New Technology and Approaches in Poultry and Pig Production

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Publication Date: 2025/04/19

Abstract: An approach and adoption to new technology in poultry and pig production was desired to study and associate important factors in particularly in non-ruminant livestock farming globally, threats and opportunities, and a comparison of the pig and poultry farming in Nepal and other developed countries including China with regard to the use of modern skills, tools and technology. A qualitative study was done with an evaluation in previous research conducted in the area of science and technology usage in pig and poultry farming from research papers, journals, national and international annual reports and pig and poultry websites that were studied using the internet as valuable tools in finding the disproportion between developed and developing nations. The findings of the study suggested that the farmers of Nepal practiced traditional farming methods and simple and old technology. However, extension in the use of modern and advanced technology in poultry rearing is found to be more in comparison to pig farming. Nepal should have appropriate plans and policies for promoting the application of technology in both fields. The result of the study showed that use of technology in pig and poultry farming have positive impacts globally by employment opportunities, nutrient supply, business and productivity. Developing countries like Nepal would need sustainable and modern technology to increase meat and egg production, which could be implemented to optimize livestock farming.

Keywords: Adoption, Approach, Disproportion, Extension, Pig production, Poultry production.

How to Cite: Mandeep Pokharel Ajit Sharma (2025) New Technology and Approaches in Poultry and Pig Production *International Journal of Innovative Science and Research Technology*, 10(4), 533-539. https://doi.org/10.38124/ijisrt/25apr054

I. INTRODUCTION

Technology affects almost everything we do today, our future plans, as we are living in 21st century (Diggory, 2018). Technology, livestock and humans are co-related to each other. There is great revolution from a tradition of hunting of animals and gathering foods to farming, production and use of tools by our early ancestors who evolved in Paleolithic period of stone era recent technology practiced in field of livestock (Kennedy, 2019). Technology in poultry and pig farming is defined as use of advanced methods, modern tools, equipment and simulators for domesticating birds and pigs and maximizing potentials for their production, and easy collection of compost. Due to ready market and easy to maintain, Chickens are globally preferred (Rahman, Jang, & Yu, 2017).

In developed nations, particularly for mitigating disease, transportation, and storage risks, government involvement and advancements in technology often acts as a booster. On the other hand, in developing countries, private enterprises are involved with the use of ancient and traditional methods of production, transportation, and storage. The condition often leads to an outbreak of diseases, transportation problems and economical loss(Rakha et al., 2022). There is drastically increasement in the population of Livestock in China, after allowing the breeding of animals in their backyards especially after the economic reform program was launched. The economic reform program was launched in 1979 in China which favors the development of livestock production (P.J., 2009).

Table 1 Shares of Non-Ruminants Production in China					
Animal Species	Regions	Shares in total animal output (%)			
	_	Household scale	Medium scale	Large scale	
Pigs	Average in China	51	27	22	
Boilers	Average in China	20	58	22	
Layers	Average in China	28	24	48	

Data Source: Statistical Yearbook of Chinese Livestock Production.

According to Ministry of Agriculture and Livestock Development, Nepal has estimated 1357507 heads of pigs in 2022/2023 which were 1504628 in 2021/2022 and 1588838 in 2020/2021. Mostly Pigs are reared in Eastern Part of the Country. Indigenous and exotic breeds of pigs are especially found in Terai and Hilly areas of Eastern Nepal. The environmental and geographical condition supports pig farming(Deka et al., 2014). The national population of poultry has gradually decreased from 66803117 in 2021/22 to 65205250 in 2022/23.Rank of Nepal in chicken and egg production is 112th and 92nd position respectively in the world. Nepal has invested NRs 33.72 billion in poultry business(Yadav et al., 2021).

As per the report of Food and Agriculture Organization (FAO), especially in developed and developing countries, livestock production accounts for 20-24% of the agricultural gross domestic product (AGDP). Livestock and poultry sectors are believed have significant contribution in the nutrition and food security by providing their products; they provide bone meal and blood meal for feed industries; and, also, provide organic manure and transportation support for crop production(Khanal et al., 2022). Cattle and Buffaloes are generally preferred for milk and meat but Pigs and Poultry are preferred for meat consumption. The meat derived from cattle, pig and poultry are known as beef, pork and poultry respectively. The consumption of meat is in increasing trends globally(Henchion et al., 2021).



Fig 1 Distribution of Pig According to Geographical Region

Note: Total percentage of pigs in Mountain, Hilly and Terai regions of Nepal

▶ Poultry and Pig Business: Present Condition, **Opportunities and Constraints**

However, only the 2% people in Nepal are vegetarian, the meat consumption is related to social, cultural, religious, and economic factor. Consumption of meat is high in August-September due to religious and cultural festivals (Shipman & Durmus, 2017).

There is direct involvement of producers, veterinarian doctors and meat processor for the quality, hygienic and food security and safety. In Nepal, several meat preservation and processing methods, ideas and skills which are practiced from traditional period and still in practice at present too. These methods play an indispensable role in order to meet the demand of increasing populations with hygiene meat at reasonable prices(Bhandari et al., 2022).

Table 2 Applied Technology of Fork and Found y with Their Main Effects on Froduction				
Method	Basic technologies	Main effects		
Lowering the moisture content	Drying, Evaporation or use of various	Microbial growth control (Based on the		
(reduction of moisture activity)	food additives for replacement of water	type of microorganism)		
Increasing the acidity	Addition of organic acids or	Lactic acid fermentation or		
	Fermentation of Lactic acid	addition of organic acids		
Preservative effects of treatment	Smoking, salting or curing,	Inhibition or cessation of growth of		
or meat additives	suitable preservative	spoilage and food		
		poisoning microorganisms		
Thermal treatment	Roasting, cooking, boiling	Significant reduction of most		
		microorganisms		
Heat treatment in containers that	Pasteurization, sterilization	Heat-induced decrease in microbial		
are hermetically sealed (glass jars,		populations and enzyme activity without		
cans, and synthetic containers)		recontamination		

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Table 3 Meat	Processing	Methods	in Nepal

Methods	Products	
Dressing of carcasses at the level of slaughterhouse	Whole carcasses that have been dressed, carcass quarters or	
	sides, and edible animal byproducts (internal organs)	
Cutting of meat or carcass Meat	Cuts for frying, cooking, roasting, and other uses; meat for	
	additional processing, both in bulk and in retail	
Meat cuts are salted and cured, either with or without	Raw gammon, bacon, cooked cured meat, cooked gammon and	
heat treatment	other cured goods like dried cured goods	
Coarse comminuting of raw meat	Hamburger-type products	
Raw meat that has been coarsely or finely ground and	Salami-style fermented sausages and fermented Asian goods	
then fermented		
Raw meat that has been finely ground and then heated	Emulsion-type sausages e.g. frankfurter, wiener sausages,	
	Hotdog sausage, meat balls, emulsion type pies	
Drying of unsalted pieces of meat	Dried meat for making meat dishes	
Finely grinding internal organs, blood, and other	Meat pies, loaf, liver pate, liver sausage, liver paste and blood	
ingredients into precooked meat	sat or sage	

Figure 2, Figure 3 and Figure 4 show the existing egg and meat marketing system in Nepal. The egg and meat is distributed with various intermediates whereby the products are not sold to processing units directly, traders are involved who buy from producers and sell to wholesalers and processing plants (Mamum, 2019). The consumers should buy in the high rate due to the involvement of long chain from producers to consumers. The producers are involved to sell their production at very low prices and the consumers have to buy meat and eggs at high prices Van Loo et al., (2020).



Fig 2 Structure of Pork Marketing System in Nepal

Note: Major Marketing Channels of Pig and Pork (Shakya).



Fig 3 Existing Broiler Marketing System in Nepal

Note: Status of boilers marketing in developing countries including Nepal (M, Rahman, Ahmed, & Hassim, 2017)



Fig 4 Existing Egg Marketing System in Nepal

Note: Status of layers marketing system in developing countries like Nepal (M, Rahman, Ahmed, & Hassim, 2017)

> Technology in Poultry and Pig Farming

The general aim of the theoretical framework is to clarify how technology has been used in pig and poultry farming to help firms in Nepal and elsewhere in the world achieve their goals. There are a number of intermediaries in egg and meat distribution; the producers do not market directly to the processing plants and wholesalers but sell to traders who, in turn, supply such wholesalers and processing plants (M, Rahman, Ahmed, & Hassim, 2017).

A study of the history of the technology's application will present the context within which the decisions to apply it in pig and poultry production will be taken, and what to take and what to leave out in the selective borrowing process. It will contribute to a better understanding, through evidence, of the relevance that exists behind Nepal if it adopts technology utilization in pig and poultry farming.

> Technology Usage in Poultry and Pig Farming in Nepal

Swine breeding system development is one of the fundamental pillars of swine breed and seed development. Socio-economic conditions are favorable at present for promoting large scale pig production. As a result, many large-scale private breeder farms are emerging. The pig farmers are dedicated to producing pure breeds of pigs, which can be used for crossbred or hybrid pigs as sire or dam line sources. However, the farmers lack the ability to produce pure bred seed stock of different breeds of pigs. Maybe in future pig breeding system development strategy such private sector pig breeders should be included for sustainability. (Shrestha N. P., 2014).

The application of artificial insemination in swine breeding programs remains a key priority to producers seeking to enhance reproductive and breeding efficiency. The program ought to be initiated right away, initially through the utilization of liquid semen, followed by the utilization of frozen semen where commercialization of piggery is more pronounced. The artificial insemination is centered on the breeding resource farms, which distribute the breeding boars of high breeding value, can manage the pedigree and performance recording system and progeny testing scheme (Nirmal, Gurung, & Singh, 2014). At present it is the government sector attempting to practice the artificial insemination practices in pigs. To implement the technology for sustainable development pig and pork industry using artificial insemination are required to be worked out soon. It is suggested that probably large scale private-public organization might need to take the responsibility of high-quality semen production for increasing pig and pork industry establishment in the country.

Poultry Farming in Nepal is advanced in comparison to other Livestock. Intensive research on various diseases and use of antibiotics, use of breeders, housing technology, brooders, and internal environment control system are responsible for improvements in farming in large scale. Use of Renewable energy to assist in heating by solar panels is cheap and environmentally friendly (Rahman, Jang, & Yu, 2017).

Introduction of brooders and technology of controlled heating helps in providing uniformity in temperature maintenance in birds. Most of the advanced hatcheries in Nepal practice modern technology in brooding having mechanism of turning eggs on ninety-degree angle and invitro vaccination. Use of LED bulbs to regulate and maintain temperature and light evenly lowers expense and improves welfare of birds as they allow free mobility of the birds(Elkanawaty et al., 2023). The housing of poultry is highly managed with bio security and safety measures which help in holding twice the number of birds raised previously. The use of environmental controllers which not only used for managing and monitoring large farms irrespective of geographical distribution but also used to analyze the current and future climate changes for preparing farming calendar (N, Averos, & Estevez, 2016).

Recently research has been conducted for the alternative source of protein in poultry farming, which is not fully successful. Poultry manure is used in agriculture(Khanal et al., 2022). The local birds are commercialized in Nepal. Also, Nepal has started interbreeding genetically modified birds with local birds for producing hybrid poultry which grow faster and disease resistant. The technologies include genetic improvement, use of AI, improved breeding, vaccine production and distribution advanced hatching and disease control using environmental controller systems(Wahyuni et al., 2024). However, further more research is necessary for better improvement in pig and poultry farming.

Emerging Trends in Poultry and Pig Farming

New technological advancements have been absorbed in pig and poultry farming globally. However, high initial expenditure, complications of technology, required of skilled manpower and low budgets are major problems for adoption of technology in developing countries. Along However, technology helps in present and future security from scarcity of food and nutrition by improvements in income generation from farming through increase in productivity.

II. ARTIFICIAL INTELLIGENCE (AI)

In pigs, AI is used for facial recognition of pigs, monitor movement, feed and water intake, identification of pigs and suggestion for feeding program. Often used with Roberts, sensors and machine vision for collection of data (Houghton, 2018).

AI is the carrying out of works by Roberts following computer sensor signals. It can recognize the internal structure of hen especially bone and meat if perfect pieces are made by cutting (L, et al., 2016).

> Roberts

In pigs, Roberts are used for improving conditions, environmental and social concern for reducing odor, emission, sanitation and animal welfare. In addition, Roberts are used for meat processing and packing. Along with this, in poultry 'nanny roberts' very popular in poultry farming to make the farmers alert on potential outbreak of diseases and transmission of infection to other birds (L, et al., 2016).

> Sensors

Sensors alert farmers by concerning in illness, heat cycles, food and water intake, record housing ammonia levels, dust, temperature, humidity and anything that is critical to productivity. In Greengage, it is reported that growth of birds by proper and efficient use of sensors (N, Averos, & Estevez, 2016).

> 3D printing

3D printing opens up possibility for farmers to print pieces or parts of equipment or machinery that save time wasted during delivery and repair. It finds application in the marketing of animal products, very useful in rural and hilly terrain(Doroshenko et al., 2021).

> Drones

Drones are highly used in agriculture field and free range poultry farming, less occasion for use in pork industry presently. However, it causes tension to chicken in closed housing (L, et al., 2016).

Virtual Reality (Vr)

Several big companies and organization of pig and poultry industry use VR for virtual tours to their consumers. It can also be used in education and training in rural areas in field of veterinary medicine and livestock production(Baltzer et al., 2025).

➢ Block Chain

Block chain is online documentation systems by holding records of transactions confidently. It is used for better traceability, increased food safety and improved payment systems(Kamath, 2018). It can be used in field of pork and poultry products for lowering cost of production and business growth.

➢ Internet of Things (IOT)

All above mentioned technologies are connected with internet. It is used for data transmission, collection of information and alert of malfunctions(Mahadewi et al., 2023). IOT connects all the individual poultry and pig sensors in a farm to one computer.

III. DISCUSSION

The profitability of poultry and pig farming in satisfying the world needs of a self-sustaining business to a great extent depends upon the implementation of technological advancements. Agricultural companies involving technology in poultry farming have exhibited tremendous enhancement regarding profitability and efficiency of farm operations. Poultry and pig farming in China is highly mechanized, whereas in Nepal, traditional forms of poultry farming are still in place, which is also the most practiced form in the nation. Because of this, technological introduction has enabled mass production in the poultry sector of developed nations. The success realized with large-scale poultry farming is due to the inclusion of machinery, poultry-dedicated educational websites, as well as online marketing skills, all of which simplify operational activities and the delivery of current information. Moreover, technology application in marketing has highly improved access to foreign markets, hence providing a ready outlet for selling products. Access to such market outlets has motivated more farmers to engage in large-scale animal production.

The major drawback for the use of technology in Nepal is closely associated with culture and religion of the citizen. As most of the people are Hindus, there is some restrictions about pork meat. Islamic religion believes the use of robots as evil and ungodly. The drawbacks have been exceeded by the reflection on the acceptability of technology usage in farming. The majority of women who work in pig and poultry farming seem to be adaptable. Women in rural, uneducated families are less likely than men to strongly associate religion with the use of technology in farming. Rather, once technology is available to them, they appear to embrace it. They are therefore likely to adopt their usage if given the chance. Furthermore, the positive feedback from poultryraising entrepreneurs regarding the use of technologies like robots, which would encourage more men to engage in the activity, indicates that the country's adoption of technology would boost the number of people working in the poultry industry and, consequently, increase output.

Some of the technologies used in developed nations also worked well in Nepal's technological and economic environment. For example, a large portion of the population in the nation has access to smartphones, and internet connectivity and its use will make it possible for farmers to use technology and access information from technology research organizations like NARC. Encouraging more people to take part in raising poultry demonstrates how the nation's adoption of technology would boost the number of workers in the poultry industry and, consequently, increase output.

IV. CONCLUSION

With the use of contemporary technology, Nepal has the potential to expand its pig and poultry farms. A significant portion of the population in Nepal engages in small- and medium-sized farming. On a worldwide internet platform, Nepal can access educational websites and online tutorials that offer educational information on livestock farming, especially the farming of pigs and poultry. The internet availability should be made possible in remote and hilly areas. In developed countries, use of Roberts and sensors like technology are easily practiced but we are using simple technologies in farming. The pig and poultry farming are mostly conducted at rural and hilly. Mostly children, women and elderly people are involved in farm management while the men are in foreign employment or involved in selling of meat and byproducts.

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