the determinants of their willingness to get livestock farming insurance. At the same time, this information is unavailable in the corpus of

literature in Cameroon. This seems to be what the government, insurance companies and development stakeholders need to know to promote livestock farming insurance in the West Region and Cameroon.

2. MATERIALS AND METHODS

2.1 Study Area

This study was conducted in the Mifi, Koung-Khi, Bamboutos and Upper-Plateau Divisions of the West Region of Cameroon. According to the West Regional Delegation of the Cameroon Ministry of Livestock Fisheries and Animal Husbandry (French acronym MINEPIA) (2019), the West Region is one of Cameroon's principal pig and poultry production areas, together with the Littoral and Centre Regions. The West Region was chosen for this study over other production areas because of the concentration of domestic production as compared to other production areas (MINEPIA / Livestock Sector Improvement and Development Project (French acronym PADFEL) (2015) cited in PARM [7]. The West Region is the largest pig production region, with a herd estimated at 3,500,000 heads, providing 4/5 of pigs commercialised in the country [9].

The cluster sampling technique was used to identify the leading poultry and pig production areas at the West divisional level. According to a report from the West Regional Delegation of MINEPIA (2019), the Upper-Plateau, followed by the Bamboutos, Upper-Nkam, Koung-Khi and Menoua Divisions were the main pig production areas, while the Mifi, followed by the Noun and Koung-Khi Divisions were the main poultry production areas in the West Region of Cameroon. Data were collected from the Upper-Plateau and Bamboutos Divisions for pig farming and the Mifi and Koung-Khi Divisions for poultry farming. Even though the Noun Division was the second most important production area for poultry farming, it was not considered because of security concerns linked to the Anglophone crisis, as this division borders the North-West Region. During the data collection period, non-state armed group (NSAG) members from the North-West Region attacked civilians in the Noun Division. This resulted in a tense atmosphere and lots of scepticism from the population. The Koung-Khi Division, the third-largest poultry production area, thus replaced the Noun Division.

2.2 Research Design and Sample Size Determination

This study employed a quantitative research design. Due to the absence of official data on the number of poultry and pig farmers per division and the inability of MINEPIA staff at the regional and divisional levels to estimate the number of poultry and pig farmers in the study area, the investigator estimated the sample size based on the total number of households involved in livestock farming on the one hand and the pig and poultry productivity in the West Region, on the other. In June 2021, the government of Cameroon started a Census for Crop and Livestock Farmers (French acronym RGAE), and the results have not been published. Table 1 shows poultry and pig production in the West Region from 2012-2016 and projections for 2020.

From 2016 (97,420,928) to 2020 (170,516,941), production increased by roughly 6.36% yearly. Given that the number of households involved in livestock farming in the West Region was estimated at 431,607 in 2012 (National Institute of Statistics, 2016). We assumed that the number of households involved in livestock farming increased proportionately to production, as shown in Table 2.

The projected number of households engaged in livestock farming in 2020 was 706,830. This figure was used to statistically calculate the sample size for this study.

The sample size was estimated using sample calculation for one proportion with the support of EpiInfo 6.04d.

$$n=\frac{NZ^2P(1-P)}{d^2(N-1)+Z^2P(1-P)}$$

Where:

N=total targeted population here estimated at 706,830.

Z= Z value corresponding to the 95% confidence level.

$Z_{\alpha/2}$ =level of significance = 1.96.

P= prevalence; the prospected prevalence used is 50% assuming optimal sample size.

d= Absolute precision set at 5%.

n effective=n*Design effect.

The design effect used was 1.1, greater than one (1) because non-probabilistic sampling techniques (snowballing) were used.

The estimated sample size for this study was 422 poultry and pig farmers (PPFs). To guard against unexpected missing cases and to ensure that the return rate was not below 80%, an excess of 10% of farmers was added to the sample, making a total of 484 farmers.

2.3 Data Collection Procedure

A total of 484 structured questionnaires were administered through a two-stage sampling technique. The cluster sampling technique was used to identify the four main divisions in which farmers were involved in poultry farming (Mifi and Koung-Khi Divisions) and pig farming (Bamboutos and Upper-Plateau Divisions). The questionnaires were distributed equally among case study divisions and administered equally to PPFs through a snowball sampling technique. A total of 430 questionnaires were returned, with a success rate of 89%, as spatially represented in Fig. 1.

2.4 Data Analysis

The Chi-Square Test was used to determine the association between poultry and pig farmers' socioeconomic and production characteristics and their willingness to subscribe to a livestock insurance scheme. Furthermore, the Binary Logistic Regression Model was used to appraise the predictive effects of socioeconomic and production factors on farmers' willingness to pay for livestock insurance. These analyses were followed by an Integrated Value Mapping (IVM) analysis to determine the category (socioeconomic or production factors) that significantly influenced PPFs' willingness to pay for LFI.

Table 1. Shows poultry and pig production in the West Region from 2012-2016 and projections for 2020

Year	Livestock and % increase		The geometric mean of increase			
	Poultry	**Pig**	**Years**	**Poultry**	**Pig**	**Total**
2012	66,592,358	2,896,271				
%increase	9.26	7.48	2013	9.26	7.48	8.37
2013	72,758,691	3,112,973	2014	3.17	3.20	3.19
%increase	3.17	3.20	2015	7.00	5.00	6.00
2014	75,063,425	3,212,588	2016	16.95	3.50	10.23
%increase	7.00	5.00	GM	15.36	4.52	6.36
2015	8,0317,865	3,373,217	**Livestock, 2020 projection**			**Total**
%increase	16.95	3.50	2017	108,357,242	3,649,086	112,006,328
2016	93,929,648	3,491,280	2018	125,000,914	3,814,025	128,814,939
Total	97,420,928		2019	144,201,055	3,986,418	148,187,473
2020 projection	166,350,337	4,166,605	2020	166,350,337	4,166,605	170,516,941
Overall total 2020 projection	**170,516,941**		Percent increase 2016-2020	77	19.34	75

Source: National Institute of Statistics (2016) and authors' projection (2020)

Table 2. Projecting the number of poultry and pig farmers in 2020, from the 2012 baseline

Year	Progression from baseline (2012)	Farmers' population (yearly increment based on a 6.36 % increase rate)
2013	431,607	459,057
2014	459,057.2052	488,253
2015	488,253.2435	519,306
2016	519,306.1497	552,334
2017	552,334.0209	587,462
2018	587,462.4646	624,825
2019	624,825.0773	664,564
2020	664,563.9522	706830

Source: National Institute of Statistics [10] and authors' projection (2020)

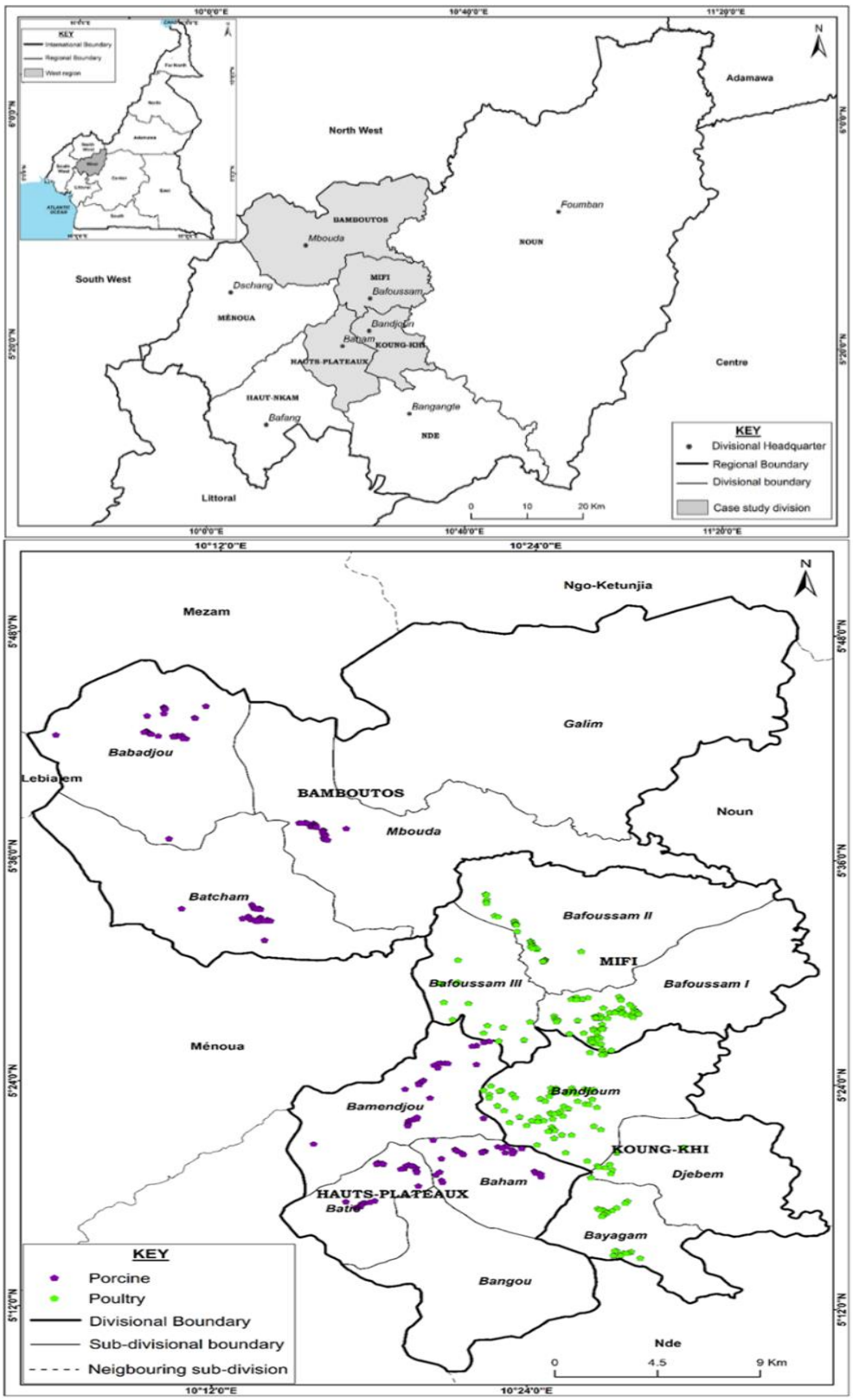

Fig. 1. Spatial layout of poultry and pig farmers in the Bamoutous, Mifi, Koung-Khi and Upper-Plateau Divisions in the West Region of Cameroon

Source: National Institute of Cartography [11] and Fieldwork (2020)

3. RESULTS AND DISCUSSION

3.1 Willingness to Pay for Livestock Farming Insurance

Poultry and pig farmers were willing, unsure and unwilling to get LFI, as shown in Table 3.

Most farmers (51.2%, 220) were unwilling to get LFI. The percentage of unwilling farmers was higher for pig farmers (70.9%, 141) than for poultry farmers (34.2%, 79). A proportion of 68.2%(150) of farmers were unwilling to get LFI because they had no knowledge of the importance and need for LFI, 14.1% (31) stated that LFI is only beneficial to large-scale farmers, 11.4% (25) indicated that LFI is generally expensive and as small scale farmers, they cannot afford it and 6.3% (14) preferred other strategies to manage risk than livestock farming insurance (LFI).

Furthermore, 15.3% (66) of farmers were undecided about getting LFI. More poultry farmers were undecided (26.8%, 62) than pig farmers (2.0%, 4). Farmers needed more information on the need and importance of LFI and the operation modalities to make an informed decision on whether to get LFI.

Moreover, 33.5% (144) of farmers were willing to get LFI. More poultry farmers (39.0%, 90) were willing to get LFI than pig farmers (27.1%, 54). A proportion of 61.8% (89) were willing because of the possibility to bounce back rapidly and conveniently after a loss with the support of insurance companies, 30.5% (44) estimated LFI will help them to increase the size of their farms because they are confident that they will get support from insurance companies if they experience losses. Furthermore, 7.6% (11) indicated that LFI would reduce their worries and stress due to losses linked to livestock production.

Fig 2 shows the spatial distribution of poultry and pig farmers' willingness to pay for insurance in the Mifi, Koung-Khi, Bamboutos, and Upper-Plateau Divisions of the West Region of Cameroon.

Farmers in the Mifi Division (59.7%, 86) were more willing to get LFI than farmers in the Bamboutos (23.6%, 34), Upper-Plateau (13.8%,20) and Koung-Khi Divisions (2.7%, 4). Farmers in the Mifi Division were more willing to get LFI because they are in the West Regional headquarters and are more exposed to innovative risk management practices. The Mifi Division is equally the main poultry production area in the West Region. Due to the delicate nature of poultry farming, poultry farmers would not like to lose their investment to several risks.

Furthermore, more farmers in the Bamboutos Division (44%, 97) were unwilling to get LFI than those in the Upper-Plateau (20%, 44), Mifi Divisions (20%, 44) and Koung-Khi (15.9%, 35). This is because pig farmers in the Bamboutos and Upper-Plateau Divisions, through experience, know that raising pigs is not as delicate as raising chickens. Thus, they do not anticipate significant losses and the need to transfer their risks to insurance companies.

Moreover, more farmers in the Koung-Khi Divisions (84.8%, 56) were more unsure of their decision to get LFI than farmers in the Mifi (9.1%, 6), Bamboutos (4.5%, 3) and Upper-Plateau Divisions (1.5%, 1). Even though the Koung-Khi Division is the third main poultry production area, it is away from the regional headquarters, and farmers are unaware of innovative livestock production practices. This makes it challenging to comprehend the notion of LFI.

Table 3. Poultry and pig farmers' willingness to subscribe to a livestock insurance scheme

Category	Stats	Yes	No	Undecided	Total
Poultry	n	90	79	62	231
	%	39.0%	34.2%	26.8%	100.0%
Pig	n	54	141	4	199
	%	27.1%	70.9%	2.0%	100.0%
Total	n	144	220	66	430
	%	33.5%	51.2%	15.3%	100.0%

Source: Fieldwork (2020)

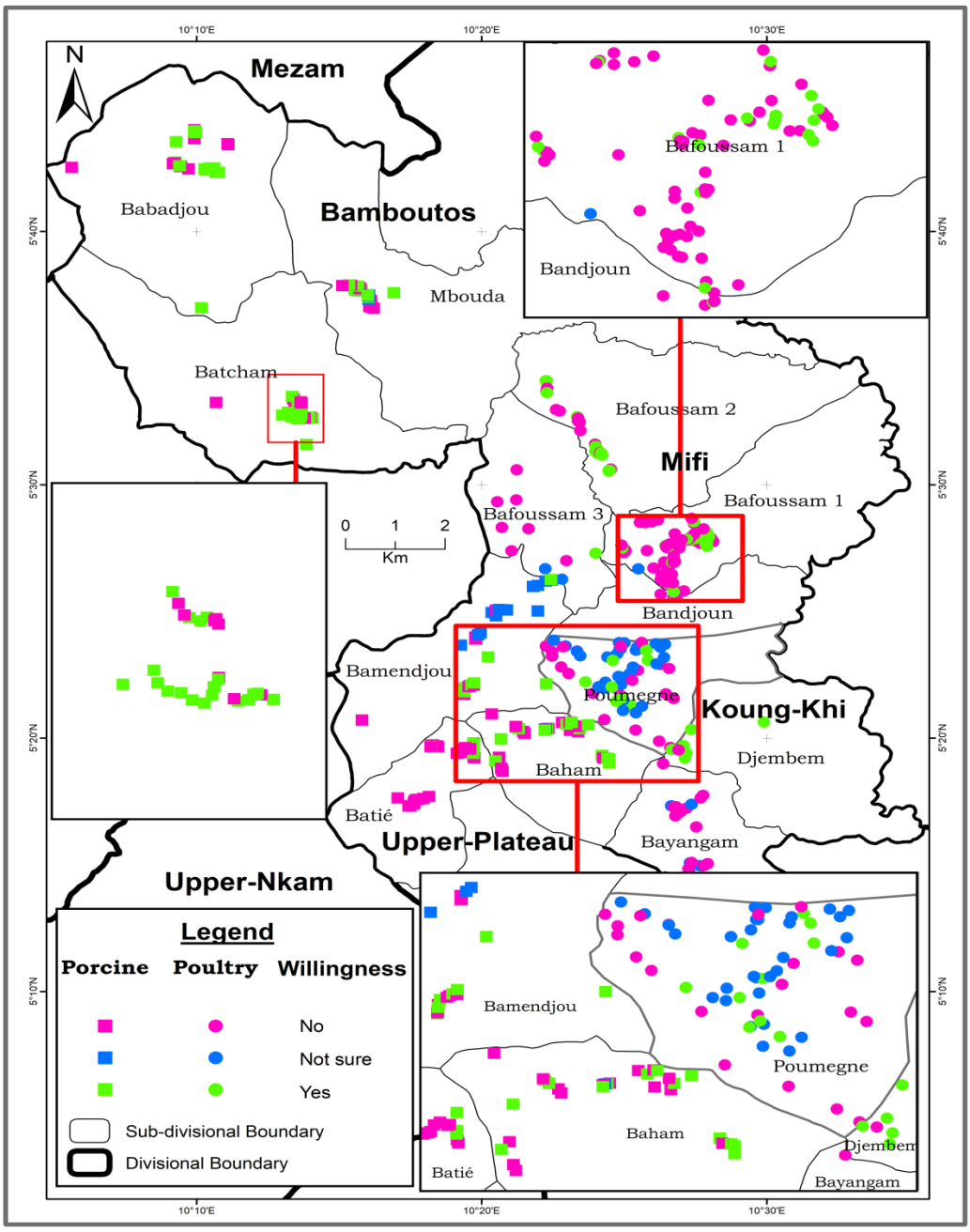

Fig. 2. Poultry and pig farmers' willingness to pay for livestock insurance in the Mifi, Koung-Khi, Bamboutos, and Upper-Plateau Divisions of the West Region of Cameroon
Source: National Institute of Cartography [11] and Fieldwork (2020)

3.2 Determinants of PPFs' Willingness to get LFI

3.2.1 Poultry farmers' socioeconomic characteristics and willingness to get LFI

The association between poultry farmers' socioeconomic characteristics and willingness to subscribe to a livestock insurance scheme is shown in Table 4.

The willingness to subscribe to a livestock insurance scheme was significantly associated with the following variables:

- **Years of work experience in livestock farming**: The higher the work experience,

the higher the willingness to subscribe to livestock farming insurance (P=0.023).

- **Main occupation**: Poultry farmers were more willing to get LFI (P=0.000) because it is their main source of income.
- **Annual income from poultry farming and monthly household income**: The higher the income, the higher the willingness to get LFI (P=0.000).

The Wald Statistics of Binary Logistic Regression depicting the predictive effect of socioeconomic factors controlled for each other on willingness to subscribe to a livestock insurance scheme is shown in Table 5. The influence of the significant determinants highlighted above was appraised while controlling for each other to silence the confounders using the Wald test of Logistic Regression.

After controlling determinants for each other, Wald Statistics highlighted only the monthly household income as a significant determinant of poultry farmers' willingness to subscribe to a livestock insurance scheme. This implies that this determinant has to be given higher attention than other determinants. However, it was not a critical predictor (OR >1; LB>1).

Table 4. Association between socioeconomic characteristics of poultry farmers and willingness to subscribe to a livestock insurance scheme

Determinants	Categories	Yes	No	n	χ2-test (df=0.05)
Gender	Male	52.7% (79)	47.3% (71)	150	χ2=0.185
	Female	57.9% (11)	42.1% (8)	19	P=0.667
Age	18-37	54.5% (18)	45.5% (15)	33	χ2=1.611 P=0.657
	38-47	48.1% (26)	51.9% (28)	54	
	48-57	58.7% (37)	41.3% (26)	63	
	58+	47.4% (9)	52.9% (10)	19	
Household size	1-2	46.3% (31)	53.7% (36)	67	χ2=4.091 P=0.129
	3-4	61.8% (47)	38.2% (29)	76	
	5+	46.2% (12)	53.8% (14)	26	
Years of experience	1-5	62.5% (10)	37.5% (6)	16	χ2=11.340 P=0.023
	6-10	36.5% (23)	63.5% (40)	63	
	11-15	62.5% (25)	37.5% (15)	40	
	16-20	63.9% (23)	36.1% (13)	36	
	21+	64.3% (9)	35.7% (5)	14	
Educational attainment	No education and primary education	50.0% (30)	50.0% (30)	60	χ2=4.641 P=0.098
	Secondary education	58.0% (58)	42.0% (42)	100	
	High school, vocational training and university education	22.2% (2)	77.8% (7)	9	
Main occupation	Poultry farm	64.5% (80)	35.5% (44)	124	χ2=24.752 P=0.000
	Crop farmer	28.6% (6)	71.4% (15)	21	
	Casual labourer	0.0% (0)	100% (3)	3	
	Employee	20.0% (2)	80.0% (8)	10	
	Businessperson	18.2% (2)	81.8% (8)	10	
Marital status	Single	44.9% (22)	55.1% (27)	49	χ2=3.191 P=0.203
	Married	55.0% (60)	45.0% (49)	109	
	Widowed/widower	72.7% (8)	27.3% (3)	11	
Annual income (FCFA)	< 1 million	15.4% (4)	84.6% (22)	26	χ2=23.129
	1 million +	66.7% (82)	33.3% (41)	123	P=0.000
Monthly household income (FCFA)	<500,000	12.9% (4)	87.1% (27)	31	χ2=32.087
	500,000 +	69.6% (80)	30.4% (35)	115	P=0.000

Source: Fieldwork (2020)

Table 5. Wald statistics of Binary Logistic Regression depicting the predictive effect of poultry farmers' socioeconomic factors on their willingness to get LFI

Determinants	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Years of experience	-.162	.197	.680	1	.410	.850	.578	1.251
Main occupation	.389	.236	2.727	1	.099	1.476	.930	2.343
Income from poultry farming	-.279	.482	.336	1	.562	.756	.294	1.944
Monthly household income	-.784	.421	3.471	1	.048	.456	.200	1.042

Source: Fieldwork (2020)

3.2.2 Poultry farmers' production factors and willingness to subscribe to LFI

The association between poultry farmers' production characteristics and willingness to subscribe to a livestock insurance scheme and the Wald statistics of Binary Logistic Regression depicting the predictive effect of poultry farmers' production factors controlled for each other on willingness to subscribe to a livestock Insurance scheme are presented in Tables 6 and 7.

Willingness to subscribe to a livestock insurance scheme was significantly associated with the following determinants:

- **Evaluation of risk management strategies**: The more adequate poultry farmers' risk management strategy was, the more they were willing to get LFI (P=0.000).
- **Source of labour**: Those who employed family labour were less willing to subscribe to livestock farming insurance schemes (P=0.000).
- **Number of farms**: Those with more than one farm were more willing to subscribe (P=0.000).
- **Flock size**: Those with a flock size of >5000 chickens were more willing to get LFI (P=0.001).
- **Division**: Poultry farmers from the Mifi Division were more willing to subscribe to livestock farming insurance (P=0.000).
- **Chicken species**: Farmers who reared traditional chickens were more willing to get LFI because it takes longer to mature than broilers.
- **Source of capital**: Poultry farmers who used personal savings and loans were more willing to subscribe to livestock farming insurance (P=0.000).

The influence of the significant determinants highlighted above was appraised while controlling for each other to silence the confounders using the Wald test of Logistic Regression, as shown in Table 7.

After controlling determinants for each other, Wald Statistics highlighted the only source of labour as a significant determinant of poultry farmers' willingness to subscribe to a livestock insurance scheme. Beyond this, it was a critical predictor (OR >1; LB>1).

3.2.3 Model summary (poultry farmers)

The model summary for socioeconomic and production factors was computed using the Integrated Value Mapping (IVM) approach, as shown in Table 8.

Production factors predicted willingness to subscribe to a livestock insurance scheme more than socioeconomic characteristics, with a predictive power/explanatory power (PP/EP) of 47.6% and 33.7%, respectively. The Integrated Value Mapping (IVM) combining the predictive effects of both components was 51.2%, implying that 48.8% variability was not accounted for. Thus, other factors apart from socioeconomic and production factors determine poultry farmers' willingness to get LFI.

3.2.4 Pig farmers' socioeconomic factors and willingness to subscribe to LFI

The association between pig farmers' socioeconomic and willingness to subscribe to a livestock insurance scheme is shown in Table 9. Wald Statistics of Binary Logistic Regression depicts the predictive effect of socioeconomic factors controlled for each other on willingness to subscribe to a livestock insurance scheme, which is shown in Table 10.

Table 6. Association between production factors for poultry farmers and willingness to subscribe to a livestock insurance scheme

Determinants	Categories	Yes	No	n	χ2-test (df=0.05)
Evaluation of risk management strategies	Adequate	64.9% (85)	35.1% (45)	162	χ2=30.792
	Inadequate	9.7% (3)	90.3% (28)	31	P=0.000
Source of labour	Family	62.5% (80)	37.5% (48)	128	χ2=18.170
	Employees	22.7% (5)	77.3% (17)	22	P=0.000
	Both	26.3% (5)	73.7% (14)	19	
Number of farms	One	41.5% (44)	58.5% (62)	106	χ2=17.279
	More than one	75.0% (45)	25.0% (15)	60	P=0.000
Total flock size	≤5000	43.4% (43)	56.6% (56)	99	χ2=11.991
	>5000	71.7% (43)	28.3% (17)	60	P=0.001
Division	Mifi	66.4% (85)	33.6% (43)	128	χ2=37.862
	Koung-Khi	10.3% (4)	89.7% (35)	39	P=0.000
Setting type	Peri-urban	49.2% (63)	50.8% (65)	128	χ2=3.452
	Rural	65.9% (27)	34.1% (14)	41	P=0.063
Poultry species	Traditional chicken	62.6% (82)	37.4% (49)	131	χ2=21.578
	Broilers	21.1% (8)	78.9% (30)	38	P=0.000
Source of capital	Personal savings	30.4% (21)	69.6% (48)	69	χ2=29.970
	Personal savings and loan	75.0% (60)	25.0% (20)	80	P=0.000
	Loan only	61.5% (8)	38.5% (5)	13	

Source: Fieldwork (2020)

Table 7. Wald statistics of Binary Logistic Regression depicting the predictive effect of poultry farmers' production factors on willingness to get LFI

Determinants	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Evaluation of risk management strategies	2.095	1.130	3.437	1	.064	8.123	.887	74.378
Source of labour	1.596	.555	8.273	1	.004	4.933	1.663	14.637
Number of farms	-.638	.676	.891	1	.345	.528	.141	1.987
Flock size	-.378	.682	.307	1	.580	.685	.180	2.610
Division	.466	2.268	.042	1	.837	1.593	.019	135.662
Poultry species	.085	1.148	.006	1	.941	1.089	.115	10.343
Source of capital	-.259	.408	.403	1	.525	.772	.347	1.717

Source: Fieldwork (2020)

Table 8. Model summary of the influence of socioeconomic and production factors on poultry farmers' willingness to get LFI

Predictive component	Omnibus Tests of Model Coefficients	Predictive Power / Explanatory Power (Nagelkerke R Square)
Socioeconomic factors	P=0.000	33.7%
Production factors	P=0.000	47.6%
Integrated value mapping	P=0.000	51.2%

Source: Fieldwork (2020)

Table 9. Association between socioeconomic characteristics of pig farmers and willingness to subscribe to a livestock insurance scheme

Determinants	Categories	Yes	No	n	χ2-test (df=0.05)
Sex	Male	29.7% (52)	70.3% (123)	175	χ2=3.484
	Female	10.2% (2)	90.0% (18)	20	P=0.048
Age	18-37	15.4% (10)	84.6% (55)	65	χ2=12.164
	38-47	27.9% (19)	72.1% (49)	68	P=0.007
	48-57	36.5% (19)	63.5% (33)	52	
	58+	60.0% (6)	40.0% (4)	10	
Household size	1-2	25.2% (28)	74.8% (83)	111	χ2=7.031
	3-4	27.3% (21)	72.7% (56)	77	P=0.030
	5+	71.4% (5)	28.6% (2)	7	
Years of experience	1-5	12.3% (8)	87.7% (57)	65	χ2=25.748
	6-10	22.8% (13)	77.2% (44)	57	P=0.000
	11-15	35.0% (14)	65.0% (26)	40	
	16-20	52.0% (13)	48.0% (12)	25	
	21+	75.0% (6)	25.0% (2)	8	
Educational attainment	No formal and primary education	25.0% (21)	75.0% (63)	84	χ2=0.575 P=0.750
	Secondary education	29.1% (32)	70.9% (78)	110	
	High school, vocational training and university education	33.3% (2)	66.7% (4)	6	
Main occupation	Poultry farm	30.0% (33)	69.7% (76)	109	χ2=3.852
	Farmer	14.8% (4)	85.2% (23)	27	P=0.426
	Casual labourer	18.8% (3)	81.3% (13)	16	
	Employee	30.8% (8)	69.2% (18)	26	
	Businessperson	35.3% (6)	64.7% (11)	17	
Marital status	Single	21.1% (16)	78.9% (60)	76	χ2=7.231
	Married	35.2% (37)	64.8% (68)	105	P=0.027
	Widowed	7.7% (1)	92.3% (12)	13	
Income from pig farming (FCFA)	≤1 million	23.1% (24)	76.9% (80)	104	χ2=2.371
	>1 million	33.0% (30)	67.0% (61)	91	P=0.124
Monthly household income (FCFA)	≤500,000	25.0% (46)	75.0% (138)	184	χ2=11.808
	>500,000+	72.7% (8)	27.3% (3)	11	P=0.001

Source: Fieldwork (2020)

Table 10. Wald statistics of Binary Logistic Regression depicting the predictive effect of pig farmers' socioeconomic factors

Determinants	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Sex	.524	.830	.398	1	.528	1.688	.332	8.591
Age	-.497	.279	3.170	1	.075	.608	.352	1.051
Household size	.687	.408	2.831	1	.092	1.988	.893	4.427
Years of experience	-.612	.179	11.663	1	.001	.542	.381	.770
Main occupation	-.177	.148	1.423	1	.233	.838	.627	1.120
Marital status	.275	.376	.535	1	.464	1.317	.630	2.755
Monthly household income	-1.920	.807	5.666	1	.017	.147	.030	.712

Source: Fieldwork (2020)

The willingness to subscribe to a livestock insurance scheme was significantly associated with the following determinants:

- **Sex,** whereby males were significantly more willing to pay more than females (P=0.048).
- **Age**, whereby willingness to get LFI increased significantly with age (P=0.007).
- **Household size**, whereby willingness increased significantly with household size (P=0.030).
- **Years of work experience in livestock farming**, whereby the higher the work experience, the higher the willingness to subscribe (P=0.000).
- **Marital status**, whereby the married had the highest willingness to subscribe (P=0.027).
- **Monthly household income**, whereby the higher the income, the higher the willingness to subscribe (P=0.000).

The influence of the significant determinants highlighted above was appraised while controlling for each other to silence the confounders using the Wald test of Logistic Regression, as shown in Table 10.

After controlling determinants for each other, Wald Statistics highlighted years of experience and monthly household income as significant determinants of willingness to subscribe to a livestock insurance scheme.

3.2.5 Pig farmers' production factors and willingness to subscribe to LFI

The association between pig farmers' production factors and willingness to subscribe to a livestock insurance scheme and the Wald Statistics of Binary Logistic Regression depicting the predictive effect of pig farmers' production factors controlled for each other on willingness to subscribe to a livestock insurance scheme are presented in Tables 11 and 12.

Willingness to subscribe to livestock insurance was significantly associated with the following determinants:

- **Number of farms**, whereby those with more than one farm were more willing to subscribe (P=0.002).
- **Flock size,** whereby those with more than 30 pigs were more willing to subscribe (P=0.004) due to their significant investment in getting more pig heads. The total flock size determines the amount of investment put in by the farmer. Due to farmers' massive investment, they would like to secure this investment by getting LFI.
- **Division**, whereby those from the Upper-Plateau Division were more willing to subscribe (P=0.000).
- **Source of capital**, whereby those who used personal savings and loans were more willing to subscribe (P=0.000) as they were not willing to lose the personal income they worked hard for.

The influence of the significant determinants highlighted above was appraised while controlling for each other to silence the confounders using the Wald Test of Logistic Regression, as shown in Table 12.

After controlling determinants for each other, Wald Statistics revealed that the total size of the flock and division were significant determinants of willingness to subscribe to a livestock insurance scheme, and division was a critical predictor (OR>1: LB>1). This, therefore, implies that these determinants should be paid higher attention.

3.2.6 Model summary (pig farmers)

The model summary for socioeconomic and production factors was computed using the Integrated Value Mapping (IVM) approach, as shown in Table 13.

Socioeconomic factors predicted willingness to subscribe to a livestock insurance scheme more than production factors, with predictive power/explanatory power (PP/EP) of 26.8% and 17.8%, respectively. The Integrated Value Mapping (IVM) combining the predictive effects of both components was 35.1%, thus implying that 64.9% variability was not accounted for. Therefore, other factors apart from socioeconomic and production factors determine pig farmers' willingness to get LFI.

3.3 Discussion

In line with livestock farmers' unwillingness to get LFI in the study area, Wolf and Widmar [20] realised that in California, Florida, Indiana, Michigan, and Wisconsin, many cattle farmers were unwilling to pay for margin insurance. Dong, Jimoh, Hou and Hou [12] revealed that

livestock farmers were unwilling to get LFI because they could not afford it and had inadequate knowledge of the importance of LFI. This is in agreement with the findings of this study. Contrary to this study's finding in which the pig farmers' willingness to get LFI increased with age (even though it was not a significant determinant), Oduniyi, Antwi, and Tekana [13] noticed that older farmers were unwilling to pay for index-based livestock insurance. Farayola, Adedeji, Popoola, and Amao [14] realised that age, educational level, farm size, and accessibility to credit significantly influenced farmers' willingness to pay for agricultural insurance schemes. This study revealed that the total size of the flock for pig farmers was a significant determinant of farmers' willingness to pay for LFI. The results of this study revealed that farmers' education level was not a determinant of farmers' willingness to pay for LFI. Most farmers had secondary education and were unwilling to get LFI. This finding is consistent with Marianne, Dimitre, Sergio and Minka [17], in which farmers with secondary education are less likely to get insured than more educated farmers, as better-educated farmers are more responsive to modern risk management approaches like insurance. According to Marcelo, Rodrigo, Marcela and Hildo [15], large producers, those with higher levels of education, who adopt more farm management tools and who receive private technical assistance are more likely to get LFI than farmers who do not align with these criteria. These producers can easily access information and present a lower risk to insurers. Furthermore, Was and Kobus [16] realised that education did not affect insurance decisions [18-20].

Table 11. Association between production factors for pig farmers and willingness to subscribe to a livestock insurance scheme

Determinants	Categories	Yes	No	n	χ2-test (df=0.05)
Evaluation of risk management strategies	Adequate	30.4% (41)	69.6% (94)	135	χ2=0.850
	Inadequate	23.5% (12)	76.5% (39)	51	P=0.356
Source of labour	Family	28.4% (31)	71.6% (78)	109	χ2=3.836
	Employees	50.0% (6)	50.0% (6)	12	P=0.147
	Both	23.0% (17)	77.0% (57)	74	
Number of farms	One	25.1% (46)	74.9% (137)	183	χ2=9.700
	More than one	66.7% (8)	33.3% (4)	12	P=0.002
Flock size	<=30	24.0% (40)	76.0% (127)	167	χ2=8.125
	>30	50.0% (14)	50.0% (14)	28	P=0.004
Division	Bamboutos	17.0% (17)	83.0% (83)	100	χ2=17.523
	Upper-Plateau	31.3% (20)	68.8% (44)	64	P=0.000
Setting type	Peri-urban	26.1% (18)	73.9% (51)	69	χ2=0.137
	Rural	28.6% (36)	71.4% (90)	126	P=0.711
Pig species	Local species	20.0% (4)	80.0% (16)	20	χ2=4.451
	Exotic species	21.1% (16)	78.9% (60)	76	P=0.108
	Crossed species	34.3% (34)	65.7% (65)	99	
Source of capital	Personal savings	21.8% (17)	78.2% (61)	78	χ2=19.900
	Personal savings and loan	54.5% (24)	45.5% (20)	44	P=0.000
	Loan only	18.6% (13)	81.4% (57)	70	

Source: Fieldwork (2020)

Table 12. Wald statistics of binary logistic regression depicting the predictive effect of poultry farmers' production factors

Determinants	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Number of farms	-.922	.740	1.550	1	.213	.398	.093	1.698
Flock size	-.692	.268	6.659	1	.010	.500	.296	.847
Division	.272	.133	4.192	1	.041	1.312	1.012	1.702
Source of capital	.337	.219	2.355	1	.125	1.400	.911	2.152

Source: Fieldwork (2020)

Table 13. Model summary of the influence of socioeconomic and production factors on pig farmers' willingness to get LFI

Predictive component	Omnibus Tests of Model Coefficients	Predictive Power / Explanatory Power (Nagelkerke R Square)
Socioeconomic factors	P=0.000	26.8%
Production factors	P=0.012	17.8%
Integrated value mapping	P=0.000	35.1%

Source: Fieldwork (2020)

4. CONCLUSION

The majority of poultry and pig farmers were unwilling to get LFI. The percentage was higher for pig farmers than for poultry farmers. Furthermore, only 33.5% of farmers were willing to get LFI and more poultry farmers were willing than pig farmers. More farmers in the Mifi Division were willing to pay for LFI than farmers in the Bamboutos, Upper-Plateau and Koung-Khi Divisions. Production factors influenced poultry farmers' willingness to subscribe to a livestock insurance scheme more than socioeconomic factors. In contrast, socioeconomic characteristics influenced pig farmers' willingness to subscribe to a livestock insurance scheme more than production factors. Notwithstanding, other variables unaccounted for predicted farmers' willingness to pay for LFI, other than farmers' socioeconomic and production factors.

5. RECOMMENDATION

There is a need for the Ministry of Livestock Fisheries and Animal Husbandry (French acronym MINEPIA) to set up a National Livestock Insurance Policy and for insurance companies to translate this policy into schemes for poultry and pig farmers.

In collaboration with extension agents of MINEPIA, insurance companies need to sensitise farmers on the importance of insurance as a risk management measure.

Insurance companies can start piloting LFI with poultry farmers in the Mifi Division. The second pilot phase can be with pig farmers in the Bamboutos Division.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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