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# INNOVATIVE PATHWAYS TO PROFITABILITY: A COMPREHENSIVE ANALYSIS OF VALUE ADDITION AND RESOURCE RECOVERY IN PERI-URBAN POULTRY FARMING

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## ABSTRACT

The primary objective of this study was to uncover innovative approaches to enhance the resilience and profitability of peri-urban smallholder poultry farmers in Wakiso District, Uganda. Data collection employed a mixed-methods approach, combining a comprehensive desk review, on-site field visits, baseline surveys, enlightening focus group discussions, and illuminating key informant interviews. A total of 180 poultry farmers participated in the survey, providing valuable insights into the challenges experienced throughout the poultry production value chain and the coping strategies employed. Upon conducting a thorough gap analysis, the study applied principles from agricultural processing engineering alongside indigenous technical knowledge to suggest resourceful value addition and resource recovery innovations. This examination unveiled capacity and knowledge gaps within the poultry sector that are impeding both productivity and profitability. The study's recommendations emphasize a strategic shift for poultry farmers toward the production of processed poultry items. These include liquid eggs, minced chicken meat, and egg powder, which not only prolong shelf life but also enhance the value of their products. Furthermore, the study underscores the importance of embracing contemporary virtual

marketing strategies such as WhatsApp, YouTube, and Facebook to expand market reach. An additional highlight is the potential for converting poultry waste into valuable resources, such as edible products, animal feeds, and bio-energy, thereby unlocking new marketing opportunities

**Keywords:** Poultry, value addition, innovations, profitability, resource recovery

## 1. INTRODUCTION

Poultry is a significant agro-enterprise globally, driven by population growth, rural-urban migration, and increasing household incomes, all contributing to a higher demand for non-staple foods (World Bank, 2018). Poultry products are among the most affordable and highly sought-after sources of animal protein worldwide, especially in urban and peri-urban areas, due to the numerous advantages they offer to both producers and consumers (Wellspring, 2014; Viljoen, 2017). In Uganda, the poultry sector comprises over 47 million chickens, with almost 88% being local chicken breeds (MAAIF, 2018). Poultry production plays crucial social, cultural, and economic roles in Ugandan communities, significantly improving the livelihoods of farmers (Tainika et al., 2019). The poultry value chain provides opportunities for employment, income generation, improved nutrition, and support for small and medium enterprises (SMEs).

The majority of poultry farmers in peri-urban areas operate profitable businesses, with easy access to markets for their poultry and poultry products. However, various constraints and disruptions in community dynamics, marketing, and product sales have led to significant losses in the poultry sector (FAO, 2020; Poudel et al., 2020; UN, 2020). These challenges necessitate a more holistic approach, encompassing both pre-existing and newly emerging difficulties. This study aimed to analyze the prevailing challenges and, in collaboration with farmers, identify feasible actions related to post-harvest handling, value addition, and resource recovery innovations to enhance the resilience of poultry farmers. The hypothesis was that various challenges were affecting poultry production, productivity, marketing, and profitability in peri-urban communities in Uganda. By adopting a comprehensive approach, the study sought to address these challenges and create alternative income opportunities while minimizing risks for poultry farmers (Tesfaye et al., 2017).

## 2. MATERIALS AND METHODS

### 2.1 Study area and scope

The study focused on identifying and analyzing constraints, and challenges, and uncovering coping strategies that integrated value addition and resource recovery innovations to increase resilience during challenging times. The study was conducted in Wakiso district, the largest urbanized district in Uganda, and hosts the highest concentration of poultry farmers. Within the Wakiso district, data were collected in five town councils, namely Kyengera, Nansana, Wakiso, Kira, and Nangabo. These were assumed to adequately represent the small-scale (80%), medium-scale (10%), and large-scale (5%) categories of

poultry farmers adversely affected by the restrictions (Figure 1).

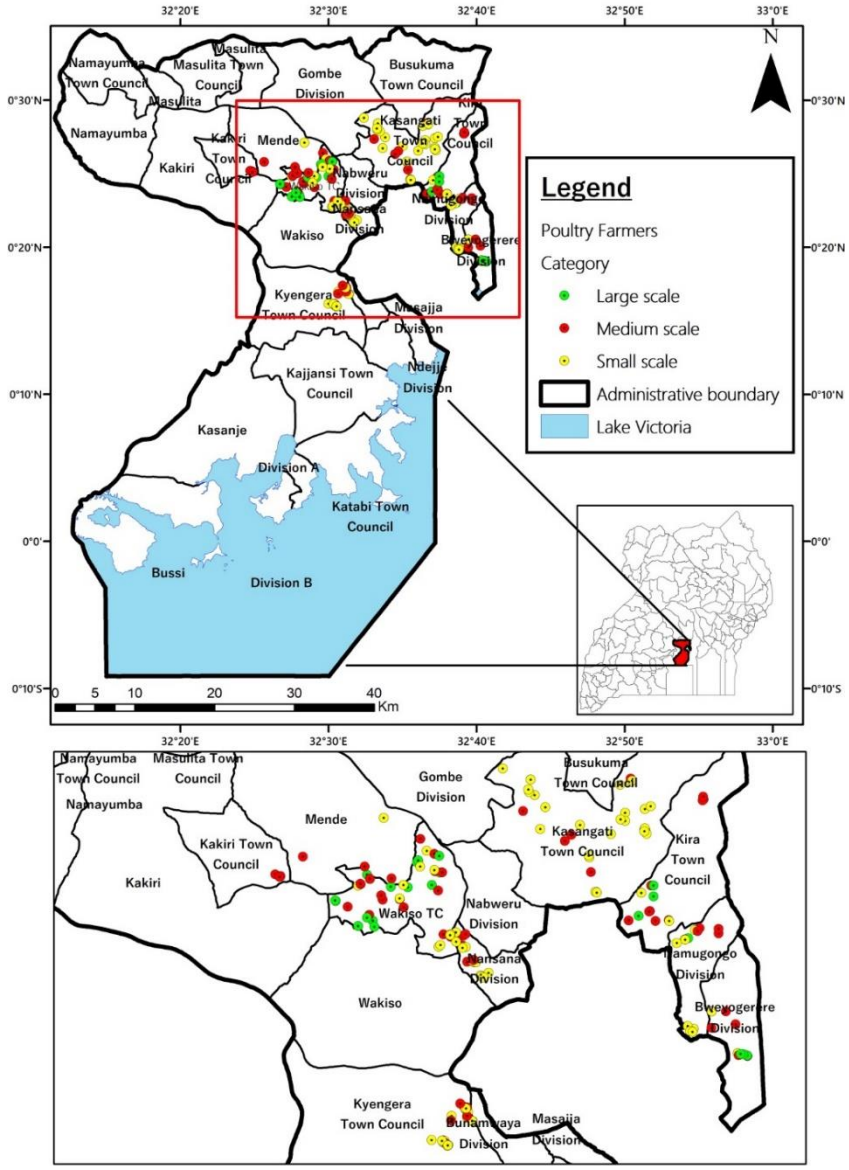


**Figure 1: Map of Wakiso district showing the poultry farming households sampled in the survey**

## 2.2 Study Approach and Sampling

The study was executed using a mixed methods approach. Specifically, the study involved a desk review of the prevailing practices, innovations, and gaps in post-harvest handling, value addition, and resource recovery within the Ugandan poultry sector and elsewhere. The aim was to benchmark the status and to draw lessons from other parts of the world. From the desk review, interventions with the potential to contribute significantly to addressing post-harvest losses were identified. The study also involved field visits, baseline surveys, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs) to identify production, marketing, and post-harvest loss-related challenges that poultry farmers were facing.

Further, the study used participatory innovation and expert knowledge generation to identify plausible actions in value addition, resource recovery, and marketing to increase farmers' resilience. Multidisciplinary approaches based on livestock husbandry, agricultural and bio-processing engineering, agricultural extension principles, indigenous technical knowledge, and local innovation were used in developing and disseminating the customized capacity-enhancing materials. The study used model farms as demonstration sites for post-harvest handling (sorting, grading, innovative feeding, quality control & value addition) and resource recovery innovations of poultry and poultry products, together with community dissemination meetings to share study findings and recommendations. All data collection activities involving more than one person at a time (as implementers or beneficiaries) were implemented following the recommended health and safety guidelines.

### 2.3 Data Analysis

One hundred eighty questionnaires (180), 10 FGDs, and 15 interviews were completed. Quantitative data were analyzed using SPSS software to obtain descriptive statistics. Qualitative data were analyzed using N-vivo and summaries of thematic content were generated.

## 3. RESULTS AND DISCUSSION

### 3.1 Production and Post-Harvest Challenges and Coping Strategies

The major production-related challenge was the high cost of feeds and other inputs which was due to disruption of the supply chains for inputs. In addition, the high demand for maize grain, the main ingredient for poultry feeds by the government in the form of relief supplies limited supplies and affected prices of poultry feeds. The majority of farmers had no coping strategies while others reduced their poultry stock while others changed feeding routines and feeds. The reason why labor was not a major challenge possibly relates to the small-scale nature of the majority of poultry enterprises (Katongole, 2020). For example, as indicated in Table 1, most of the labor on farms was provided by the family. Where labor was hired by large-scale poultry farmers, the workers stayed on the farm. Agricultural extension services were classified by the government as essential services meaning that veterinary personnel and supply shops are always open and accessible.

Katongole et al., (2012) claim that poultry farmers have started implementing various coping strategies, such as improved biosecurity measures, diversifying feed sources, and adopting cost-effective post-harvest handling practices. These strategies aim to enhance the resilience and profitability of poultry farming in the region, showcasing the determination and resourcefulness of Ugandan poultry farmers in the face of adversity. Addressing these challenges and sharing successful coping strategies is crucial for the long-term sustainability and growth of the poultry industry in Uganda (Byamugisha et al., 2008).

***Table 1*: Direct production and post-harvest related challenges and coping strategies (n = 180)**

| **Challenges** | | **Coping Strategies** | |
|---|---|---|---|
| **Challenge** | **% affected** | **Strategy** | **% applying*** |
| High cost of Poultry Feeds and Other Inputs | 82.8 | No coping strategy | 30.6 |
| | | Reduced poultry stock | 19.0 |
| | | Changed feeds or feeding | 24.5 |
| | | Other Strategies | 25.9 |
| Shortage of Casual Labour | 11.1 | No coping strategy | 57.2 |
| | | Used family labor | 33.3 |
| | | Other Strategies | 9.5 |
| Limited Access to Veterinary Services | 32.8 | No coping strategy | 50.0 |
| | | Herbs and indigenous knowledge | 16.7 |
| | | Changed service provider or incentives | 10.0 |
| | | Others | 23.3 |
| Shortage of Feed Supplies | 22.0 | No coping strategy | 22.0 |
| | | Changed feeds or feeding | 36.6 |
| | | Reduced poultry stock | 14.6 |
| | | Other Strategies | 26.8 |
| Limited Access to Transport Services | 14.0 | No coping strategy | 83.3 |
| | | Dedicated transport means | 16.7 |

**Based on those affected*

In addition to the direct challenges, there were also some indirect challenges that farmers faced with poultry production (Table 2). For example, there was a general reduction in the income invested into poultry enterprises possibly due to impairment of other income sources coupled with fears about the future of the poultry sector. In addition, there was a general reduction in incomes from poultry enterprises owing to a decline in demand and a drop in prices (Kahigi, 2020). This was a challenge to the livelihood of poultry farmers; poultry farming is the main income source for the majority of farmers sampled. Furthermore, poultry farmers barely received any production-related assistance or information to help them navigate through the challenges faced (Table 2).

***Table 2:*** **Indirect challenges for poultry production (n=180)**

| Aspect | Measure | Indicator/ aspect | % of farmers 2021 |
|---|---|---|---|
| Enterprise Sustainability | % of other income invested | > 90% | 10.0 |
| | | 71-90% | 23.3 |
| | | 51-70% | 22.8 |
| | | 30-50% | 20.6 |
| | | <30% | 16.7 |
| | | Others | 6.6 |
| Income Impairment | % of income from poultry | > 90% | 20.0 |
| | | 71-90% | 23.3 |
| | | 51-70% | 15.0 |
| | | 30-50% | 20.6 |
| | | <30% | 14.4 |
| | | Others | 6.7 |
| Inadequate support | % of farmers receiving assistance | Assistance for Poultry enterprise | Not applicable |

### 3.2 Marketing Challenges and Coping Strategies

The marketing challenges faced by poultry farmers arose from a simultaneous drop in prices and demand for poultry and poultry products, largely due to the stated challenges (Table 3). A relatively high percentage (29%) of farmers had no coping strategies for these challenges, indicating their vulnerability. The rest tried to navigate the challenges by selling at a lower price than the market could offer, while others attempted to explore new markets and marketing approaches.

***Table 3:*** **Direct marketing challenges and coping strategies (n = 180)**

| Challenges | | Coping Strategies | |
|---|---|---|---|
| **Challenge** | **% affected** | **Strategy** | **% applying*** |
| | | No coping strategy | 29.0 |
| Drop in prices of poultry and | | Reduced poultry stock | 12.3 |
| poultry products | 86.1 | Changed marketing approach | 11.0 |
| | | Sold at the prevailing price | 38.1 |
| | | Other Strategies | 9.6 |
| | | No coping strategy | 32.0 |
| | | Held stock till after lockdown | 5.9 |
| Drop in demand for poultry and | 85.0 | Changed marketing approach | 18.3 |
| poultry products | | Sold at low prices | 24.8 |
| | | Other Strategies | 19.0 |

**Based on those affected*

Additional marketing challenges including a lack of market information (Figure 2) arose from the inevitable changes in the marketing and selling options for poultry and poultry products in terms of location of sale and major customers (Figure 1).

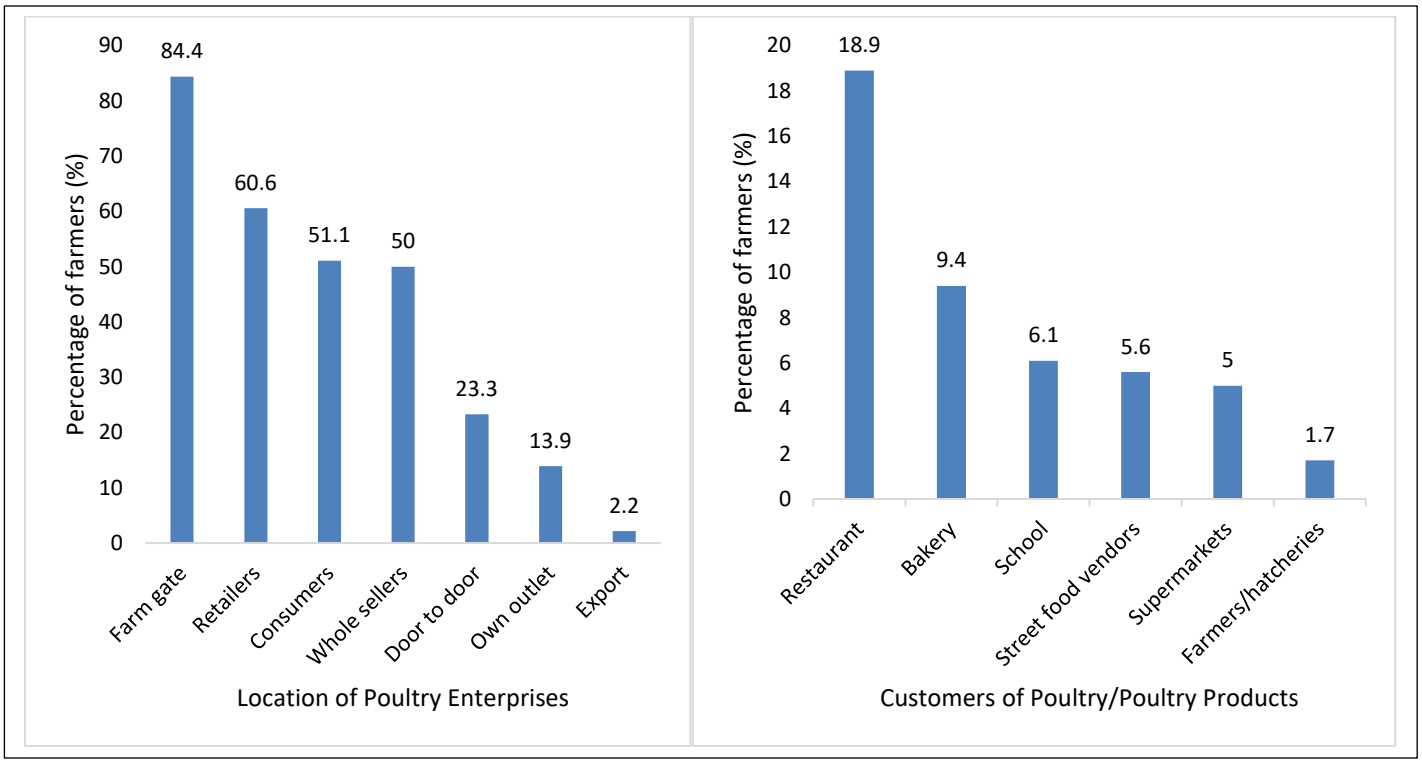


**Figure 1: Location and potential customers for poultry enterprises (n=180)**

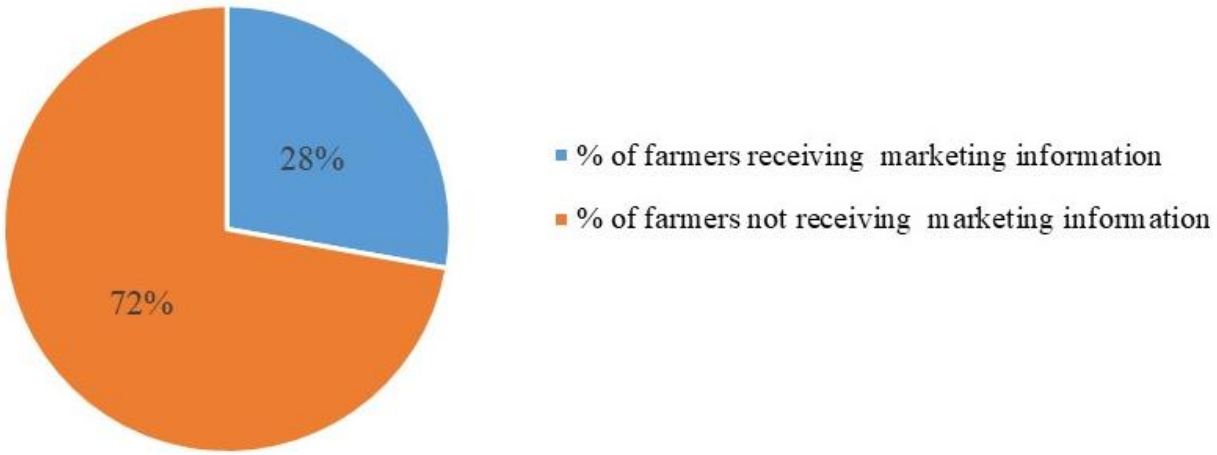


**Figure 2: Access to marketing information y poultry farmers**

Farmers who were used to selling from the farm gate had to suddenly change and find alternative locations as their traditional customers were no longer available and neighbors simply could not afford them. This

led to significant losses as the alternative selling points were limited for many poultry producers. Moreover, poultry farmers barely accessed any marketing information as they grappled with the challenges of the lockdown. This led to many farmers experiencing losses due to failure to get alternative advice to enable them to address the market challenges.

### 3.3 Emerging Opportunities

#### 3.1.1. Changing consumer behavior

It was noted that the marketing challenges including the pandemic caused more than just disruption in the market in terms of impacting supply, demand, production, or logistics but also disrupted consumer behavior preferences (Lakuma and Sunday, 2020). The lifestyle, way of eating, attitude toward spending, and purchasing behavior all changed significantly. The pandemic challenged poultry farmers to think in unique and different ways. The disruptions caused by the outbreak left deep impacts on consumer behavior and preferences. Customers exercised caution on what, when, why, where, and how they spent, and this did not spare the poultry sector. Those who had been buying chicken products from supermarkets no longer considered them essential items but instead opted for other foodstuffs to keep them surviving. This compromised not only the business but also the nutritive benefits that people would otherwise get from consuming chicken meat and eggs (Rwibasira, 2020). Therefore, poultry farmers have to plan accordingly and respond to the shift in consumer behavior if they are to cope with the changes.

#### 3.1.2 Processed Chicken

The copying strategies strengthened market opportunities for the processed chicken segment. This was in agreement with Agboola (2020) who established that the challenges created some business opportunities for some segments of the poultry sector in Nigeria. A live poultry market puts pressure on producers as fresh meat prices are impacted by supply-demand economics and unexpected market shocks, which the industry has witnessed in the past (McNamara et al., 2020). A business model that necessitates continuous rearing and a natural gestation period makes it difficult to vary supply with demand. A well-developed processed meat market will benefit both producers and consumers, as processing will increase the shelf life of meat products and will enable producers to absorb demand shocks through improved inventory control.

#### 3.1.3 Shift to Frozen Eggs

Opportunities also exist in new products developed and launched in the form of optimizing liquid white eggs and egg yolk powder among retailers. Switching from live eggs to frozen liquid eggs that last longer, easy to package could enable an uninterrupted supply of eggs that is least affected by seasonality and can support sustained supply to meet retailers' demand.

### 3.2 Value Addition and Resource Recovery Interventions and Strategies

The study revealed that few farmers were engaged in value addition interventions (Table 5) and there was a slight drop in the number of farmers. This was possibly due to low demand and prices. It has also been

observed that the approaches used for value addition did not change owing to the limited options and high cost of options such as cold storage.

**Table 5: Value addition interventions by poultry farmers**

| Aspect/Product | Value addition interventions |
|---|---|
| Farmers engaged (%) | 27.2 |
| Chicken | Slaughter and dress, pack (whole and parts), and distribute or keep in cold storage |
| Eggs | Clean, sort, grade, label, yellow yolk production, hatch & and brood |
| Chicken droppings | Compositing, drying and park for sale, biogas production, vermicomposting |
| Heads, legs, intestines | Clean and pack |

The study revealed that the following innovations have been adopted in the poultry sector as ways of adding value to the enterprise.

Farmers had adopted sorting and grading of eggs based on size, color, shape, breed, etc. which facilitated segmented marketing and price differentiation. There was also manipulation of feed and feed mixes to produce eggs with varying shell color, and yolk size and color for the different market segments. This could favor the creation of market segments (niche marketing) and avoid unnecessary competition and low prices by selling a variety of unique eggs. Several farmers have adopted the practice of packing eggs and labeling them to show husbandry and feeding practices, something that provides attraction and assurance information about the origin and perceived quality of the eggs. This will positively influence the demand for uniquely sorted and packaged poultry products to the argument by Alphonse et al. (2020) about consumer preference for novel products. In addition, some poultry farmers were slowly adapting the processing of cracked eggs into liquid eggs. The liquid eggs could then be pasteurized, canned, and frozen or be further processed and dried into powder form, which has a longer shelf life of up to four years, it is easy to handle and use since all that is needed is mixing it with water. The innovation offers advantages including smaller usage of storage space and lack of need for regular refrigeration. Bakeries in Uganda could be the target markets for liquid and powdered eggs and some are already embracing the use of powdered eggs in their trade.

### 3.2.1 Chicken Meat

The study revealed that a proportion of progressive farmers were slowly adopting value addition to chicken meat through dressing, partitioning, and preservation, which provides convenience for urban consumers who have no time and space to dispose of slaughter waste. This also gives customers a wide range of choices and an incentive for well-to-do corporate clients (Muduli et al., 2019). In addition, one can charge varied prices for the different chicken parts including gizzards, drumsticks, necks, legs, and

breasts separately packaged (Figure 3).

***Figure 3:*** **Dressed Portioned Chicken for Varied Markets**

### 3.2.2 Meat Processing

Instead of selling live birds, one can add value through the sale of processed meat in the form of minced meat, sausages, and boneless meat (Figure 4). The study revealed that boneless chicken is becoming popular among the middle class in Uganda with an extensive market, and peri-urban poultry farmers need to tap it. It was noted that the bones can be packed and sold separately because they can make great soups. Potential markets could be specialized e.g., Chinese and Korean restaurants as bone soup is popular. The Kenyan market is also rising because bone soap is popular there too. Peri-urban poultry farmers need to note that the Chinese and Korean population is on the increase in Uganda and they need to take advantage of it in a bid to ease the marketing of poultry products for increased profitability. Otherwise, awareness and market campaigns could be started to create a market based on information elsewhere.


***Figure 4:*** **Some ways of processing and packaging chicken meat appropriate for the Ugandan market (Source: Fresh cuts Uganda limited)**

Marinated minced chicken, and chicken meat sausages for barbeque parties could also appeal to city dwellers who shop in high-end supermarkets.

### 3.2.3 Chicken butchery

Kim et al., (2010) assert that this is another avenue for meeting demand and increasing the value of chicken meat. There are few but gradually increasing outlets that specialize in selling slaughtered chicken-full fresh, frozen, or in pieces just as the famous spots for roasted goat meat in the suburbs of Kampala city. Chicken butchers are becoming popular in most urbanized settings. Most importantly chicken farmers can pull meat together every day to sustain supply and maintain reliability.

### 3.3 By-products

Value can be added to chicken by-products such as feet and heads by packaging and selling them as pet food among well-to-dogs in peri-urban areas as claimed by Jayathilakan et al., (2012). In addition, extra income can be earned by cleaning, sorting, and selling dry chicken feathers as a good fiber source and can be used to make pillows and cushions. There are several dog and pet breeding centers. Kampala city and her suburbs. The pets (especially dogs) are high end and they are supposed to be fed on a high protein diet of fish and meat; hence processed offals, legs, and bones can be substituted as protein sources.

### 3.4 Potential of Resource Recovery in Poultry

Resource recovery, as defined by Komolafe and Sonaiya (2014), involves the efficient retrieval of materials like fertilizers, alternative feeds, chemicals, and energy, as well as services, from what would otherwise be discarded as waste. This process aims to optimize the economic, environmental, and social costs associated with these materials by repurposing or selling them instead of disposing of them. In the context of poultry farming, innovative resource recovery practices have been identified. These include composting fresh poultry manure to create organic fertilizer for peri-urban farmers, fortifying dried manure with lime and packaging it as high-value fertilizer, utilizing poultry manure to produce alternative protein-rich animal feeds like earthworms and maggots, and processing various poultry parts such as intestines, heads, and legs for potential markets like pet owners. Additionally, Dove & Wickler (2016) maintain that feathers are processed for textiles, pillow-fill materials, decorations, and fashion, while eggshells are utilized in feed mixtures and fertilizers as a source of essential plant nutrients such as calcium, magnesium, iron, and phosphate. Furthermore, blood harvested and dried from chicken slaughterhouses serves as valuable feed supplements for pigs and fish, demonstrating the diverse and sustainable avenues for resource recovery in the poultry industry.

### 3.5 Poultry Value Chain

The study revealed that the main marketable poultry products are meat and eggs. It was also found that the majority of poultry farmers rely on physical contact between producers and buyers as the main marketing strategy, and this was badly curtailed by the lockdown restrictions. Therefore, any efforts geared towards enhancing the profitability of the poultry enterprise should focus on the use of approaches cognizant of community dynamics and taking advantage of ICTs for connecting poultry farmers to possible markets (Msoffe et al., (2018). Based on the information gathered during the study promising distribution channels for eggs and meat were developed. The emerging channels are based on recommendations for alternative marketing and plausible value-addition innovations that farmers need to tap into.

### 3.6 Chicken meat distribution channels

Figure 5 comprises both existing and emerging distribution channels for chicken meat which poultry farmers need to tap into if they are to remain competitive in the new normal. The existing distribution channels include hotels, education institutions, market outlets, events catering services, and roadside vendors. However new promising marketing strategies and outlets have been brought such as e-marketing

using internet-based platforms, door-to-door vending/hawking, increased prominence of chicken butchers, shift to chicken processing, and market outlets focusing on resources from chicken and chicken would-be waste.

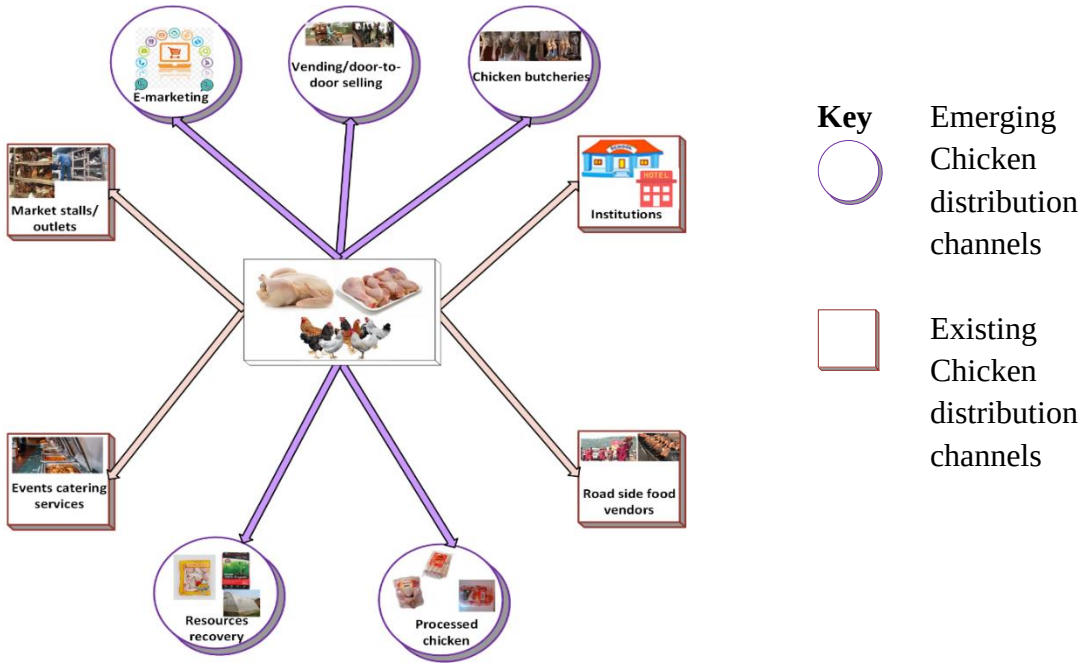


**Figure 5: Chicken meat distribution channels**

### 3.7 Egg distribution channels

Figure 6 comprises existing, emerging, and impending distribution channels for eggs which poultry farmers need to take advantage of to remain competitive and enhance the profitability of poultry farming in peri-urban areas. The existing distribution outlets for eggs include retailers, wholesalers, confectionaries, institutions e.g., hotels, schools, etc., roadside food vendors, and poultry feed suppliers. The new coping strategies brought about new marketing strategies and outlets such as e-marketing using internet-based platforms, door-to-door vending/hawking, and new market outlets. There are also impending egg distribution channels in the form of processors and exporters who present a big market for eggs shortly. The processors will help egg producers solve the problem of losses attributed to the short shelf life of their eggs during times of peak harvest or uncertain times.

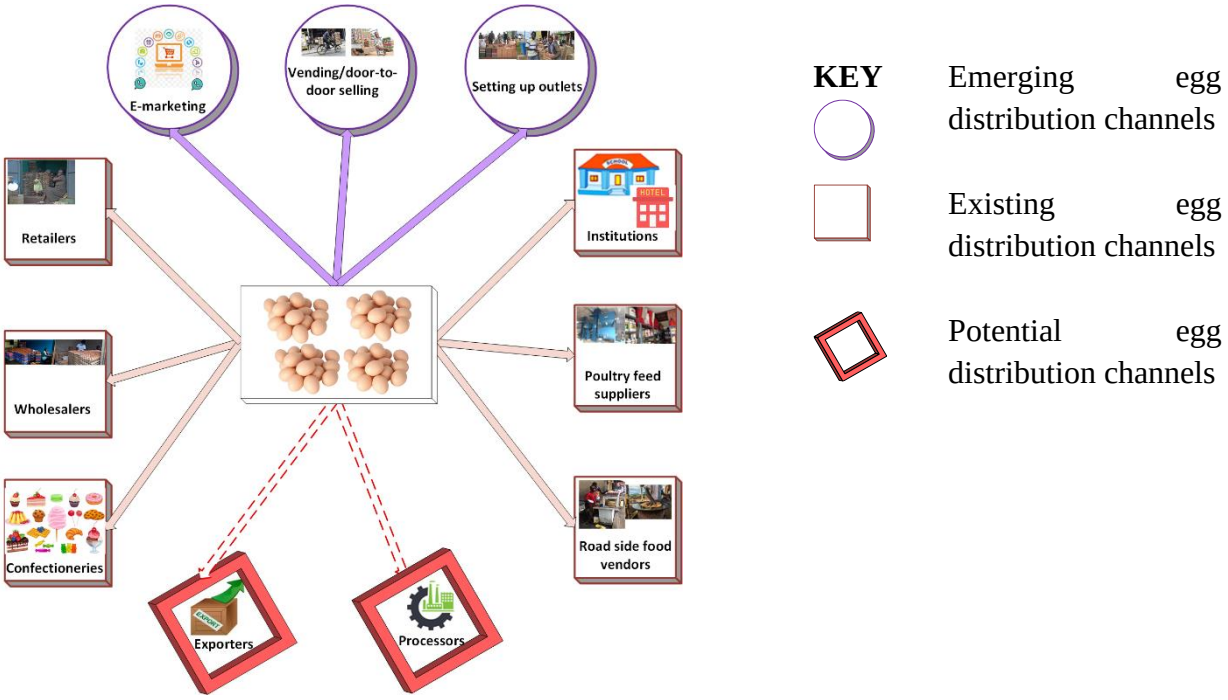


**Figure 6: Egg distribution channels Conclusions**

## CONCLUSIONS

In conclusion, the research has unveiled essential insights into the challenges and opportunities within the peri-urban poultry sector. The study's foremost finding highlights the substantial capacity and knowledge gaps prevailing among smallholder poultry farmers. These gaps impede their ability to maximize productivity and profitability. However, a significant opportunity lies in the diversification of poultry products through value addition, including the production of processed items like liquid eggs, minced chicken meat, and egg powder. The adoption of modern virtual marketing strategies, such as WhatsApp and Facebook, can greatly enhance market reach. Additionally, turning poultry waste into valuable resources can lead to novel economic prospects while promoting sustainability. The study's findings underscore the need for tailored training and capacity-building programs, value-addition workshops, digital literacy, and efficient waste management. Collaboration between government agencies and NGOs, research and extension services, and continuous adaptation to new technologies can all significantly contribute to the sector's growth and smallholder farmers' prosperity.

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**Declaration of Conflict of Interest**

The authors state that there is no conflict of interest.

**Author Contributions**

All authors contributed to the study's conception and design. Material preparation, data collection, and analysis were performed by [Ahamada Zziwa], [Robert Kambugu], [Simon Savio Kizito] and [Rebecca Mukebezi]. The first draft of the manuscript was written by David Matsape and Ahamada Zziwa and all authors commented on previous versions. All authors read and approved the final manuscript.

**REFERENCES**

Adeniyi R.T., Adetunji T.A., Olumoyegun B.A., Fanifosi G.E., and Odozi J.C. (2021). Poultry Farmers Adaptation Strategies to Consequences of COVID-19 Pandemic in Oyo State, Nigeria. Journal of Agricultural Extension. DOI: 10.4314/jae.v26i1.3S

Agboola J. (2020). A loss or gain for Nigeria's poultry sector? Accessed from https://medium.com/enabling-sustainability/covid-19-impact-on-the-nigeria-poultry-sector-a-loss-or-gain-for-entrepreneurs-ceef3c3125b0 on 11/06/2021

Alphonse, R., Waized, B.M. and Larsen, M.N. (2020). "Consumer preference for novelty in processed foods: a developing country perspective", Journal of Agribusiness in Developing and Emerging Economies, Vol. 10 No. 4, pp. 429-446

Byamugisha, H. M., Ikoja-Odongo, R., Nasinyama, G. W., & Lwasa, S. (2008). Information Seeking and Use Among Urban Farmers in Kampala District, Uganda. *Agricultural information worldwide*, *1*(3).

Dove, C. J., & Wickler, S. (2016). Identification of bird species used to make a Viking Age feather pillow. Arctic, 29-36.

FAO (2020). Mitigating the impacts of COVID-19 on the livestock sector. Rome, doi.:10.4060/ca8799en

Genoni, M. E., Khan, A. I., Krishnan, N., Palaniswamy, N., and Raza, W. (2020). Losing Livelihoods: The Labor Market Impacts of COVID-19 in Bangladesh. Washington, DC: World Bank. doi: 10.1596/34449

Good, K. (2020). Meat Processing, Meat Shortages a Growing Concern; Livestock Producers Face Tough Choices. Available online at: https://farmpolicynews.illinois.edu/2020/04/as-covid19-slows-meat-processing-livestock-producers-may-face-tough-choices/ (accessed March 03, 2022).

Jayathilakan, K., Sultana, K., Radhakrishna, K., & Bawa, A. S. (2012). Utilization of byproducts and waste materials from meat, poultry and fish processing industries: a review. Journal of food science and technology, 49, 278-293.

Kahigi M. K. (2020). Poultry farmers count losses as COVID-19 pushes down demand. Accessed from http://rwandatoday.africa/news/Poultry-farmers-count-losses-/4383214-5573294-yod4hsz/index.html on 11/06/2020

Katongole, C. B., Nambi-Kasozi, J., Lumu, R., Bareeba, F., Presto, M., Ivarsson, E., & Lindberg, J. E. (2012). Strategies for coping with feed scarcity among urban and peri-urban livestock farmers in Kampala, Uganda. *Journal of Agriculture and Rural Development in the Tropics and Subtropics (JARTS)*, *113*(2), 165-174.

Katongole G. (2020 How a poultry farmer can stay afloat. https://www.monitor.co.ug/Magazines/Farming/Covid19-poultry-farmer-afloat-Kenya-Uganda-market/689860-5554478-11y3fksz/index.html on 11/06/2020

Komolafe A. A. and Sonaiya, E. B. (2014). Simple processing method for recycling poultry waste into animal feed ingredients. International Journal of Applied Agricultural and Apicultural Research, 10 (1&2): 21 – 32.

Lakuma P. C. and Sunday N. (2020). Impact of COVID-19 on micro, small, and medium businesses in Uganda. Accessed from https://www.brookings.edu/blog/africa-in-focus/2020/05/19/impact-of-covid-19-on-micro-small-and-medium-businesses-in-uganda/ on 11/06/2020

McNamara, J., Robinson, E. J., Abernethy, K., Midoko Iponga, D., Sackey, H. N., Wright, J. H., & Milner-Gulland, E. J. (2020). , systemic crisis, and possible implications for the wild meat trade in Sub-Saharan Africa. Environmental and Resource Economics, 76, 1045-1066.

Muduli S., Champati A., Popalghat H. K., Patel P., and Sneha K. (2019). Poultry waste management: An approach for sustainable development. International Journal of Advanced Scientific Research, 4 (1): 8 – 14.

Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and Uganda Bureau of Statistics (UBOS). 2018. Statistical Abstract 2018. Kampala. Uganda.

Msoffe, G., Chengula, A., Kipanyula, M. J., Mlozi, M. R., & Sanga, C. A. (2018). Poultry Farmers' Information needs and Extension advices in Kilosa, Tanzania: Evidence from Mobile-based Extension, Advisory, and Learning System (MEALS). Library Philosophy & Practice.

Mutegeki G. (2020). Farmers count losses. Accessed from https://www.newvision.co.ug/news/1517754/covid-19-lockdown-farmers-count-losses on 11/06/2020.

Nakkazi, C, Kayitesi, A, Mulindwa, H E, Kugonza, D. R, and Okot, M. W. (2014). The status of local chicken (Gallus domesticus) production in Northern Uganda. Livestock Research for Rural Development 26 (11) 2014.

Osagie, A., Shobo, B., Ayodeji, A., and Abasilim, C. (2020). Profitability Analysis and Factors Influencing Profit Level of Small-Scale Broiler Farmers in Nigeria. Asian Journal of Agricultural Extension Economics & Sociology. 38. 127-135. 10.9734/AJAEES/2020/v38i930415.

Poudel P. B., Poudel M. R., Gautam A., Phuyal S., Tiwari C. K., Bashyal N., and Bashyal S. (2020). COVID-19 and its Global Impact on Food and Agriculture. Journal of Biology and Today's World, 9(5): 221.

Rosen, L. (2020). Field Notes: Bangladesh in Times of COVID-19 and Food Security Implications. Available online at: https://fish.cgiar.org/news-and-updates/news/field-notes-bangladesh-times-covid-19-and-food-security-implications (accessed February 16, 2022).

Rwibasira E., (2020). Effects of COVID-19 on farming in Rwanda: the fate of poultry farming. The New Times, published May 20, 2020.

Schilling M. (2020). Poultry farming realities during COVID-19 rapid changes lead to a volatile market. Accessed from https://www.agriculture.com/livestock/poultry/poultry-farming-realities-during-covid-19 on 11/06/2020

Tainika, B., Şekeroğlu A., Duman, M., Şentürk, E. Y. (2019). Poultry Production in Uganda: Challenges and Opportunities. International Congress of the Turkish Journal of Agriculture - Food Science and Technology (International Congress of TURJAF) at Antalya, Turkey.

Tesfaye T., Sithole B., and Ramjugernath D. (2017). Valorization of chicken feathers: Recycling and recovery routes. Proceedings Sardinia 2017 / Sixteenth International Waste Management and Landfill Symposium/ 2 - 6 October 2017, S. Margherita di Pula, Cagliari, Italy.

UBOS. (2018). Statistical Abstract 2018. Kampala. Uganda.

United Nations in Uganda (2020). Analyses of the socioeconomic impact of COVID-19 in Uganda. Economic Policy Research Centre (2020). Agricultural enterprises hardest hit by COVID-19 - EPRC report.

Viljoen, W. (2017). The South African poultry sector - trade, consumption, production, and inputs. TRALAC Trade Law Centre.

Weersink A., von Massow M., and McDougall B. (2020). Economic thoughts on the potential implications of COVID-19 on the Canadian dairy and poultry sectors. Doi:10.1111.cjag.12240

Wellspring. (2014). The Kuroiler Chicken in Uganda - Performance and market potential in the backyard poultry sector. Nairobi.

World Bank. (2018). Mozambique: Smallholder Inclusion in Agri-Food Value Chains; Insights from the Maize, Poultry, and Sesame Subsectors. Washington DC: World Bank Group.