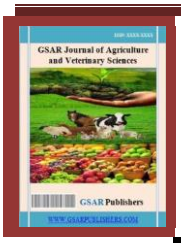

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Influence of the Education of Poultry Farmers in Mali on the Productivity of Their Farms

By

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Abstract

Poultry farming plays a key role in food security and income generation in Mali, particularly for women and youth in rural areas. However, low technical productivity in poultry farms limits the sector's development. This narrative literature review analyzes the influence of farmers' education on their technical efficiency, using data from Mali and West African countries. A higher level of education promotes the adoption of best practices (vaccination, feeding, management), thereby enhancing technical efficiency. The review highlights the mechanisms through which education improves farm management, encourages adoption of innovations, and fosters better interaction with extension services. It also identifies associated factors such as access to inputs, credit, continuous training, and socio-economic variables like gender, age, and experience. Finally, the review points out literature gaps, including the lack of Mali-specific studies and insufficient consideration of regional or educational differences. It provides insights for future research and policy development, emphasizing education as a strategic lever for modernizing Mali's poultry sector. Public policies should incorporate technical training adapted to producers.

Keywords: *Agricultural education, Poultry productivity, Technical efficiency, Human capital, Mali.*

Introduction

Poultry farming plays a crucial role in Mali's agri-food systems, contributing significantly to food security and household income, particularly in rural areas. It serves as a key source of employment and an important economic lever for women and youth(FAO, 2019; MEP, 2021). However, the productivity and technical efficiency of poultry farms remain low, hindering the full potential of the sector (Dossa et al., 2015 ; Koné et al., 2020). Poultry populations in Mali are divided between the modern sector, with 8,650,997 birds (13.65%), and the traditional sector, estimated at 54,703,373 birds (86.35%) (DNPIA, 2021).

In this context, several factors are identified as determinants of poultry farmers' performance, including access to inputs, sanitary practices, institutional environment, and the education level of producers. Education, as a component of human capital, is often considered a key factor in the adoption of innovations, improvement of management practices, and consequently, enhancement of technical efficiency(Becker, 1964; Schultz, 1975; Asfaw et al., 2012) .

Studies conducted in sub-Saharan Africa suggest that a higher level of education supports the understanding and adoption of poultry technologies such as vaccination, balanced feeding, and health management (Ogundari, 2008 ; Yabi et al., 2020) . In Mali, although few studies have specifically focused on this relationship, some research has shown a correlation between education level and the adoption of good agricultural practices (Coulibaly et al., 2017 ; Diallo et al., 2018) .

The objective of this literature review is to analyze the relationship between poultry farmers' education levels and their technical efficiency, with a focus on available data from Mali and comparable West African contexts. It also aims to identify the mechanisms through which education influences performance, while highlighting gaps in the existing literature to guide future research.

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Materials and Methods

This study is based on a narrative review of scientific and technical literature. The sources include institutional reports (FAO, DNPIA, MDR), academic articles (peer-reviewed journals), and dissertations or theses related to poultry farming and agricultural economics. The selected documents focus primarily on Mali, but also include relevant studies from Ghana, Nigeria, Burkina Faso, and Senegal.

Technical efficiency refers to a producer's ability to maximize output from a given set of resources. Introduced by Farrell (1957), his concept remains central to the analysis of agricultural performance. A production unit is considered technically efficient when it operates on the production frontier. Any deviation from this frontier indicates inefficiency.

Two methods are commonly used to assess technical efficiency. Data Envelopment Analysis (DEA) is a non-parametric method based on linear optimization, while the Stochastic Frontier Approach (SFA) is a parametric method that incorporates a random error term (Coelli et al., 2005).

A comparative table on education levels and poultry productivity across several West African countries was compiled based on available data.

Results and Discussion

Statistical context of poultry farming in Mali

Poultry farming is gaining strategic importance in Mali's national economy and food security landscape. It serves as a key source of animal protein, income, and employment, particularly for women and youth living in rural and peri-urban areas. The Malian poultry sector is primarily based on two production systems: a predominant traditional extensive system in rural areas, and a growing semi-modern to modern system, especially in the peri- urban zones of Bamako District and regional capitals (DNPIA, 2021).

According to the most recent national statistics, the poultry population is estimated at around 42 million birds (chickens, guinea fowl, ducks), representing an economic value of nearly 25 billion CFA francs per year (MDR, 2023) . The layer hen population is estimated at 3,175,371 with an annual output of approximately 275,248,601 table eggs, including 1,600,000 guinea fowl eggs (DNPIA, 2021). This production mainly originates from semi-modern and modern farms located in peri-urban areas, which are better structured and have easier access to inputs, veterinary services, and market outlets.

Despite this potential, per capita poultry meat consumption remains relatively low, estimated at about 1.1 kg per person per year nationally, compared to 3.9 kg/person/year in urban settings (FAO, 2013). This disparity reflects not only the rural-urban divide but also underscores significant opportunities for improving productivity, market access, and value chain organization.

Several constraints hinder the sector's development, including limited access to quality feed, high input costs, weak animal health services, and, most notably, a lack of training and technical knowledge among producers. The education level of poultry farmers strongly influences their ability to adopt good farming practices, manage their operations efficiently, and interact effectively with support services. Thus, human capital development through targeted education and training programs is a critical lever for enhancing technical efficiency and supporting sector modernization.

In Africa, particularly in Mali, these dynamics have revealed significant room for improvement in the poultry sector, often linked to limited access to education, information, and inputs (Ogundari, 2008).

According to Becker (1964) and Schultz (1975), human capital theory posits that education, training, and health enhance productivity. In agricultural contexts, education facilitates the adoption of technologies, effective resource management, and adaptability to change (Asfaw et al., 2012; Yabi et al., 2020).

In Mali, Coulibaly et al., (2017) and Diallo et al., (2018) demonstrated that producers who received formal education or technical training are more likely to adopt innovations. Similar findings were reported in Nigeria (Ogundari, 2008), Ghana (Ainembabazi & Mugisha, 2014) , and East Africa (Asfaw et al., 2012) , confirming the impact of human capital on productive efficiency.

Link Between Education and Technical Efficiency

Table 1 shows a positive correlation between the level of education and technical productivity. Countries where poultry farmers have received secondary or higher education report higher output levels. This confirms the key role of human capital in improving poultry farming performance.

Table 1: Comparison of Poultry Farmers' Education Levels and Technical Productivity in Selected West African Countries

Country	Predominant Education Level of Poultry Farmers	Type of Poultry System	Average Productivity (eggs/year/hen)	Source
Mali	Primary or no formal education	Traditional / semi-modern	80–120	(MDR, 2023)
Senegal	Secondary	Semi-modern /	150–180	(FAO, 2013), (ANSD, 2020)

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Country	Predominant Education Level of Poultry Farmers	Type of Poultry System	Average Productivity (eggs/year/hen)	Source
		modern		
Burkina Faso	No education or functional literacy	Traditional	60–100	FAO (2015), (Ouédraogo & Kabore, 2019)
Ghana	Secondary to tertiary	Semi-modern / modern	180–220	(Asare et al., 2017)
Nigeria	Mixed (primary to university)	Modern	200–250	(Adene & Oguntade, 2006)

It follows that better-educated poultry farmers are generally more technically efficient. Their level of education facilitates the adoption of improved practices (such as vaccination and balanced feeding), enhances farm management, and promotes more effective interaction with support and extension services.

Moderating or Associated Factors in the Relationship Between Education Level and Technical Efficiency

Several factors moderate or reinforce the effect of education level on the technical efficiency of poultry farmers in Africa.
First, access to continuous training and agricultural extension services enhances the updating of technical knowledge and improves farmers' adaptability to innovations. Studies have shown that producers who regularly attend training sessions tend to achieve better productive performance (Asfaw et al., 2012 ; Yabi et al., 2020).

Second**,** access to credit, infrastructure, and agricultural inputs (such as feed, vaccines, and equipment) plays a central role in the practical implementation of acquired knowledge. Farmers with access to financing and technical resources are better equipped to adopt improved practices (Ogundari, 2008 ; Coulibaly et al., 2017) .

Third**,** socio-economic characteristics such as gender, age, professional experience, or farm size also influence technical efficiency. For instance, older or more experienced farmers may benefit from accumulated practical knowledge, while younger farmers are often more open to adopting new technologies (Ainembabazi & Mugisha, 2014).

Finally**,** the effective use of technologies such as vaccination, balanced feeding, or the introduction of improved breeds—is both a reflection of educational attainment and a direct lever for improving technical efficiency(Asfaw et al., 2012; Ogundari, 2008).

Gaps in the Literature

Despite progress in analyzing technical efficiency in poultry farming in Africa, several gaps remain in existing studies.

First, there is a lack of country-specific research focused on Mali, even though the poultry sector is experiencing significant growth. Most studies concentrate on countries like Nigeria, Benin, or Ghana, leaving a gap in understanding the specific Malian context (Ogundari, 2008 ; Coulibaly et al., 2017) .

Second, there is a scarcity of longitudinal analyses that track changes in technical performance over time. Most available studies rely on cross-sectional data, which limits the dynamic analysis of the effects of human capital or technology adoption (Asfaw et al., 2012; Ainembabazi & Mugisha, 2014).

Moreover, existing studies often neglect regional, sociocultural, or ethnic differences, which are crucial in understanding the diversity of farming practices across West and Central Africa(Tambo & Abdoulaye, 2013; Siéwé Pougoué et al., 2019).

Lastly, the data used are often insufficiently disaggregated by type of education (formal, non-formal, technical), even though these dimensions may better explain disparities in performance among producers (Yabi et al., 2020).

Conclusion

Education plays a critical role in improving poultry productivity in Mali by directly influencing farmers' technical efficiency. Whether formal, non-formal, or technical, education serves as a key driver for strengthening farmers' capacities in farm management, technology adoption, and engagement with support services.

Evidence from Mali and other West African countries shows that better-educated producers are more likely to adopt modern practices, optimize resource use, and cope with the challenges of the poultry sector. However, for this potential to be fully realized, certain research and policy gaps must be addressed—particularly through the development of accessible continuing education, attention to regional specificities, and the promotion of vocational and technical training.

Thus, promoting farmers' education is not only a social imperative but also a sustainable economic strategy for enhancing the performance of the poultry sector in Mali and across the sub-region.

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Recommendations

It is essential to strengthen the education and technical training of poultry farmers in Mali by developing programs tailored to their level of education, delivered in local languages, and focused on best farming practices.

Agricultural extension services should be modernized and made more accessible by combining community-based outreach with digital tools to effectively disseminate information.

Moreover, better access to credit, basic infrastructure, and quality inputs is crucial to enable producers to apply the skills they have acquired.

It is also recommended to promote applied research on the link between education and productivity in poultry farming, using data disaggregated by gender, type of education, or region.

Finally, training and technical support policies must integrate a gender-sensitive approach, to better include women, who are highly active but often marginalized in the poultry sector.

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