

# A BINARY LOGISTIC ANALYSIS ON FACTORS AFFECTING THE PARTICIPATION OF SMALLHOLDER FARMERS IN THE MARKET OF INDIGENOUS CHICKENS (ICS)

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**Abstract.** Participating in the indigenous chicken (IC) market enables farmers to generate income and alleviate household food insecurity. The objectives of the study were to profile the socio-economic characteristics of smallholder farmers and determine the factors influencing smallholder farmer participation in the IC market. The study employed purposive and snowball sampling techniques to identify 50 indigenous chicken farmers in the Dihlabaneng village, Makhuduthamaga Local Municipality, Limpopo Province of South Africa. Descriptive statistics and Binary Logistic regression model were employed to meet the objectives of the study. Moreover, experience in rearing chickens, land size and number of chickens owned were determined to be the factors influencing farmer participation in the IC market. The study also confirmed that female farmers dominate the IC market when compared to males. This calls for government intervention to be taken in promoting IC markets to encourage greater farmer participation, enabling the improvement of the livelihoods of rural communities.

**Keywords:** indigenous chickens, market participation, Dihlabaneng village, binary logistic

## INTRODUCTION

Indigenous chickens play an important role in the livelihoods of rural communities in Africa and other devel-

oping regions (Malatji et al., 2016; Akidi et al., 2018). Chickens not only serve as a source of nutrition but also provide households with income and employment. As explained by Padhi (2016), backyard farming has significantly contributed to the rural economies of developing countries in recent years by providing them with a livelihood. The poultry industry is a vital part of agro-processing, as well as a major driver of development and job creation within the Southern African Development Communities (SADC) region (Ncube, 2018). Moreover, IC production provides opportunities for unemployed youth, women and children due to the easy maintenance, easy adaptability to climate change and disease resistance of ICs, as well as the ability to utilise poor-quality feeds in such production (Kumarr, 2012; Assefa, 2019). Traditionally reared by impoverished households to generate income and improve food security, ICs also serve as a token of appreciation for services rendered and gifts to be exchanged with guests (Mtileni et al., 2012); additionally, they are used in traditional events and customs (Assefa, 2019). Indigenous chickens are one of the most adaptable domestic animals and can survive in hot and cold weather conditions, both sheltered and unsheltered in cages, and some even roost on trees (Grobberlaar et al., 2010; Tarwireyi and Fanadzo, 2013).

In Africa, about 94% of the total chicken population is indigenous poultry, which provides most rural

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households with meat and eggs (Tabler, 2019). Various authors have documented the vital role that ICs play in rural livelihoods. For example, Bwalya (2014); Kattel (2016), emphasized that ICs meet the nutritional needs of households by serving as a source of proteins, vitamins and micronutrients. Sokołowicz et al. (2016) also highlighted that ICs serve as a source of income for smallholder farmers and rural households. A study conducted by Mtileni et al. (2012) found that about 50% of households owned chickens as compared to other livestock. A study by Adiki et al. (2018) indicates that such countries as Uganda offer significant IC market opportunities due to the increasing demand for chickens and chicken products locally, regionally and in the neighbouring countries. Despite this evidence, there is limited information concerning the IC market availability, which might have contributed to the limited participation of smallholder farmers in IC production.

The most common IC breeds in South Africa include the Boschveld chicken, Naked Necks, Ovambo's and Potchefstroom Koeks and Venda, which adapt to the South African climate much better than the commercial breeds (Kriel, 2019). These breeds are easy to maintain and production-efficient (Larbi et al., 2013). With the rising demand for juicy, tender, low-fat and high-protein meat with excellent flavour and aroma (Horsted et al., 2012; Chumngoen and Tan, 2015; Sokołowicz et al., 2016), indigenous chickens are perfectly capable of meeting it. Furthermore, IC consumption is increasing due to the consumers preferring ICs over broiler chickens and red meat (McCarthy et al., 2004; Nkukwana, 2018). A study conducted by Ayieko et al. (2015) showed that the IC market is segmented based on consumer preferences, with some consumers willing to pay higher prices for safe and quality meat. This provides an opportunity to increase IC production for income generation and food security purposes, particularly in rural settings. According to Tarwireyi and Fanadzo (2013), the lack of extension services has led to most households experiencing tremendous difficulties in rearing ICs; households also lack the required husbandry skills, training and opportunities to improve upon their poultry production practices and make them sustainable.

Market participation is defined as being involved in livestock, horticulture or maize and other field crop market (Makhura, 2001). Ouma et al. (2010) define market participation based on the sales and quantity of produce. Although smallholder farmers participate in IC

production, the market participation among them is low (Mtileni et al., 2012; Kyule et al., 2014). This might be due to such factors as tenure insecurity (Wanjugu, 2015) and the quantity of ICs produced (Ayieko et al., 2015). According to Moges et al. (2010), the high mortality rate due to diseases such as the Newcastle disease is yet another challenge in IC production. If uncontrolled, diseases may result in low market participation, leading to household income and food security being compromised (Ahlers et al., 2009). Poor management, attacks by predators such as wild and domestic cats, robberies, lack of funding, lack of water and proper feed, as well as lack of housing pose significant challenges for rearing ICs (Abera and Geta, 2014; Haoua et al., 2015; Sebho 2016). Despite this, participating in the IC market can help smallholder farmers by boosting household income, effectively reducing food shocks.

The World Bank (2008) states that efficient and well-functioning markets and trade systems that keep transactions costs low, minimise risks and relay information to all actors in different areas with intensive agricultural production should be established. In some parts of Asia, IC rearing is considered a feasible and efficient business, and as such, a better understanding of the socio-economic aspects of the small-scale poultry farmers in urban, semi-urban and rural areas is necessary (Dutta et al., 2013).

## FACTORS AFFECTING IC MARKET PARTICIPATION

A study conducted by Abeykoon et al. (2013) confirmed that the smallholder farmers' decision to participate in the IC market is influenced by religion and the gender of the household head. Abeykoon et al. (2013) further indicate that households headed by males are more likely to participate in the IC market compared to households headed by females. This shows that there are gender disparities between smallholder farmers in IC market participation. A similar study conducted by Akidi et al. (2018) determined that household income influences the farmers' decision to participate in the IC market. On the other hand, Bett et al. (2014) found that the main reason for keeping ICs is home consumption. Nonetheless, Mohamed et al. (2016) determined that rural farmers typically rear ICs for income generation. It seems that the smallholder farmers' decisions to participate in the IC market are motivated by different home consumption

and income generation criteria. This suggests that ICs play an important role in household food security and income generation.

A study by Simon et al. (2015) determined that IC market participation intensifies as the age of the household head increases, suggesting that older farmers may have an advantage due to their ability to make better decisions thanks to their experience in IC rearing. However, Ayieko et al. (2015); Akidi et al. (2018) found that the opposite is the case, suggesting that as a smallholder farmer grows older, he or she is less likely to be involved in the IC market due to the travel distance to reach the market.

On the other hand, Mirembe (2018) found that non-farm income, household head's level of education, cooperative membership and price of the flock significantly increase along with the sale and market participation level. Furthermore, Simon et al. (2015) attest that income is one of the factors that affect the participation of smallholder farmers in the IC market. Wong et al. (2017) also found that 35% of women's income comes from rearing chickens since poorer households generally keep poultry and pigs for consumption and income generation more often than wealthy households. This might suggest that the higher the income generated from IC production, the higher the households' market participation. To this end, this study intended to profile the socio-economic characteristics of smallholder farmers and determine the factors that influence their participation in the indigenous chicken market.

## METHODOLOGY

The study was conducted in the Dihlabaneng village, located in the Makhuduthamaga Local Municipality (MLM), Sekhukhune District Municipality, Limpopo Province of South Africa. The dominant language spoken in the area is Sepedi. According to a Stats SA 2011 Census, the village consists of 476 households. The village is in Ward 16 of MLM and is situated in a rural area (Sekhukhune District Municipality annual report, 2017/2018); it is 21.5 km away from Jane Furse – accessible via Schoonoord Road – which serves as MLM's seat (MLM, 2020).

Structured questionnaires were used to gather information from a sample of 50 households in the Dihlabaneng village through face-to-face interviews. The Stats SA 2011 Census concluded that Dihlabaneng has



**Fig. 1.** A map of the Makhuduthamaga Local Municipality, indicating the location of the Dihlabaneng village (☆ indicates the study area; GPS Coordinates: 24.71S, 29.983E) Source: AfriGIS (Pty) Ltd, 2020.

476 households. Therefore, ten per cent (10%) of the households were chosen and two more were added for a total sample of 50. Purposive and snowball sampling procedures were then employed to identify the households that produce ICs.

Descriptive statistics in the form of means, standard deviations, frequencies and percentages were used to address the first objective of the study (profiling the socio-economic characteristics of smallholder farmers). To address the second one – to determine the factors influencing the smallholder farmer participation in the IC market – a Binary Logistic Regression (BLR) model was used. This followed the practice established by Tarekegn and Yosefe (2017), who used a BLR model to analyse the factors affecting smallholder farmer IC market participation in Ethiopia. The general BLR model is expressed as follows (Gujarati, 2010):

$$In = \frac{\left[ p\left(y = \frac{1}{x}\right) \right]}{\left[ 1 - p\left(y = \frac{1}{x}\right) \right]} = \alpha + \beta_1 X_1 + \dots + \beta_n X_n \quad (1)$$

where:  $Y_i$  – dependent variable (sales on market),  $P_i$  – probability of a farmer selling ICs in the market,  $1 - P_i$  – probability of a farmer not selling ICs in the market,  $\beta_0$  – intercept,  $\beta_1$  to  $\beta_n$  – parameter coefficients,  $X_1$  to  $X_n$  – explanatory variables and,  $u_i$  – the disturbance

term. In this study, market participation is defined as a situation where households sell their produce (i.e. ICs) to maximise profit.

## RESULTS AND DISCUSSION

According to the results presented in Table 1, farmer household size ranges between a minimum of one person and a maximum of 14 people, with an average of at least five people in each a household. This means that smallholder farmers are likely to involve some family members in chicken rearing. Regarding the farm size, farmers typically rear ICs on a land size ranging from 0.05 to 0.44 hectares. This may indicate that farmers in the study area have limited space for rearing chickens, which may prevent them from trading in larger markets. The number of ICs owned by smallholder farmers ranged between a minimum of three and a maximum of 60, with an average of 13. This implies that some farmers had enough chickens to participate in the IC market.

**Table 1.** Descriptive statistics results concerning household size, land size and the number of ICs

Variables	Household size	Size of the land owned (ha)	Number of ICs
N	50	50	50
Mean	5.30	0.499	13.32
Std. deviation	2.957	0.1054	10.680
Maximum	14	0.44	60
Minimum	1	0.05	3

Source: based on a research survey, 2019.

The descriptive results in Table 2 revealed that 62% of female and 38% of male farmers rear ICs. This suggests that women dominate IC rearing in the study area. Moreover, most farmers (44%) who reared chickens were over the age of 50 while about 30% of them were between 40 and 49 years old. This means that older farmers who participate in IC rearing may have more experience in the IC market. The descriptive results also revealed that 14% of the farmers were between 30 and 39 years old, whereas 12% of them were between 20 and 30 years old.

**Table 2.** Descriptive statistics results for selected categorical variables

Variables	Category	Frequency	Per cent
Gender	Male	19	38
	Female	31	62
Age (in years)	20–30	6	12
	30–40	7	14
	40–50	15	30
	>50	22	44
Level of education	Primary	8	16
	Secondary	19	38
	Tertiary	20	40
	No formal education	3	6
Years of rearing IC	1–3	14	28
	4–5	13	26
	>5	23	46

Source: based on a research survey, 2019.

Additionally, most smallholder farmers (40%) in the study area have tertiary education and 38% of the farmers have secondary education. The descriptive results further reveal that about 16% of the farmers only attended primary school and 6% of them never attended any school at all. Furthermore, most smallholder farmers rearing ICs (40%) have more than 5 years of experience in doing so. The results also indicate that 28% of the respondents have between 4 and 5 years of experience while the remaining 26% only have 1 to 3 years' experience in rearing chickens. Therefore, the descriptive statistics suggest that older farmers may have a better knowledge of rearing ICs since it becomes easier for a farmer to understand a market once he or she has been active in it for a long time.

### Farmer participation status in the indigenous chicken market

The cross-tabulation results in Table 3 indicate that female farmers (18%) participate in the IC market more frequently than males (12%). Since women are noticeably more active than men in various markets, these results may be true to some extent. This is because women always look for ways of generating extra income from

**Table 3.** Gender of the household head \* Households participating in the indigenous chicken market – cross-tabulation

Gender	Participation (%)	No participation (%)	Total (%)
Male	12	26	38
Female	18	44	62
Total	30	70	100

Source: based on a research survey, 2019.

different farming activities as a way of alleviating their families' poverty. On the other hand, 26% of males and 44% of females do not participate in the IC market at all. Such households either produce ICs for consumption or as a hobby, but not to maximise profit. Therefore, only about 30% of the farmers sampled participate in the market whereas 70% of them do not.

### Factors influencing smallholder farmer participation in the indigenous chicken market in the Makhuduthamaga Local Municipality, South Africa

Table 4 shows the BLR estimates of the factors influencing smallholder farmer IC market participation. These results indicate that only three variables out of the nine

included in the model were found to be significant. The significant variables included the years of experience in rearing chickens, land size and number of chickens owned. The Cox and Snell R-squared of the model was 0.531 and this indicates that about 53.10% of the variation in the dependent variable was explained by the binary logistic regression model and 46.9% was unaccounted for. Also, a Nagelkerke R-squared of 0.753 was obtained, which indicates that more of the variation was explained by the model with an overall prediction percentage of 70.0.

### Experience in rearing indigenous chickens

The results in Table 4 indicate that there is a positive relationship between experience in rearing ICs and market participation, with experience being significant at a 10% level. These results imply that as the experience of a smallholder farmer increases, the probability of them participating in the IC market may increase as well. The findings presented by Simon et al. (2015) were similar and indicated that as a farmer gets older, they may also have a better knowledge of the trade and its techniques. Since farmers are likely to build social ties as they age, this may help them find markets for their produce. The results are in line with the findings of Akidi et al. (2018), who indicated that while experience is not significant,

**Table 4.** Binary Logistic Regression results

Independent variables	Beta	Std Error	Wald	Significance
Years of chicken rearing experience	0.986	0.516	3.653	0.056***
Gender of the household head	1.558	1.320	1.393	0.238
Family size	-0.376	0.259	2.116	0.146
Age of the household head	0.315	0.691	0.208	0.648
Level of education	-5.025	4.826	1.084	0.298
Number of chickens	0.323	0.124	6.840	0.009*
Employment status of the household head	-2.344	1.724	1.849	0.174
Deposit income in Rands	0.000	0.000	0.026	0.872
Land size in ha	-77.562	33.056	5.505	0.019**
Constant	3.712	5.571	0.444	0.505

Model summary: (-2) Log-likelihood – 23.212; Cox & Snell R-square – 0.531; Accuracy of prediction: overall (%) – 70.0; Nagelkerke R-square – 0.753

\*Significant at 1%; \*\*significant at 5%; \*\*\*significant at 10%.

Source: based on a research survey, 2019.

it had a positive coefficient for the value of IC sales. Nonetheless, Abeykoon et al. (2013) presented evidence to the contrary and found that farming experience does not influence poultry market participation in the case of indigenous chicken farmers.

### Land size (in hectares)

The BLR results confirmed a negative relationship between land size and market participation at a 1% level of significance. This suggests that the less land is available for IC rearing, the smaller the IC market participation. Simon et al. (2015) also stated that IC market participation decreases when farmers have limited land for rearing chickens. This relationship can be explained as follows – farmers with limited land available are likely to focus on other activities instead of rearing ICs, ultimately limiting the market participation among such farmers. This is because their possibilities of investing in other forms of livestock and crop production are hindered by their limited land. Farmers who own larger plots of land can afford to use some parts for keeping livestock and others for crop production.

### Number of indigenous chickens

The number of ICs owned by smallholder farmers was found to be positive and statistically significant at a 5% level. The results indicate that the number of ICs reared by farmers is likely to influence their market participation. This coincides with the findings of Akidi et al. (2018), who found that flock size and non-farm income differed significantly between market participants and non-participants. This may further explain why the participants who had a large flock were also characterised by higher income and increased market participation compared to those with a small flock. Abeykoon et al. (2013) also revealed that the number of chickens owned by farmers affects the value of poultry sales.

### CONCLUSION AND RECOMMENDATION

The study concluded that in the study areas, women typically dominate both IC rearing and market participation compared to men. Additionally, such farmers usually rear their chickens on a limited plot of land ranging from 0.05 to 0.44 hectares. The study further concludes that most farmers rearing ICs are over the age of 50, with many of them having completed primary education. Regarding market participation, the study concluded that

most farmers do not participate in the IC market. The BLR estimates discovered that such factors as professional experience, years of experience in rearing chickens, the number of chickens owned and land size affect IC market participation among farmers.

Since most female farmers participate in the IC market, it is recommended that the government provides the necessary farming inputs such as feed, sustainable infrastructure – including chicken coops – as well as enough water to support them. This may help improve efficiency and allow all farmers to find larger markets while empowering women both in the IC sector and the whole farming industry alike. Farmers must be made aware of the need to participate in the IC market to boost their household income and improve food security, and as such, additional education through government extension officers may be necessary. This can be achieved by using extension services capable of providing informal education to the farmers to explain to them the economic benefits of rearing ICs. Therefore, the study recommends that the government should provide extension services that will offer guidance to the farmers on how to commercialise IC production.

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