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**Mind the gap: An assessment of scope for collaboration between public and private veterinary services for effective disease management in Bangladesh’s poultry sector**

**Meherjan Islam**

**Roll no: 0121/01**

**Registration no: 964**

**Session: 2021-22**

**A thesis submitted to the Department of Medicine and Surgery in partial fulfillment of the requirements for the degree of Master of Science in Epidemiology**

**Department of Medicine and Surgery**

**Faculty of Veterinary Medicine**

**Chattogram Veterinary and Animal Sciences University**

**Chattogram-4225, Bangladesh**

**September 2023**

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**Meherjan Islam**

**September 2023**

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**This is to certify that we have examined the above Master’s thesis and have found that is complete and satisfactory in all aspects, and that all revisions required by the thesis examination have been made**

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# Table of contents

Title page

[**Authorization** ii](#_Toc149685649)

[**Acknowledgements** iv](#_Toc149685650)

[**Table of contents** vi](#_Toc149685651)

[**Figure** ix](#_Toc149685652)

[**List of abbreviations and elaborations** x](#_Toc149685653)

[**Summary** xiii](#_Toc149685654)

[**Chapter 1: Introduction** 1](#_Toc149685655)

[**Chapter 2: Literature review** 4](#_Toc149685656)

[2.1. The poultry sector as an economic linchpin in Bangladesh 4](#_Toc149685657)

[2.2. The prominence of backyard chicken rearing 5](#_Toc149685658)

[2.3. The growth of commercial poultry farming in Bangladesh 7](#_Toc149685659)

[2.4. Vertically integrated contract farming system in Bangladesh 11](#_Toc149685660)

[2.5. Development of the veterinary profession in Bangladesh 14](#_Toc149685661)

[2.5.1. Public and private employment sectors for veterinarians available in Bangladesh 17](#_Toc149685662)

[2.5.2. Public-private partnership in the veterinary sector 19](#_Toc149685663)

[2.5.3. Public-private partnership in the poultry sector in Bangladesh 22](#_Toc149685664)

[**Chapter 3: Materials and methods** 24](#_Toc149685665)

[3.1. Semi-structured interviews 24](#_Toc149685666)

[3.2. Participant selection and recruitment 24](#_Toc149685667)

[3.3. Data analysis 26](#_Toc149685668)

[3.4. Ethical considerations 27](#_Toc149685669)

[**Chapter 4: Results** 28](#_Toc149685670)

[4.1. Affiliations and key differences between veterinarians 28](#_Toc149685671)

[4.1.1. Outdoor vs. indoor service 30](#_Toc149685672)

[4.1.2. Regular service vs. emergency service 31](#_Toc149685673)

[4.1.3. Phone call service vs. on-spot service 32](#_Toc149685674)

[4.1.4. Providing treatment through dealer vs. directly to farmers 33](#_Toc149685675)

[4.1.5. Free veterinary service vs. paid veterinary service 33](#_Toc149685676)

[4.1.6. Treatment vs. laboratory service 34](#_Toc149685677)

[4.1.7. Performing postmortem vs. not performing 35](#_Toc149685678)

[4.1.8. Differences in farm data record system 36](#_Toc149685679)

[4.1.9. Differences in prescription 36](#_Toc149685680)

[4.1.10. Suggesting about biosecurity measures 38](#_Toc149685681)

[4.1.11. Suggestions about vaccinations 39](#_Toc149685682)

[4.1.12. Differences in actions during disease outbreaks 40](#_Toc149685683)

[4.1.13. Differences in ethical practice 43](#_Toc149685684)

[4.1.14. Differences in training provision for farmers and non-veterinarians 43](#_Toc149685685)

[4.1.15. Veterinary engagement with antimicrobial resistance 47](#_Toc149685686)

[4.2. The role of non-veterinarians in veterinary provision 49](#_Toc149685687)

[4.2.1. The involvement of dealers in veterinary provision 50](#_Toc149685688)

[4.2.2. Sales representatives influence in veterinary provision 51](#_Toc149685689)

[4.2.3. Influences of other non-veterinarians 52](#_Toc149685690)

[4.3. Opportunities and challenges for public and private sector collaboration 54](#_Toc149685691)

[4.3.1. Increasing veterinary provision for poultry farmers through collaboration 54](#_Toc149685692)

[4.3.2. Sharing data between public and private sector veterinarians 58](#_Toc149685693)

[4.3.3. Comprehensive disease surveillance using collaboration 59](#_Toc149685694)

[4.3.4. Modification in vaccine and medicine supply: require for national prescription guideline 60](#_Toc149685695)

[4.3.5. Training for farmers and non-veterinary service providers 62](#_Toc149685696)

[4.3.6. Extending laboratory facilities through collaboration 64](#_Toc149685697)

[**Chapter 5: Discussion** 66](#_Toc149685698)

[5.1. Different employers responsible for variation in veterinary provision in poultry sector 66](#_Toc149685699)

[5.2. Non-veterinarians’ involvement in veterinary provision except for veterinarians 86](#_Toc149685700)

[5.3. The potential for collaboration to improve veterinary services in Bangladesh’s poultry sector 90](#_Toc149685701)

[**Chapter 6: Conclusion, recommendations, limitations of the study and future direction** 104](#_Toc149685702)

[6.1. Conclusion 104](#_Toc149685703)

[6.2. Recommendations 105](#_Toc149685704)

[6.3. Limitations of the study 105](#_Toc149685705)

[6.4. Future direction 106](#_Toc149685706)

[**References** 107](#_Toc149685707)

[**Appendices** 125](#_Toc149685708)

[**Appendix-Ⅰ: Semi-structured interview guideline for veterinarians** 125](#_Toc149685709)

[**Appendix-Ⅱ: Distribution of the veterinarians (N=62) in the study based on the particular employers from June 2021 to July 2023** 126](#_Toc149685710)

[**Appendix-Ⅲ: Demography of the participated veterinarians (N=62) in the study from June 2021 to July 2023** 126](#_Toc149685711)

[**Appendix-Ⅳ: Different organogram was obtained from the participants of the study working in different companies from June 2021 to July 2023** 130](#_Toc149685712)

[**Appendix-Ⅴ: Different laboratory activities according to the participants of the study from different feed and day-old chicks producing company laboratories from June 2021 to July 2023** 132](#_Toc149685713)

[**Appendix-Ⅵ: Involvement of different feed and day-old chicks producing companies in data collection and utilisation process obtained from the participants of the study from June 2021 to July 2023** 137](#_Toc149685714)

[**Appendix-Ⅶ: Trainings organised by different institutes for the farmers according to the participants of the study from June 2021 to July 2023** 140](#_Toc149685715)

[**Brief Biography** 146](#_Toc149685716)

# Figure

[**Figure 1:** A map showing the distribution of the veterinarians (public and private) across the Bangladesh participated in the study from June 2021 to July 2023 26](#_Toc143897539)

# List of abbreviations and elaborations

|  |  |
| --- | --- |
| **Abbreviations** | **Elaborations** |
| Aftab | Aftab Bahumukhi Farms Limited |
| Aman | Aman Group Limited |
| AMR | Antimicrobial Resistance |
| AMU | Antimicrobial Usage |
| APA | Annual Performance Agreement |
| ASA | Association of Social Advancement |
| BAB | Bangladesh Breeders Association of Bangladesh |
| BAHIS | Bangladesh Animal Health Information System |
| BARA | Bangladesh AMR Response Alliance |
| BCRDV | Baby Chick Ranikhet Disease Virus |
| BCS | Bangladesh Civil Service |
| BLRI | Bangladesh Livestock Research Institute |
| BPA | Bangladesh Poultry Association |
| BPC | Biman Poultry Complex |
| BPICC | Bangladesh Poultry Industries Central Council |
| BRAC | Bangladesh Rural Advancement Committee |
| B.Sc. of AH | Bachelor of Science of Animal Husbandry |
| B.Sc. in Vet. Sci. and AH | Bachelor of Science of Veterinary Science and Animal Husbandry |
| CDIL | Central Disease Investigation Laboratory |
| Central Epi Unit | Central Epidemiology Unit |
| CP | C.P. Bangladesh Company Limited |
| CS | Cultural Sensitivity |
| CSO | Customer Service Officer |
| CVASU | Chattogram Veterinary and Animal Sciences University |
| DLS | Department of Livestock Services |
| DOC | Day-old chick |
| DVMS | Diploma in Veterinary Medicine and Surgery |
| DVM | Doctor of Veterinary Medicine |
| DO | DVM Officer |
| ECS | Executive Customer Service |
| ELISA | Enzyme-Linked Immune Sorbent Assay |
| EPI | Extended Programme on Immunization |
| ETS | Executive Technical Service |
| FAO | Food and Agricultural Organisation of the United Nations |
| FC | Feed and Day-old Chick producing companies |
| FDIL | Field Disease Investigation Laboratory |
| FIAB | Feed Industries Association Bangladesh |
| FIVDB | Friends in Village Development Bangladesh |
| FY | Fiscal Year |
| GDP | Gross Domestic Product |
| GP | Grand-Parent |
| HA | Haemagglutination |
| HEED | Leprosy Control Programmes of Health, Education and Economic Development |
| HI | Haemagglutination Inhibition |
| HR | Human Resource |
| ISO | Integration Sales Officer |
| IVSP | Informal Veterinary Service Provider |
| Kazi | Kazi Farms Limited |
| LDDP | Livestock and Dairy Development Project |
| LRI | Livestock Research Institute |
| LSP | Livestock Service Provider |
| MO | Marketing Officer |
| MOF | Ministry of Finance |
| MoU | Memorandum of Understanding |
| NGO | Non-Government Organisation |
| NHS | National Health Service |
| Nourish | Nourish Poultry and Hatchery Limited |
| NTP | National Tuberculosis Control Programme |
| OHPH,B | One Health Poultry Hub, Bangladesh |
| Paragon | Paragon Group Limited |
| PC | Pharmaceutical Companies |
| PDS | Participatory Disease Surveillance |
| PKSF | Palli Karma Sahayak Foundation |
| PM | Prime Minister |
| PPC | Private Poultry Consultant |
| PPP Act | Public-Private Partnership Act |
| PPP Authority | Public-Private Partnership Authority |
| PPP | Public-Private Partnership |
| PRTC | Poultry Research and Training Centre |
| PS | Parent Stock |
| RDV | Ranikhet Disease Virus |
| RIR | Rhode Island Red |
| RVP | Rural Veterinary Practitioner |
| SO | Scientific Officer |
| SR | Sales Representative |
| TMSS | Thengamara Mohila Sabuj Sangha |
| ToT | Training of Trainers |
| TSO | Technical Service Officer |
| U2C | Upazila-to-Community |
| UK | United Kingdom |
| ULO | Upazila Livestock Officer |
| ULO and VH | Upazila Livestock Office and Veterinary Hospital |
| USA | United States of America |
| US$ | United States Dollar |
| VFA | Veterinary Field Assistant |
| VPPs | Veterinary Para-Professionals |
| VS | Veterinary Surgeon |
| WFP | World Food Programme |
| WOAH | World Organisation for Animal Health |
| WPSA-BB | World Poultry Science Association Bangladesh Branch |

# Summary

Bangladesh's poultry sector is crucial for national protein and micronutrient requirements and employment opportunities. Despite the positive contribution of the sector, its growth also increases demand for veterinary support and disease management, while both the public and private sectors have a significant role in this sector. Farmers and veterinarians are closely connected to both public and private poultry companies. No research has been conducted in Bangladesh to investigate gaps in veterinary care or explore collaboration between public and private veterinarians. This qualitative study, therefore, aimed to identify gaps between private and public veterinarian services in the poultry industry and identify potential obstacles in establishing public-private partnerships. Data was collected from June 2021 to July 2023 through semi-structured interviews with 62 veterinarians from Bangladesh transcribed in Microsoft Word 10 and analysed using MAXQDA software. The study's methodology involved thematic analysis—developing and refining codes using deductive and inductive analytical methods. The findings were organised into three major themes: differences in veterinary provision between public and private companies, the benefits and shortcomings of non-veterinary service provision for farmers, and the opportunities for public-private partnerships in the sector. The study reveals that the affiliation of veterinarians from specific companies leads to disparities in veterinary service for poultry farmers. Veterinarians from both public and private sectors face difficulties such as staff shortages, excessive workloads, lack of recognition, and regulatory bodies. Communication breakdowns between public and private veterinarians also contribute to dissatisfaction. Dissatisfaction is expressed due to different service purposes, lack of skills, and lack of freedom. The study suggests that public-private partnerships are suitable for improving veterinary provision, data sharing, surveillance activities, laboratory facilities, and veterinary medicine and vaccine supply. The study emphasises the need for a common association between veterinarians from both sectors to advance the industry. The findings will serve as a foundation for initiating public-private partnership that benefits the country and its marginal farmers financially.

**Keywords:** Poultry Sector, Public, Private, Veterinarians, Veterinary Service, Public-private partnership, Bangladesh.

# Chapter 1: Introduction

In Bangladesh, the rapid growth of the poultry sector is often considered to be a positive thing, one that creates opportunities for economic development and nutritional improvements at a national level. Although poverty rates have dropped and the economy has grown significantly in the last 25 years, the poverty rate in Bangladesh is still 24.3%, and the extreme poverty rate is 12.9% due to the lack of regular employment opportunities (Bangladesh Bureau of Statistics, 2023; Halder, 2023). So, for many, the relative affordability and growing availability of poultry provide an opportunity to better meet their protein and micronutrient requirements, which is very important for a nation’s development and population health (Masud et al., 2020). The sector is also associated with employment opportunities for around one million entrepreneurs and eight million people, directly or indirectly covering lots of positions ranging from small-scale farmers to larger multinational stakeholders; however, not all stakeholders benefit equally from the sector (Shah et al., 2006; Masud et al., 2020; Islam et al., 2021). The sector is growing faster than existing infrastructure and legislation can provide for, a discrepancy that results in new and potentially serious challenges to ensure the nation’s nutritional security, safe meat, sustainable poultry production, and curbing the risk of the future pandemic from poultry (Rahman et al., 2019; Hashem, 2020). These factors not only cause economic downfalls for farmers and an impact on public health but may also be a source of future zoonotic disease (Khatun et al., 2019).

In response to some of these challenges, the government has attempted to enact several policies under the National Poultry Development Policy 2008 (Haque et al., 2020). This policy includes a government commitment to ensuring proper treatment of poultry diseases, including the provision of laboratory diagnostic facilities, good-quality medicines and vaccines, prioritising the farm’s biosecurity measures and waste disposal system, maintaining proper distance between the poultry farms and good-quality day-old chicks (DOC), and feed production (Department of Livestock Services, 2008). Besides, the Bangladesh government is willing to pledge to develop robust disease surveillance and laboratory facilities through a joint venture with the private industries involved in the poultry sector (Department of Livestock Services, 2008). The policy also states the government’s commitment to facilitate and train entrepreneurs engaging in poultry enterprises (Department of Livestock Services, 2008).

However, the government needs manpower and logistical support to implement all these policies successfully. The contribution of field veterinarians could provide a solution to help address this need. But currently, the limited number of government field veterinarians, along with no or little collaboration with private veterinarians, remains a barrier to what can be accomplished (Khatun et al., 2019).

This thesis will argue that the public-private partnership (PPP) strategy is one potential solution that could be instigated in the poultry sector to help support the government’s strategy for the sector, particularly as it relates to disease management on poultry farms. The World Organisation for Animal Health (WOAH) defines PPP as a “joint approach in which the public and private sectors agree to share responsibilities, resources, and risks to achieve common objectives that deliver benefits in a sustainable manner” (World Organisation for Animal Health, 2021). This concept is already acknowledged and applied in Bangladesh through the Public-Private Partnership Act 2015, and several projects are already being run successfully under PPP in different non-livestock sectors across the country (Asian Development Bank, 2022). If applied correctly, this joint approach could establish effective schemes for managing poultry diseases, developing the emergency preparedness plan, controlling indiscriminate usage of antimicrobials, ensuring services in meat inspection and animal production, and running an effective poultry disease surveillance programme in Bangladesh (Hamid et al., 2017; Husain and Amin, 2018).

Bangladesh’s poultry sector is a good fit for this approach, as services revolve around the work of private and public field veterinarians, who currently do not coordinate their work (Hamid et al., 2017). Veterinarians’ efforts to provide for poultry farmers are hampered by the lack of infrastructure, limited budget, paucity of workforce, and incoordination of service provision. The initiative to build up a collaborative relationship between private and public veterinarians has the potential to establish a distinct and new model of veterinary practice, bridging public and private companies that can improve the current condition of the poultry sector. Through a formal agreement between the government and private livestock, sectors can distribute tasks among themselves and bring harmony to service provision, including implementing policies. Both the public and private sectors have some shortcomings that hinder their service provision systems. Cooperation and collaboration will not only help our private sector make more profits but also help achieve the government’s target to gain sustainable animal production (Hamid et al., 2017).

Therefore, the general objectives of this study were ⅰ) to explore the existing services offered by public and private veterinarians for disease management in the poultry sector and ⅱ) to identify any challenges and opportunities for collaboration between public and private veterinary services and what the potential consequences of extended overlap might be.

A qualitative study was therefore conducted with veterinarians working across Bangladesh to achieve the aforementioned objectives. Semi-structured interview guidelines with open-ended questions were used to explore the history of being veterinarians, participants’ ambits of work, including their facilities and challenges of field work, connectivity with farmers and dealers, interlinks with other veterinarians and heterogeneous background people working in companies, opinions regarding existing complications in the poultry sector, and convictions for scopes of collaboration to sort out the sector’s crises.

To situate the data generated from these interviews, which provide the core focus of this paper’s discussion, the next section provides a literature review on the development of the commercial poultry sector in Bangladesh and the feasibility of public-private partnerships in the sector in light of examples from other countries. Then, chapter three will detail the materials and methods of the study, including the study design, participants, and data analysis. The fourth and fifth chapters will cover the results and discussion of the study, respectively, along with the limitations of the study. After that, the following chapter will conclude the study with recommendations and future directions from the study findings.

# Chapter 2: Literature review

This chapter presents a synthesis of key findings and discussions from existing published and grey literature in the separate sections that are relevant to the study that follows. To begin, this chapter will describe the contribution of poultry to the economy of Bangladesh. Then, this chapter will describe the flow of development of commercial poultry farming from traditional backyard chicken rearing, along with the history of advancing towards the vertically integrated poultry farming system in Bangladesh. Following this, this chapter will summarise what has been written about the development of veterinary education in Bangladesh before proceeding to discuss the veterinary career opportunities, struggles, and dedication to the poultry sector. After that, this chapter will describe the public-private partnership (PPP) activities already in use in neighbouring countries and distant countries of Bangladesh, including the typologies of PPP as captured in existing literature. Finally, the chapter will conclude with the existing PPP status in Bangladesh and the opportunities for introducing the PPP in the poultry sector from contemporary publications.

## 2.1. The poultry sector as an economic linchpin in Bangladesh

Agriculture, including livestock production, is currently one of the three most significant contributors to the Bangladesh economy (Bangladesh Economic Review, 2021). The livestock sector, including ruminants and poultry is a significant subsector of the agricultural sector (Redoy et al., 2017). In the 2021-22 fiscal year (FY), Bangladesh’s agriculture sector accounted for 11.5% of the total gross domestic product (GDP) (Bangladesh Economic Review, 2022). The livestock sector gave 1.9% of the country's total GDP and shared 16.5% of the agriculture sector’s GDP contribution (Bangladesh Economic Review, 2022). While only the third largest contributor to national GDP, agriculture is the reported profession of 51.9% of the country’s working population—a larger employment provider than any other sector (Bangladesh Bureau of Statistics, 2019). This fast growth is often associated with poultry being the cheapest source of animal protein and micronutrients and poultry meat and eggs are accepted by all religious, economic, social, and demographic groups (Rahman et al., 2017). About 1.5-1.6% of the country’s total GDP contribution comes from the poultry sector, which is the largest part of the GDP contribution from the livestock sector (Howlader et al., 2022). Poultry fulfills about 22-27% of the total animal protein requirement of the nation, while poultry meat alone imparts 37% of the total meat production in Bangladesh (Prabakaran, 2003).

## 2.2. The prominence of backyard chicken rearing

Rearing poultry in a backyard system is a traditional occupation in Bangladesh. About 75% of the country’s population resides in rural areas, and 89% of them rear poultry in backyard rearing systems (Kabir et al., 2015; Bangladesh Bureau of Statistics, 2019). Backyard chicken rearing was described as being predominantly undertaken by people living in rural areas, especially women and children (Das et al., 2008; Bhuiyan et al., 2005). Backyard farms might have 10-20 chickens at a time, made up of local indigenous breeds, for example, Hilly, Naked Neck, Aseel (Sarail and Chittagong type), Yasine, Native dwarf type, and Frizzled Plumage (Bhuiyan et al., 2005; Das et al., 2008). These birds are kept at household premises and reared in scavenging or semi-scavenging systems (Bhuiyan et al., 2005; Das et al., 2008). While the commercialization of the poultry sector is attracting many people in Bangladesh into poultry farming as a profession, these new farms operate at commercial scales than the backyard farms, where activities usually supplement family diets or incomes alongside other activities rather than constituting the primary income (Rimi et al., 2017).

Backyard poultry, especially chickens significantly contributed to national protein demand (Das et al., 2008). While other poultry species like duck, pigeon, quail, goose, and turkey were reared in households and sold, chicken was the most commonly raised and sold in the largest quantities (Das et al., 2008). Backyard chickens are often sold in village markets or between neighbours and have been described as the primary source of indigenous chickens and a key contributor to meeting basic protein requirements for family consumption (Das et al., 2008). To encourage the rural poor people in backyard chicken rearing, the Bangladeshi government introduced the improved yielding capacity chicken type ‘Sonali (a cross between Foyoumi hen and Rhode Island Red cock)’ in the backyard production system with the leading NGOs (Non-Government Organisations) of Bangladesh from 1996-2000 (Uddin et al., 2015; Islam and Hossen, 2021). However, some of the literature states that the contribution of indigenous chicken from backyard farms, in country’s poultry supply has been decreasing as time passes (Das et al., 2008; Sonkar et al., 2020). The majority of family protein requirements were being met through the consumption of backyard eggs and meat until 2005 (Bhuiyan et al., 2005). Almost 75% of all eggs and 78% of all chicken meat being consumed were still coming from backyard farms (Bhuiyan et al., 2005). This had dropped to 50% of eggs and only 40% of chicken meat by 2017 (Rahman et al., 2017).

Despite the shrinking of backyard chicken rearing, it is still common and may provide a means to empower rural women by providing access to independent incomes because backyard chicken rearing is easy and requires less investment (Permin et al., 2001; Jha and Chakrabarti, 2017; Islam, 2022).

However, despite the prominence and contribution those backyard chicken operations have always had in Bangladesh, some of the recent literature has associated backyard chicken rearing with very poor levels of biosecurity and disease risks. Backyard chickens can be raised in a free-range or semi-scavenging system in a small space with little air and light, which are responsible for the drawbacks of being affected by common chicken diseases (Alam et al., 2014; Islam et al., 2015). As the indigenous chickens are reared without a constructive infrastructure, there is nothing like biosecurity measures (Islam et al., 2015). However, indigenous chickens are naturally immunised against several common diseases, but they are also vulnerable to contagious zoonotic diseases like Avian Influenza because the indigenous roaming chickens easily come into contact with the wild birds, who are the reservoir of Avian Influenza (Alhaji and Odetokun, 2011; Delabouglise et al., 2017). For this reason, poultry experts recommend vaccinating the backyard chickens at least against some of the common diseases, for example, Newcastle disease, Fowl Pox, and Fowl Cholera (Branckaert, 2007; Alam et al., 2014). Besides, biosecurity is considered the most protective measure to reduce the spread of the diseases from the environment to commercial farms through backyard chickens (Burgos and Burgos, 2007). Introducing biosecurity measures is possible in small-scale commercial chicken farms at least, whereas it is an unlikely practice in backyard chicken rearing due to the free-roaming nature of backyard chicken (Das et al., 2008).

## **2.3. The growth of commercial poultry farming in Bangladesh**

Commercial poultry farming in Bangladesh is an old concept. In 1935, before the independence of the country, the former government first imported a variety of chickens from foreign countries and set up six breeder farms in different locations in the country to supply hatching eggs and chicks in 1947 (Shamsuddoha and Sohel, 2004). To increase the supply of chicks to marginal farmers, the government imported improved variety breeds, for example, White Leghorn and Rhode Island Red (RIR), from the United States of America (USA) (Shamsuddoha and Sohel, 2004). In 1964, the private poultry sector was instigated by the establishment of a commercial farm named “Eggs and Hens Limited” (Shamsuddoha and Sohel, 2004) in East Pakistan. After the liberation of Bangladesh in 1971, under government patronization, the first commercial poultry farm named Biman Poultry Complex (BPC) was launched through collaboration between Biman Bangladesh Airlines and a poultry breeding farm in Canada (Shamsuddoha and Sohel, 2004). It is considered that commercialization in poultry farming got momentum from 1980 and behind this, the role of private investors and different non-government organisations (NGOs) is noteworthy (Shamsuddoha and Sohel, 2004; Rahman et al., 2017; Hamid et al, 2017).

While digging the foundation of a commercial poultry farm, the history showed the first contribution of NGOs. The most popular and earliest working NGO in Bangladesh, the Bangladesh Rural Advancement Committee (BRAC), was highlighted for contributing to the poultry sector and aimed at making rural women economically solvent by providing microcredit and training regarding small-scale, semi-scavenging, and layer farming (Jensen, 2000). Since 1980s, they worked with the Department of Livestock Service (DLS) to replicate the concept of large-scale commercial poultry production by utilising rural women (Mack et al., 2005). The government was the implementing agency of the concept to coordinate, monitor, control, and provide technical support, while the BRAC funded the activities from its donor project, “World Food Programme (WFP)” (Jensen, 2000). They developed local mini hatcheries and feed mills utilising rural people by increasing the demand for day-old chicks (DOCs) (Jensen, 2000). This was the development phase of commercial poultry farming, and that was the lag phase of this sector (Saleque and Mustafa, 1996). In the mid-1990s, an experimental intervention, rearing Sonali crossbred commercially, brought about a revolution in the sector. Until 1993, BRAC ran their activities with WFP donations; by then, the programme had achieved its purposes (BRAC, 2017). Then, BRAC started its own hatcheries in 1997 along with credit facilities for collecting DOCs for the farmers (BRAC, 2017). Besides, they developed three feed mills in Manikganj, Nilphamari, and Gazipur by 2000 with a larger capacity for feed production (Dolberg et al., 2002; BRAC, 2016). In 2003, BRAC poultry was established as a social enterprise of BRAC (BRAC, 2017). It was reported that up to 2005, about 150 NGOs assisted to stimulate poultry sector growth along with government support (Hossain et al., 2014). Some NGOs, for example, Proshika, Swanirvar Bangladesh, Care-Bangladesh, Friends in Village Development Bangladesh (FIVDB), and Association of Social Advancement (ASA), working in poultry sector were mentioned in different literatures (Alam, 1997; Khanl, 2007; Rahman et al., 2014).

Similarly, when private companies understood that the poultry sector could be a way of contributing to the country’s GDP, they started to invest more in this sector from in the early 90s’ (Shamsuddoha and Sohel, 2004; Hamid et al., 2017). From 1991, several companies, for example, Aftab Bahumukhi Farms Limited, Paragon Poultry Limited, Kazi Farms Limited, C.P. Bangladesh Co. Limited, Nourish Poultry and Hatchery Limited started their feed mills and parent stocks (PS) for supplying feeds and chicks (Muhibbullah and Karim, 2016). The chicken population gradually increased from 91 million in 1990 to 123 million in 1995 and 153 million in 1997 (Jabbar et al., 2007). From 1990-2005, the poultry population growth rate increased by 4% per year, and since 1995, it has gained a significant annual average growth rate, approximately 15-20% (Hamid et al., 2017). During 2005-2007, many companies launched grand-parent (GP) farms (Raha, 2007). Then the Bangladesh poultry sector faced extreme losses due to the Avian Influenza outbreak, causing a decrease in commercial chicken farms from 1,15,000 to 55,000 from 2007 to 2013 (Imam et al., 2020). After 2015, the sector regained its capacity to fulfill the meat and egg demand of the country population (Department of Livestock Service, 2023).

Currently, the chicken population in Bangladesh is 320 million and registered commercial chicken farms are 90,000 (Ali, 2023; Department of Livestock Service, 2023). Hamid et al. (2017) stated that the government operated 33 chicken farms, including 6 chicken hatcheries with the objective of preserving the genetic line, which was not achieved, and they failed to supply DOCs as per the farmers’ requirement. There are 16 GP farms, 206 PS, and 198 registered feed mills running under the initiative of the private sector (World Poultry Science Association Bangladesh Branch, 2023). The investment of the private sector in the poultry sector, particularly in commercial poultry, is also increased by 350 billion BDT ($3.2 billion) in 2020, while in 2011; the amount was 327 billion BDT ($3.0 billion) (Huque et al., 2016; Saleque and Ansarey, 2020). The sector has been projected to become the second largest employment-generating sector after the garments sector by creating jobs for 10 million people by 2030 and increasing investment by 600 billion—an anticipation by Bangladesh Poultry Industries Central Council (BPICC) (Ahmed, 2017; Huq, 2021). Commercial poultry farming is being a popular profession choice among new entrepreneurs, although the number of farms fluctuates due to the adversities of the sector, for example, market volatility, high feed and DOC price, disease outbreaks, and natural calamities like floods (Islam et al., 2014; Saleque and Ansarey, 2020; Ali and Chowdhury, 2021). Farmers can move to other businesses from commercial poultry farming when they find volatility in the price of ready birds (Ali and Chowdhury, 2021). They start other livestock rearing or handling a shop by keeping the chicken’s shed as usual so that they can return to poultry farming when the condition progresses (Ali and Chowdhury, 2021).

In Bangladesh, depending on the size, commercial chicken farms can be categorized into three types: small-scale farms (rearing up to 3000 chickens), medium-scale farms (rearing 3001-20,000 chickens), and large-scale farms (rearing more than 20,000 chickens) (Saleque and Ansarey, 2020). Besides, based on biosecurity measures the commercial chicken farms can be categorized in two types: high biosecurity commercial chicken farms (having moderate to high biosecurity measures) and low biosecurity commercial chicken farms (having low to minimal biosecurity measures). The small-scale commercial poultry farmers establish their poultry sheds using conventional ventilation, manual feeding systems or open-sided walls, either on owned homestead land or hired or mortgaged land, whereas the large-scale poultry farmers can afford the expenses for variable costs including better facilities for good waste management, biosecurity measures, and owned transportation (Das et al., 2008; Sarker et al., 2009; Islam et al., 2010; Kabir et al., 2015; Islam et al., 2015). Commercial farming operations involve variable recurring costs for farmers (Akter, 2013). These costs include paying for feed, DOCs, labor, veterinary services and medicine, electricity, litter, transportation, and the cost of any repairs (Akter, 2013). There is also an initial fixed cost for housing, tools, and equipment (Akter, 2013). The feed cost for rearing chickens is the major cost, covering 65-70% of the total cost (Das et al., 2008). Due to the lack of economic solvency and the inadequate facility of government loans, small-scale farmers fail to bear the cost, which makes them take credit from dealers to run their poultry farming businesses (Shah et al., 2006).

Moreover, the commercial poultry sector comprises 81% of small-scale chicken farms, contributing 78% of the meat supply in Bangladesh (Begum et al., 2013; Bangladesh Bureau of Statistics, 2017). As a result, commercial chicken farmers start chicken farming being categorized as independent chicken farming and company-contracted chicken farming (Jabbar et al., 2007; Masud et al., 2020). Independent chicken farming is mostly dealer-based, where the wholesalers are certain one or more types of feed and chick producing companies (Jabbar et al., 2007; Islam et al., 2009). Independent chicken farming is dealer-based because the farmers need to collect their required feed and chicks from any of the company dealers, either for cash or on credit (Jabbar et al., 2007). Dealers play a significant role in Bangladesh’s poultry distribution network, being connected with a single company or multiple companies and receiving feed and DOC according to their requirements from the company at a wholesale price (Høg et al., 2019). These dealers then sell the feed and DOC on to associated farmers for a margin of profit (Jabbar et al., 2007; Høg et al., 2019; Khan, 2023). The way dealers run their dealership business with the poultry farmers follow the social capital theory, where the human relationship is captured as the capital (Liñán and Santos, 2003; Masud et al., 2020). Dealers need to invest resources, labour, and time, which match the social capital theory (Lin, 2003). As the producer companies incentivize the dealers for their contribution to selling the products (feeds and DOCs), the dealers input labour for the poultry farmers by accessing information about the market channel and reducing transaction costs for the farmers through coordinating the activities (Grootaert and van Bastelaer, 2001; Jabbar et al., 2007). When feed and other subsidiaries become unaffordable for small-scale commercial farmers, dealers come forward to them, offering suggestions and guidance on a range of topics, such as the installation requirements for poultry sheds and equipment (such as feeders, drinkers, feeding trays, brooders, and litter materials). The core aspect of dealers’ roles, along with this guidance, is to supply poultry feed, medicine, and DOC on credit (Shah et al., 2006; Masud et al., 2020; Hennessey et al., 2021). While working with dealers in this way does not remove the risk that comes from poultry farming (e.g., sudden disease outbreak and unstable market price), it does alleviate some of the economic risk that farmers would otherwise face. As such, dealers and farmers develop tightly linked and often dependent relationships, particularly from the farmers’ side, making dealers a key actor associated with how many farms are managed (Høg et al., 2019).

Not all farms are reliant on credit in this way. Rather, many large-scale farmers, especially the layer farmers who are independent, purchase feed in cash from dealers (Chowdhury and Chowdhury, 2015). Farmers can reduce the production cost by at least 10-12% by rearing large-scale poultry farm, because this helps the farmers detour from the common dealership channel to purchase the feed directly from the company (Khan, 2023).

Despite the sector’s growth, there is disagreement across the literature about how much farmers working in different modalities are benefiting from their engagement in the sector. Khan (2023) argues that recently, two-thirds of the small-scale farmers have dropped out of poultry farming because of the increasing production cost of chickens due to the increasing feed costs, whereas contract farming shows a profit of 10-12 BDT per kg. However, contract farmers also claim losses due to the biassed conditions of the contract farming system (Khan, 2023). While investors in the poultry sector think that when the poultry farmers will get government loans for farming at a 4-5% interest rate, only then the replacement of the dealership system in the poultry distribution network can be conceived (Khan, 2023).

## **2.4. Vertically integrated contract farming system in Bangladesh**

Contract farming is a kind of vertical integration strategy that is practiced by many companies (CP Bangladesh Company Limited (CP), Kazi Farms Limited (Kazi), Paragon Group Limited (Paragon), Rafid Poultry and Hatchery Limited, Aftab Bahumukhi Farms Limited (Aftab), Afil Agro Limited, AG Agro, Aman Group Limited (Aman), Nourish Poultry and Hatchery Limited (Nourish)) and NGOs (BRAC Poultry, BPC) in Bangladesh (Rahman et al., 2017; Saha et al., 2021; Al-Amin, 2022). Firstly, to understand the vertically integrated farming system, a definition can be adopted: farms are vertically integrated when they partially or wholly internalize their operations without the involvement of external agents (Adams et al., 2022). A vertically integrated farming system is a single management with two or more production stages where downstream activities are the inputs of all upstream production activities, and usually the system does not reflect the market price or transmit product development (Creswell, 2014). This system omits the participation of business intermediaries and avoids market exchanges (Mookherjee et al., 2017; Adams et al., 2022). Vertical integration follows a backward and forward direction, where backward integration produces the input and forward integration targets reaching the consumers (Adams et al., 2022). Due to competitiveness, backward integration is more popular than forward integration (Lin, 2014). However, single-party backward vertical integration is always more beneficial for a manufacturer’s profitability than forward vertical integration (Lin, 2014). Hence, both backward and forward integration augment the full implications of vertical integration (Lin, 2014; Adams et al., 2022).

Contract farming in the form of vertical integration can combat unpredictable markets, for example, to reduce the economic risk of the poultry sector in Bangladesh (Katchova, 2013). During the 1940s, contract farming was popularized in the United States poultry sector to reduce the financial losses of broiler farmers (Vukina, 2001). The form of contract farming can be defined in various ways depending on some criteria, for example, types of partners involved, shared risks, and benefits, and obligations, types of agreements, enforcement and monitoring, and settling of disputes (Jabbar et al., 2007).

In broiler contract farming, coordination or integration is specified between the broiler farmers and integrators about the conditions or stages of producing and marketing broilers (Martin, 1994; Begum, 2005). Here, the integrators are the owners of the DOCs to be ready broilers and suppliers of the DOCs, feeds, veterinary services, and technology (Martin, 1994). The broiler farmers join the business with their labor and supporting infrastructure. including land and housing facilities (Martin, 1994). Vertical poultry contract farming comprises two types of contracts: production contracts (backward integration) and marketing contracts (forward integration) (Begum, 2005). Production contracts determine the services provided by the farmers, and farmers obtain compensation from the integrator and responsibility from the integrator toward the farmers (Begum, 2005; MacDonald, 2011). Marketing contracts focus on the ready product’s pricing, amount, and delivery to consumers (MacDonald, 2011). Farmers and integrators bear both production and price risk in production contracts, while they share only price risk in marketing contracts; however, contracts benefit the farmers by reducing income loss and assuring farmer’s outlets in the market (MacDonald, 2011).

Contract farming with a large number of poultry farms is popular in India, Thailand, and the Philippines (Islam et al., 2010). In Bangladesh, Aftab first introduced contract farming in 1994 with 20 selected broiler growers; however, from 2017 on, the farming system accelerated among the farmers of Bangladesh (Begum, 2005; Al-Amin, 2022). At present, CP is the biggest chicken farming contract provider, with at least 2000 small and medium-scale chicken farmers (Al-Amin, 2022). It is predicted that contract farming will take up 50% of the industry in the following years, where 25% of the country’s broiler is being supplied from the existing contract farms (Al-Amin, 2022). Currently, about 5000 farms are being run under the contract farming systems of different corporate companies (Nobel, 2023).

Despite the scale and options that contract farming can provide, some articles describe some of the negatives that can be associated with the system in Bangladesh. About 30 leading companies in the poultry industry are involved in contract farming but do not reveal their involvement in contract farming because many farmers have complaints against the contract farming system of the companies, which is making them defaulters (Khan, 2023; Nobel, 2023).

Khan (2023) noted that the contract farmers experienced a lack of consistency in the conditions of agreement by which the companies served their business motives (Khan, 2023). The integrators take advantage of farmers by manipulating the quality of the products and finding ways to pay farmers less than what they are due (Ramaswami et al., 2006; Khan, 2023). For example, Ramaswami et al. (2006), Wainaina et al. (2012), and Khan (2023) described how integrators have been known to supply poor-quality medicines, DOC, and feed, as well as instances where integrators have lied about the number of sick chickens in a flock to pay farmers less. Even farmers cannot expect 12-14% of the production cost as a growing charge or his labour cost following the contracts (Nobel, 2023; Siddiqui, 2023). Moreover, Khan (2023) and Nobel (2023) reported that almost 10,000 farmers and dealers from Bagura, Joypurhat, and Jhenaidah were legally harassed and accused of monetary issues because, while they started contract farming with their companies, they signed blank cheaque as security of the contract. The companies utilised the cheaque as a weapon to compel the farmers to follow their instructions (Khan, 2023; Nobel, 2023).

Many authors have described the inherent and often negative consequences of the power dynamics in contract farming systems. Contract farming can bring monopolistic farming character to the sector by breaking up usual poultry farming activities as the farmers become pawns of the companies because farmers do not get scope for negotiation with the companies while the companies have the lone power of settling the agreements of the contract (Shivramkrishna and Jyotishi, 2007). This system is also criticized for being beneficial only for large-scale farmers, as small-scale poultry farms are ineligible for most contracts. These smaller farms are more likely to include the input of women and children, who are thus deprived of contract opportunities (Jabbar et al., 2007; Wainaina, 2012).

Some authors feel that, in spite of all the issues, contract farming is a potential way of overcoming credit constraints, minimizing transaction costs, providing market access, and reducing risk for farmers and businesses (Begum et al., 2005; MacDonald, 2011). However, some authors would rather see contract farming revised or replaced with more dependable alternatives. For example, to benefit small-scale poultry farmers’, more work could be done to develop collective actions such as producer groups, input and output marketing cooperatives, and product collection schemes (Jabbar et al., 2007; Adnan et al., 2019). In fact, the biggest impetus for farmers to enter into contract farming is risk sharing, which some authors believe can be lessened by training or education of the farmers and microcredit access for the farmers (Greiner et al., 2009; Adnan et al., 2019).

## 2.5. Development of the veterinary profession in Bangladesh

The development of the veterinary profession in Bangladesh stems from past veterinary education patterns in South Asia (Kalam et al., 2013). The veterinary profession has long-established roots in the region. Archaeological findings from 1920-22 have revealed evidence of developing veterinary medicine and animal husbandry by ayurvedic treatment using herbal medicines and handy techniques (Somvanshi, 2006). It is assumed that the indoor veterinary facilities of the time king Ashoka (300 BC) for horse treatment were introduction of the concept of veterinary hospital in the Indus Valley civilization (Somvanshi, 2006). Gradually, this region passed several periods with traditional veterinary facilities and animal husbandry practices, followed by the Maurya dynasty, the medieval period, and the pre-colonial periods except for any institutional schooling on animal disease control or treatment (Rahaman, 2018).

During the British colonial period, while cattle mortality was widespread in India due to Rinderpest disease, the colonial authority started the Indian Cattle Plague Commission. This commission made sketch plans to progress veterinary conditions systematically through veterinary schools, colleges, and research institutes from 1889 (Rahaman, 2018). As a part of this plan, the first academic institute for providing formal veterinary education, Bengal Veterinary Institution, was established in 1893 in Calcutta, West Bengal, in India, which is a Bengal-speaking city like Bangladesh which was known as East Bengal at the time (Rahaman, 2018). Side by side, the British colonial government developed a civil veterinary service similar to the world veterinary service system in the Bengal region for veterinarians (Kalam, 2013). At that time, they produced the organogram according to the necessity of the places as the region was ruled by the British Viceroy (Kalam, 2013). The veterinary service of the British colonial period was provided and monitored by a veterinary advisor, reserved assistant veterinary surgeons, field veterinary inspectors, and field veterinary assistants (Kalam, 2013). Then, in 1947, India and Pakistan were partitioned, and eventually both countries gained independence from British colonial rule (Pant, 2017). In this year, on December 7, a veterinary college known as the College of Veterinary Science and Animal Husbandry was established in the region of Comilla town (present-day Cumilla) in East Pakistan (former East Bengal and now Bangladesh), and that was the first veterinary college in Bangladesh at this time with a three year diploma degree named DVMS (Diploma in Veterinary Medicine and Surgery) (Samad and Ahmed, 2003). After 1947, more veterinarians were recruited in the civil service, creating different posts at the sub-district (upazila) level due to the increasing requirement for veterinarians as a consequence of partition (Kalam, 2013). Gradually, the civil department of veterinary service was named Directorate of Animal Husbandry in 1948 and shifted the headquarter to Comilla (present-day Cumilla) (Kalam, 2013, Department of Livestock Service, 2022).

After that, the veterinary college was again shifted from Comilla to Tejgaon, Dhaka (present) in 1950 and started a five-year bachelor course in animal husbandry in 1951 (Samad and Ahmed, 2003). In 1957, the degree was renamed the Bachelor of Science in Veterinary Science and Animal Husbandry (B.Sc. in Vet. Sci. and AH), which covered 80% of animal health and medicine and 20% of animal husbandry and production (Samad and Ahmed, 2003). In 1957-58, the veterinary college was moved to Mymensingh, offering both B.Sc. and Diploma degree on veterinary sciences (Kalam, 2013). In 1960, the civil veterinary service system was renamed the Directorate of Livestock Service (Department of Livestock Service, 2022). Livestock Research Institute (LRI) was established as a project to strengthen the research capabilities and vaccine production under the DLS in 1956 (Kalam, 2013). On August 18, 1961, East Pakistan Agricultural University opened as an extension of the college in a rural area near the south part of Mymensingh (Anon, 1966), and the institution constructed two separate faculties providing two distinct degrees: Doctor of Veterinary Medicine (DVM) and B.Sc. of Animal Husbandry (Samad and Ahmed, 2003). After the liberation of Bangladesh, in 1972, the university was named Bangladesh Agricultural University (BAU, 1997). Post-liberation progress in Bangladesh veterinary sector was slow. However, practicing veterinary medicine was recognised as a profession in Bangladesh in 1982 through the “Bangladesh Gazette,” and “The Bangladesh Veterinary Practitioner’s Ordinance 1982” was enacted by the Bangladesh government as “an ordinance to make provision for the regulation, control, and registration of veterinary practitioners in Bangladesh,” followed by the developed constitution of “The Bangladesh Veterinary Council Regulation 1985” as a regulatory body for veterinary education and registration of the veterinarians in Bangladesh (Samad and Ahmed, 2003). In the meantime, veterinary research facilities were eventuated by the establishment of the Bangladesh Livestock Research Institute (BLRI) under the presidential ordinance of 1984 (Kalam, 2023). Afterward, all veterinary extension services and research activities were being accomplished under the authorisation of the DLS and BLRI (Kalam, 2023).

Parallel to this, to enrich veterinary education, four government veterinary colleges: Sylhet Government Veterinary College, Sylhet (1995); Chittagong Government Veterinary College, Chittagong (1995); Hajee Mohammad Danesh Veterinary College (1999); Patuakhali Veterinary College (2000) were established, providing a combined degree of DVM covering both veterinary medicine and animal husbandry and facilitating a five years course including one year of internship (Prova and Rahman, 2021). At present, twelve public universities are offering Degree of Veterinary Medicine (DVM), including a private university. After finishing a 4-year academic course plus 6-12 months of internship, a student earns a DVM degree and is required to collect a registration number from the Bangladesh Veterinary Council as a pre-requisite for field practice or any type of job (Bangladesh Veterinary Council, 1985; Kalam, 2013; Sattar et al., 2022).

### Public and private employment sectors for veterinarians available in Bangladesh

Veterinarians work in both the government and private sectors in Bangladesh (GonoBishwabidyalay, 2016; Sarker et al., 2021). This presence of both public and private veterinary provision is not unique to Bangladesh, with different countries sharing in this at different levels. For example, in Pakistan, about 70% of poultry health services come from the government due to trust in quality, service cost, and easy accessibility of the service. The remaining 30% of provision is supplied by the private sector, mostly serving large-scale, independent chicken farms as well as fully- and partially-integrated farms (Aslam et al., 2020). In India, private veterinary practice has also been spotlighted to balance the economy by reaching the service of “toll goods (low rivalry and high excludability, e.g., disease diagnosis and treatment provision)” and “common pool goods (high rivalry and low excludability, e.g., biosecurity measures in poultry farms)” and increasing government efficacy in the livestock sector (Sen and Chander, 2003). Rates of private provision for veterinary services differ across the world. For example, in Germany, 50% of the veterinary practitioners are involved in private practice. This jumps to more than 80% in the United States and 85% in Belgium (Mlangwa and Kisauzi, 1994; Wise and Adams, 1999). Sen and Chandler argue that the high rates of private veterinary provision around the world are a reflection of the fiscal constraints and reluctance of governments to adequately cover necessary veterinary services (Sen and Chander, 2003).

In Bangladesh, recently a provision of 13,052 manpower, which included 2498 veterinarians /related degree holders (e.g., Animal Husbandry graduates) and 10,554 veterinary para-professionals including supporting staff at different tiers (e.g., central, divisional, district and sub-district) of present organogram have allocated in the revised organogram [DLS, 2023]. The veterinarians have government job opportunities in Livestock Cadre, including other general Cadre, different government (non-Cadre) jobs related to veterinary science, research institutes (e.g., BLRI), meat inspection sections in different city corporations, bank jobs, government projects, teaching in universities and other educational institutes, and Bangladesh Army (GonoBishwabidyalay, 2016). Livestock Cadre is a professional cadre service in Bangladesh Civil Service where the veterinarians can join after passing Bangladesh Civil Service (BCS) Examination being a first-class gazetted officer (Debnath et al., 2011). Karl and Sutton (1998) and Lewis and Frank (2002) expounded that having a government job due to its security, satisfying salary, recognition, favorable working hours, and preferable working schedule is ranked highly for a job seeker, and that is no different for a job-expecting veterinarian in Bangladesh (Star Business Report, 2021). To join the Livestock Cadre in Bangladesh, a candidate is required to pass two-year-long, three-stage BCS examination (Bangladesh Public Service Commission, 2022). Despite all efforts, veterinarians do not get a sufficient number of livestock cadre posts in the BCS examination; for instance, only 22 posts were granted to DVM graduates based on the empty posts of Veterinary Surgeon (VS) and Scientific Officer (SO) in different regions in the last 45th BCS (Sarder, 2015; Prothom Alo, 2023).

Every year, nearly one thousand veterinary graduates have been incorporated into the field of work as candidates (Continuing Education Conference for Veterinarians, 2022). Lack of enough government jobs, therefore, directs the unemployed veterinarians towards the private sector (Bhuiyan, 2013). In addition, veterinarians also prefer private jobs due to more vacancies and diversified job opportunities in private companies (Bhuiyan, 2013; GonoBishwabidyalay, 2016). Moreover, the increasing demand for veterinarians in this growing livestock sector has led to employment by private institutions in different types of work, including, administration, technical services, diagnostics, and product manufacturing (Prova and Rahman, 2021). Different meat processing industries, milk processing industries, private dairy farms, beef fattening farms, poultry farms and hatcheries, livestock hatcheries, pharmaceutical companies, international NGOs, and national NGOs are taking on the veterinarians in different private jobs. Besides, the veterinarians can engage in entrepreneurship as private veterinary consultants or apply for scholarships and research at home and abroad (GonoBishwabidyalay, 2016). However, no research paper was found to be a reference, such as one that has been conducted to find out the preferences or obligations of veterinarians working in the private and public sectors for veterinary provision in the poultry sector in Bangladesh or neighbouring countries.

### 2.5.2. Public-private partnership in the veterinary sector

Public-private partnership (PPP), sometimes called public-private collaboration, can be defined as a “contractual framework or structure where the public and private sectors come together to deliver a project or service that is usually provided by the public sector by means of risk transference” (Husain and Amin, 2018). The public-private partnership (PPP) concept was originated in the early 1990s in different countries around the world (Brogaard and Petersen, 2018). At this time, most PPP projects were related to engineering, business, and economics, including public administration and the most successful countries to adopt the innovation were in China, the USA, the United Kingdom (UK), and Australia opening new fields for PPP research (Song et al., 2016). Even so, PPP in the health sector is not rare. The UK and the USA were the first countries to try the PPP concept in the health sector and made it a popular and easy example for the government and private health sectors to follow (Torchia et al., 2015; Łakomy-Zinowik and Horváthová, 2016). For instance, through the PPP approach, treatment facilities for people were made easy and accessible by improving the treatment practices in the National Health Service (NHS) in the UK (Łakomy-Zinowik and Horváthová, 2016).

In Bangladesh, the Public-Private Partnership Act (PPP Act) was approved in September 2015 and ruled under Act 18, the Public-Private Partnership authority (PPP authority) introduced the policy and strategy in 2010 (Public-Private Partnership authority, 2016; Bangladesh Economic Review, 2023). Considering the basic demand and the expedition of the socio-economy and infrastructure of the country, this legal act was mandated to attract local and foreign investment (Public-Private Partnership authority, 2016). In Chapter Ⅱ of PPP Act under Section 4 “Establishment of PPP Authority”, it has been mentioned that the PPP authority under the Ministry of Finance (MOF) shall be the statutory body having all administrative powers, including the capacity to supervise the viable PPP projects and the developmental and financial accreditation of the projects (Public-Private Partnership authority, 2016). The PPP authority shall be governed by the Prime Minister (PM) as chairman, the Minister of MOF as vice chairman, a nominated minister by the PM, the Minister of the concerned project, the principal secretary to the PM, and the chairman of the PPP authority (Public-Private Partnership authority, 2016). A public-private partnership (PPP) project is worked out after the approval of the proposal in the Cabinet Committee by PPP authority when the project proposal obeys the selection criteria according to the act to expedite the socio-economic development of the country (Public-Private Partnership authority, 2016).

Public-private partnership (PPP) is also practiced in the veterinary domain in the higher economic countries e.g., the USA, the UK, Australia, Canada, and Denmark, including the sub-Saharan countries (Grimsey and Lewis, 2007; Black, 2012; Donado-Godoy et al., 2015; Mangeni, 2019; Esteve-Gasent et al., 2020). According to the WOAH, the veterinary domain includes all activities directly or indirectly related to terrestrial and aquatic animals, their products, and by-products that help to protect, maintain, and improve the health and wellbeing of people, including the protection of animal health, animal welfare, and food safety (World Organisation for Animal Health, 2021). In the veterinary domain, PPP is “a joint approach in which the public and private sectors agree on responsibilities and share resources and risks to achieve common objectives that deliver benefits in a sustainable manner” (World Organisation for Animal Health, 2019). More precisely, Galière et al. (2019) defined PPP in the veterinary domain as a partnership between the government veterinary department and multiple types of private actors, including independent practitioners, practitioners working in corporate companies, and veterinary statutory bodies. Their definition also includes private companies such as pharmaceutical, poultry feed, and chick suppliers, food industries, private diagnostic laboratories, veterinary paraprofessionals (VPPs), farmers’ associations, producers’ associations, and community animal health care providers’ associations (Galière et al., 2019). This list of vital stakeholders reveals the sector’s complexity which is important to acknowledge when implementing the concept of PPP in the most sustainable way.

Galière et al. (2019) also mentioned that separate types of PPPs can be introduced in veterinary services that engage with these different actors in their study of WOAH. For instance: a) transactional PPPs, representing the traditional understanding of PPPs by Veterinary Services, initiated and funded by the public; b) collaborative PPPs, including partnerships between producer associations and public veterinary services for trade interests; and c) transformational PPPs, indicating joint programmes initiated and funded by private companies with business development objectives. They also found that the American region practiced more PPP in the veterinary sector, focusing on disease prevention and control, vaccination, food safety, animal and animal product export, disease eradication, emergency outbreak control, epidemiological surveillance and veterinary education and communication, and farmers training and awareness, than the Asia and Pacific region (Galière et al., 2019).

To establish a structured PPP, it is important to have a veterinary statutory body for veterinary sector in the PPP team of the PPP authority of the country (Galière et al., 2019). A true PPP was possible through a combined initiative between public and private partners, although Galière et al. (2019) found most PPP activities were instigated by the participation and responsibilities of the private sector rather than government.

The mechanisms of PPPs have been identified: legislation/regulation, sanitary mandate with legislation and contract, contract or memorandum of understanding (MoU), agreement/convention, no or not specific governance. Of these protocols, the following legislation and contracts, or MoUs, are mostly followed by Europe and Africa (Galière et al., 2019). For successful PPP, several key success factors and ways of managing obstacles are required under the category goal alignment and mobilization of partners, for example, communication between partners, trust and transparency, shared goals and mutual benefits, and the level of involvement of partners; the second category is implementation including, governance or management and a clear division of roles and responsibilities along with government support and resources (Galière et al., 2019).

### 2.5.3. Public-private partnership in the poultry sector in Bangladesh

The Bangladesh government has been responsible for the growth and investment of the private sector by implementing policies from different sectors (e.g., infrastructure, energy, and manufacturing) of the country because of the significant impact of private investors in a transition into a middle-income country by 2031 and a developed country by 2041 (Bangladesh Economic Review, 2023). Currently, the contribution of the private sector is more than 75% of total country investment (Financial Express Report, 2022). In a webinar, “Private Sector’s Role in Bangladesh’s Middle Income Journey: Enablers, Lessons, and the Path Ahead,” on May 19, 2022, for making the best use of private sector as a great asset for the country by strengthening and expanding of PPP was discussed (Financial Express Report, 2022). The government facilitates with special economic zones, general incentives for investors, and creating investment promotion agencies (Bangladesh Economic Review, 2023). Between 1990 and 2022, a total of 80 PPP projects (of which 61 were for the energy sector) were successfully implemented in Bangladesh, investing a total of $10.1 billion, while reports on government meetings revealed plans to introduce PPP in the agricultural sector (Star Business Report, 2022). This was despite many proposals (such as agriculture training centres, terminal markets, cold chain logistics, agricultural machinery manufacturing and servicing, molecular breeding, pesticide and seed production, and export) already being under evaluation by the PPP authority. Nevertheless, no projection has been made for implementing PPP projects in the livestock sector (Star Business Report, 2022). In fact, there is no previous history of PPP installation for the animal health sector, especially in the poultry health sector in Bangladesh, though there is evidence of government work with some NGOs in human health sector, for example, the national tuberculosis control programme (NTP), the extended programme of immunisation (EPI), the leprosy control programmes of Health, Education, and Economic Development (HEED), CARE Bangladesh’s reproductive health project, and BRAC’s health and development programmes (Perry, 1999; Ullah et al., 2006). Additionally, the government worked with several NGOs, for example, BRAC, Proshika, and Thengamara Mohila Sabuj Sangha (TMSS), with the purpose of poverty alleviation and women empowerment through small-scale poultry rearing since 1978 (Rahman et al., 2004; Islam and Jabbar, 2005; Jabbar et al., 2007).

While there has been little development in the way of PPP in the poultry sector in Bangladesh thus far, Larive Group, a Dutch-based international business consultancy group, has earmarked the poultry sector as a promising one (Larive International, 2018). Since 2018, it has been working for the improvement of the sector in the name of LightCastle in Bangladesh (Larive International, 2018). LightCastle has launched Poultry Tech Bangladesh onApril 1, 2021, in a PPP approach between the Netherlands and Bangladesh, where Larive-LightCastle is the collaborator from the Netherlands and the Bangladesh Breeders Association of Bangladesh (BAB) and Feed Industries Association Bangladesh (FIAB) are the conjoint collaborators (PoultryTechBangladesh, 2021; LightCastle Analytics Team, 2022). The representatives of Larive-LightCastle organised online training skills for the employees of the Bangladesh partners and organised training of trainers (TOT) model training for them in person to ensure proper knowledge transfer for one week with a target of conducting regional grassroots-level training for poultry farmers in May 2023 (Tribune Desk, 2023). This contribution of Larive-LightCastle could be a little but a starting point for the implantation of PPP projects in the poultry sector. On August 30, 2022, in the ‘Dutch-Bangladesh Knowledge Sharing Roundtable event, Gordon Butler, president of Gands Agri Consultants Co. Ltd., said that “the poultry sector is unique in comparison to global poultry industries. Hence, we cannot aim to replicate the practices of the global west, but instead we need to collaboratively come up with unique solutions that are relevant to the Bangladeshi poultry industry” (The Business Standard, 2022).

**Summary:** This chapter examines the poultry sector in Bangladesh, focusing on the roles of poultry farmers and veterinary service providers, particularly veterinarians, in the existing literature. It explores the development of veterinary education and job opportunities for veterinarians and discusses public-private partnerships (PPP) in neighbouring countries, particularly in the poultry sector. The chapter emphasises that PPP in the poultry sector is a new and promising approach for sector development, with few papers researching its opportunities in high-economic countries including a few papers from the neighbouring countries, of Bangladesh. The importance of this literature review is highlighted in the study ***"Mind the Gap: An Assessment of Scope for Collaboration between Public and Private Veterinary Services for Effective Disease Management in Bangladesh's Poultry Sector."***

# Chapter 3: Materials and methods

## 3.1. Semi-structured interviews

Semi-structured interviews were conducted with veterinarians working across Bangladesh to achieve the set objectives. The time span of the study was from June 2021 to July 2023. Separate semi-structured interview guidelines were developed for particular types of field veterinarians (e.g., public and private) in this study. As the study was conducted during the COVID-19 pandemic, the Zoom platform was used as a tool to meet the veterinarian in person and talked to him/her directly regarding study queries. The duration of every interview ranged from 1.5 hours to 3 hours (average: 2 hours). The semi-structured interview guidelines were developed in six main sections: a) Demographic information of the participants; b) Job description, facilities, and challenges; c) Relationship between veterinarians and farmers; d) Relationship between veterinarians and dealers, including other non-veterinarians; e) Relationship among the veterinarians; and f) About the public-private partnership concept—by digging deeply into each topic to obtain participants’ perception of concept of a public-private partnership. A format of semi-structured questionnaire guidelines used in this study has been appended in Appendix-Ⅰ. Later, the questions from the guidelines under each topic were adjusted accordingly during interviews using a semi-structured approach that allowed the interviewer to probe areas of interest as they arose from what participants said. A single researcher was assigned to structure these guidelines, which were mandated before piloting interviews and trailing interviews by the senior researchers of the study.

## 3.2. Participant selection and recruitment

A total of 62 field veterinarians participated in the study of which 48 veterinarians were involved in private poultry sector and remaining 14 veterinarians from public sector. The veterinarians who serve the food-producing animals travel to the location of the animal in a vehicle equipped for veterinary services in the field (Bowen, 2023). Covering all 8 divisions representing Chattogram (26), Dhaka (15), Khulna (7), Rajshahi (5), Rangpur (4), Mymensingh (2), Sylhet (2), and Barisal (1), veterinarians were selected across Bangladesh.

Some inclusion criteria were pre-set. The veterinarians were also classified based on where they worked and who they were employed by (Appendix-Ⅱ). During the selection of the veterinarians, their working zones, for example, poultry-dense regions, lowly poultry-populated areas, hilly regions, and riverine places were included in consideration. The locations of the veterinarians were emphasised because the responsibilities and working patterns of a veterinarian differ based on differences of the region and locality. Even depending on the production type of the chickens, the working pattern or idea of the veterinarian can be changed due to the differences in farming, and so the locations matter when selecting the participants for the study.

The veterinarians were also enlisted for the study depending on their years of experience, which also ensured variation in the institutions they were educated at. Most veterinarians were chosen based on their frequent or dedicated work with poultry. Some veterinarians who are not poultry practitioners have also been selected to gather information about the challenges of being a poultry practitioner and why they have chosen not to work with poultry. During the selection of the veterinarians, it was also kept in mind that the positions of the veterinarians should cover both junior and senior positions. For example, many veterinarians were newly hired in the company; some were still in the entry post, although they had several years of working experience, and some were in the most senior posts. Based on these criteria, participants were selected using convenient and snowballing sampling. Most veterinarians (n= 47) who participated in the study were conveniently selected based on the knowledge of a senior academic at Chattogram Veterinary and Animal Sciences University (CVASU), who was also a supervisor for this study. A smaller number (n= 15) was recruited using snowball sampling, whereby participants we were speaking with suggested other people we might want to work with as well.

The selected veterinarians were initially contacted over the phone, and then through email, they were updated about the Zoom link, interview date, and time. The interview date and time were preferred based on the convenience of the participant.

The demography of the participating veterinarians (Appendix-Ⅲ) indicates that 4 are female veterinarians and 58 are male veterinarians who are aged between 25 to 60 years, with a median age of 32.5 years.



Figure 3.1: A map showing the distribution of the veterinarians (public and private) across the Bangladesh participated in the study from June 2021 to July 2023

## 3.3. Data analysis

The interview recordings were manually transcribed into transcripts in verbatim form in English. The transcripts were read and re-read by the supervisor and co-supervisors of the work for probing and reviewing. After finishing the interviews, the transcripts were stored in MAXQDA *(the software is named after German sociologist Max Weber, and QDA stands for Qualitative Data Analysis)* for coding. Firstly, the analytical codes were developed in the deductive method following the pre-set themes of the study, which were then re-coded in the inductive method by following the findings from the codes of the deductive method. The themes were generated using the consolidated codes. The themes were described using some sub-themes for better explanation and connection of the findings in the result and discussion parts. The quotations used in the results sections were selected focusing on ethnographic principles, ensuring equivalent meanings.

## 3.4. Ethical considerations

Before all interviews, permission was taken to have the time and opinion for the study purposes from individual participants. By assuring commitment to avoiding sharing the conversation and securing the reservation of the personal identity of the participant, the whole interaction between the interviewer and respondent through a Zoom meeting was recorded. The participants were given full freedom to answer all the queries as per their willingness. To get a solid opinion regarding study queries, leading questions were also avoided. The study was approved by the Chattogram Veterinary and Animal Sciences University Ethics Committee [permit ref. no: CVASU/Dir(RandE)/EC/2023/551-1-2; date: 31/08/2023] Bangladesh.

# Chapter 4: Results

The results of this study have been organised based on three main themes that emerged from the analysis that would impact the potential for PPP for veterinarians working in the poultry sector in Bangladesh. These three themes are: (a) affiliations and key differences between veterinarians; (b) the role of non-veterinarians in veterinary provision; and (c) opportunities and challenges for public and private sector collaboration.

## 4.1. Affiliations and key differences between veterinarians

There are two main pathways that veterinarians tend to follow in their careers that influence veterinary provision in the poultry sector: becoming a private veterinarian working for a feed or pharmaceutical company, or becoming a government veterinarian. This study finds that there is less scope to serve poultry for veterinarians linked to government jobs than those in private companies. Veterinary provision is then informed by who veterinarians work for and their specific job designations. Another new trend of being a veterinary consultant dedicated to veterinary provision for poultry has been noticed in the study among the veterinarians. Such veterinarians do not require a public or private employer to work in this role; rather, they serve the poultry as a main or side profession.

The private sector companies recruit veterinarians into the technical section, marketing section, and diagnostic laboratories to serve poultry. The veterinarians are recruited as Technical Service Officer (TSO), Customer Service Officer (CSO), Executive Technical Service (ETS), Executive Customer Service (ECS), DVM Officer (DO), and Integration Sales Officer (ISO) in different companies and are required to provide veterinary provision to the poultry and poultry farmers. However, the veterinarians can serve clinically from the upper posts of the organogram after getting promotion; nevertheless, the promotional system in private companies is very irregular, according to the participant during the interview (Appendix-Ⅳ). Interviews with participants reveal their feelings that their affiliation can add value to their lives.

*“For getting a promotion, working in the marketing department is good for the veterinarians because the company arranges a structured organogram for the employees of marketing. The technical section of the company is laggy in this case. The technical officers do not get their promotions quickly due to the lack of upper posts.”*

*—PV-8, Private*

In the case of public veterinarians, duties are also defined according to their affiliation and specific position within the government as a veterinary surgeon (VS) or scientific officer (SO). The promotion system in the government system was also not as smooth as now. The recently passed organogram helps government veterinarians get promoted regularly (Appendix-Ⅳ). However, there are still some bureaucratic challenges in smooth promotion of government veterinarians.

*“After 7-8 years, I got the promotion to Upazila Livestock Officer. In the past, the veterinary surgeons got their promotion lately, like 10-12 years later. Till then, they needed to work on field tasks, mostly as veterinary surgeons. Now, this problem has been solved by a new organogram. Due to creating new empty posts, the employees are getting an early promotion within 4-5 years of service.”*

*—GV-1, Private*

The veterinarians working in private companies are categorically involved in feed and DOC-producing companies (FCs) and pharmaceutical companies (PCs). In FCs, the veterinarians have scope to work in the technical section, providing clinical service to the poultry farmers, and in laboratories for disease diagnosis with laboratory support. In many FCs, the veterinarians are also recruited in the marketing section. Similarly, in PCs, veterinarians are involved in both the technical section for administering veterinary treatment at chicken farms and the marketing section for increasing sales for the company. However, in PCs, veterinarians do not work in laboratories, as the companies do not have disease diagnostic laboratories like some FCs do.

On the other hand, in government, veterinarians get jobs in ULO and VH. The veterinarians working in ULO and VH as VS are responsible for providing clinical service, while the SO in FDILs undertakes disease diagnostics. In ULO and VH, there is another post for veterinarian designated as upazila livestock officer (ULO, a promoted post). Those working as ULOs are mainly responsible for administrative purposes along with being involved in poultry or animal treatment practices.

In addition to the public and private veterinarians described above, there is one additional type of veterinarian involved in providing veterinary services commercially to poultry farmers. There are private poultry consultants (PPC). These are veterinarians who provide dedicated consulting services to poultry farmers for a set fee. They often have a background of working in private and public institutes or independent entrepreneurship, sometimes maintaining multiple roles across these sectors simultaneously.

Depending on the type of employer and affiliation, the Bangladeshi veterinarians deliver their services in different ways, and it is necessary to describe their services to understand the scope of collaboration between the sectors and among the veterinarians. This section explores the key differences obtained from this study between private and public veterinarians who are involved in veterinary provision in the poultry sector of private and public industries in Bangladesh.

### 4.1.1. Outdoor vs. indoor service

Providing veterinary services at field-level is the foremost duty of the private veterinarians, whereas the public veterinarians mostly provide veterinary services from ULO and VH. Except for visiting farms, the private veterinarians sit in the dealer’s point or chemist’s chamber to provide veterinary services to their associated farmers. The public veterinarians do not sit at dealer points; rather, they have a distinct office for providing veterinary treatment to the chickens if they are brought to ULO and VH. However, private poultry consultants (PPCs) also provide indoor veterinary service to the poultry farmers from their own chambers most of the time.

*“I do not think that visiting a farm is important because I can sense the farmer’s pulse and know what he is going to say about the farm’s condition. I can get the answers to my queries by asking the farmers. I think to get an idea about farm management; an experienced veterinarian does not need to visit the farm.”*

*—ICV-1, Consultant*

### 4.1.2. Regular service vs. emergency service

The private veterinarians visit the selected and representative number of poultry farms regularly, regardless of whether the chickens are reported to be sick or not. Their regular task during these farm visits is monitoring the feed and chick quality, particularly if there are any complaints from the farmers related to these company products. They also give treatment to the chickens if the farmers ask for it during a regular farm visit. In addition to this regular oversight of affiliated farms, the private veterinarians also attend to emergency cases when they get calls from diseased poultry farms. Many FCs, like CP and Kazi, also have contracted poultry farms. Rather than being included in the regular rotation of farms visited by company field veterinarians, these farms will be the responsibility of particular private veterinarians. Despite their dedicated focus on contract farms, the duties of these veterinarians are identical to those of other company veterinarians. Some companies have demo or model farms, which also have almost similar services as contracted farms from those companies’ veterinarians. Private veterinarians from PCs and PPCs do not have this type of responsibility.

Comparatively, the public veterinarians usually do not regularly provide veterinary service to commercial poultry farms; rather, they visit farms in response to emergency calls or give treatment in emergency cases from ULO and VH occasionally. Besides, in their recently introduced annual performance agreement (APA), they have been assigned the task of visiting farms, and so sometimes they visit the poultry farms as a part of their duty.

*“Poultry farmers think that government veterinarians do not provide service to the poultry farmers or that there is no service for the poultry farmers in the government veterinary hospitals. So they do not come to upazila veterinary hospital.”*

*——GV-5, Public*

### 4.1.3. Phone call service vs. on-spot service

When veterinarians could not reach the farmers in person, all the participating veterinarians said they were able to deliver clinical services over the phone. Both private and public veterinarians served the farmers over the phone. More private veterinarians were connected with the farmers over the phone compared to the public veterinarians.

*“I did not provide treatment over the phone when I newly started my job because it is very risky and requires more expertise. But sometimes I get calls from such a remote place where providing treatment is impossible after visiting the farm. Though it is not logical, if I do not talk over the phone with the farmer in such a problematic situation on his farm, the farmer becomes mentally depressed and economically suffers. If at that time I suggest something to the farmer to maintain about the farm biosecurity, he feels interested in maintaining this. Besides, a suggestion of using an antibiotic over the phone makes the farmer feel relaxed about the disease condition on his farm. So, it is important to talk with the farmer about his needs and to give mental support as well. It is also important for developing good relationships with farmers.”*

*—PV-5, Private*

However, private poultry consultants (PPCs) prefer mobile phone even apps (e.g., WhatsApp) to communicate with farmers about symptoms and signs and dispense advice for treatment instead of visiting poultry farms in person.

*“At present, I provide consultancy on some larger poultry farms rearing 1,50,000 birds, 84,000 birds, and 2,50,000 birds. I have very few small farms to provide veterinary consultancy but I do not go to visit the small farms now. That is why I want to develop the “tele-medicine” app so that everyone can get an available treatment from me.”*

*—ICV-4, Private*

Despite this preference for most, there are some PPCs who oppose providing treatment over the phone. They said this was due to the decreasing quality of the treatment, saying they would prefer to receive the patients in their chamber.

*“Providing treatment over the phone or by seeing images (Messenger/WhatsApp) or on the internet is kind of a wild guess because there is no scope to understand the disease of the birds by hearing the description of the farmers.”*

*—ACV-2, Private*

### 4.1.4. Providing treatment through dealer vs. directly to farmers

The private veterinarians provide veterinary services mostly through dealers, while the public veterinarians work more with poultry farmers who seek treatment directly in ULO and VHs. The private veterinarians working in PCs also have a channel to reach their farmers via sales representatives (SRs) of their companies and dealers who purchase feed from their companies. Private poultry consultants (PPCs) provide treatment directly to their connected farms by visiting the farms or from their own chambers. Most participating PPCs in the study believe that their dedication to working for poultry at the field-level, and subtle skills in poultry treatment has helped them develop their career with reputation among poultry farmers. Notwithstanding these, a few PPCs acknowledge their mentors or any media (e.g., learning sources, even dealers and SRs) who are to lend a hand in their career as PPCs.

### 4.1.5. Free veterinary service vs. paid veterinary service

Participants claimed that private veterinarians provide free veterinary services at farms or from a dealer’s point. Public veterinarians also provide free veterinary services when their care is sought at ULO and VHs. However, they reportedly charge for services whenever they visit a farm outside of office hours, as providing veterinary service except for office hours is not included in their official duties. The private poultry consultants (PPCs) have a fixed fee for their services according to the production type of the poultry.

*“As visiting farms is a regular task of the government veterinarians, I do not take a fee if I visit a farm during my working hours. But if I provide service to the farmers during the off-day or after the office hours, the farmers give me 200 BDT for the postmortem and prescription.”*

*—GV-10, Public*

### 4.1.6. Treatment vs. laboratory service

In private and public institutes, both types of veterinarians are found who are involved in providing either veterinary treatment or laboratory (lab) services exclusively. While both services are technically available through different veterinary services, fewer laboratory facilities are available in public institutes than in private companies, according to the veterinarians interviewed.

Different companies’ laboratories offer different types of laboratory services according to their business strategy (Appendix-Ⅴ). The private veterinarians working in the regional laboratories of the companies primarily focus on increasing the acceptability of laboratory service among the farmers and growing the company’s customer base in their region. For veterinarians working in more central labs, their work focuses more on the improvement of company-associated GP stock, PS, integrated broiler or layer farms, and quality improvement of company products (dressed poultry, feeds, and DOCs). However, the service is limited, and the field private veterinarians cannot always ensure laboratory facilities for marginal farmers.

*“Generally, the company considers its profit at first. The company will set up the laboratory in a region of large sale. To increase its sales and to keep the quality of the company’s service, they organise a laboratory.”*

*—FV-9, Private*

There is also a lack of laboratory facilities in ULO and VHs, so the public veterinarians are not required to do same tasks as the private veterinarians working in the lab. However, the public veterinarians from FDIL perform laboratory tests, which are especially required for any government-assigned project or surveillance programme. They are not involved in regular testing like the private veterinarians do in their regional labs.

*“We cannot facilitate the farmers with a laboratory test though they want to do laboratory tests and pay for them.”*

*—GV-9, Public*

### 4.1.7. Performing postmortem vs. not performing

Postmortems are a popular diagnostic process employed by veterinarians of every type in this study. While this process is useful for identifying the cause of death or types of disease present on a farm, postmortems are not performed every time a farmer seeks advice from a veterinarian. This decision can be based on farm type or the means of veterinary provision. For example, while both private and public veterinarians perform postmortems of diseased chickens to diagnose diseases, public veterinarians from ULO and VH do not perform postmortems on backyard chickens. Participants described their reason for this being that the number of birds on backyard farms is so limited that doing a postmortem on just one sick bird would have a negative impact on the farmer’s income.

*“We do not prefer to perform postmortem of the backyard birds because the backyard farmers rear 5-7 birds in their houses. So, it is not profitable for them to perform a postmortem of the birds (sick birds) for disease diagnosis.”*

*—GV-5, Private*

Sometimes private veterinarians also provide treatment without performing any postmortem, but rather by visiting the diseased farm. While this work can be done without a postmortem, participants described how farmers usually prefer to one.

*“Every farmer wants to have his birds treated following a postmortem assessment. They will not be happy if I give a prescription by seeing the birds without performing a postmortem, even if the farmer brings a live bird. They want me to kill the live birds for a postmortem of the birds and then to give a treatment.”*

*—ACV-2, Private*

### 4.1.8. Differences in farm data record system

Private veterinarians are more involved in real-time data collection from the farm level than public veterinarians (Appendix-Ⅶ). Also, it is a regular task for the private veterinarians working in FCs. They influence the farmers to maintain a record-keeping sheet for their farming benefits. Henceforth, from FCs, the private veterinarians supply farm record-keeping sheets to the farmers for recording information regarding mortality rate, body weight, and amount of feed intake, farm management, disease incidence, vaccination, and medication regularly. The private veterinarians from FC laboratories also collect data regularly. In contrast, private veterinarians from PCs and PPCs do not collect data from farms.

The public veterinarians also have an assigned task of data collection manually, and they have newly introduced software, named BAHIS (Bangladesh Animal Health Information System), to store the data. The VS of ULO and VH is responsible for data storage in both ways, while it is enough to store data manually for SO.

*“We need to enter data in BAHIS. But we cannot do this. It is true that, due to excessive workload and a lack of manpower, we cannot be able to store data in BAHIS. We have informed the authority about the limitations of the BAHIS. It is not user-friendly software... I enter the data only for keeping my performance okay.”*

*—GV-3, Private*

### 4.1.9. Differences in prescription

Prescription writing varies among different types of veterinarians. To make a rational prescription, having freedom of medicine selection is very important. In this regard, public veterinarians are more independent than private veterinarians. Many times, private veterinarians are encouraged to prioritise prescribing certain medicines over others. This is often a consequence of the core affiliation private veterinarians have with their employers. For example, private veterinarians who work in PCs are more bound to prescribe medicines from their companies, while private veterinarians in FCs can prescribe from a wider range of pharmaceutical companies depending on the quality and necessity of a diseased case.

*“About 70-80% of medicines I keep from my company, as I am an employee of this company. I prefer the medicine of other companies when I need to prescribe a medicine that has no supply from my company or when I am prescribing from such an area where there is no supply of certain products from my company.”*

*—PV-9, Private*

However, private veterinarians from FCs can also be biassed in providing prescriptions in different situations; for example, the veterinarians may prescribe the medicines from a PC if they are privileged by that company.

*“2-3 marketing representatives of the pharmaceutical companies always stay with me. They carry me on their bikes. For this service, I may prescribe medicine from his company if it becomes feasible to do so.”*

*—PLV-1, Private*

In addition to their company affiliation, private veterinarians prescribe medicines to the farmers according to the dealers’ recommendations and farmers’ demands. These preferences might be influenced by what a dealer stocks in their own shop or what farmers have heard from other farmers they trust.

*“Sometimes, dealers ask the veterinarian, “Why did you prescribe this medicine? It is not available in my shop.”*

*—PV-2, Private*

*“My experience says farmers like to have a prescription full of medicine. So sometimes in healthy farms, just to satisfy them, I prescribe normal growth promoters and vitamin syrups.”*

*—FV-10, Private*

Unlike these other veterinarians, private poultry consultants are rarely influenced by all these reasons; nevertheless, their prescriptions are highly valued by the farmers. On the other hand, the public veterinarians prescribe the government-supplied medicines in ULO and VH to the backyard chickens and recommend commercial poultry farmers purchase the prescribed medicines from any veterinary dispensary as they do not have a sufficient supply of medicines for commercial farms, and the medicines for commercial chickens are also different from those of backyard chickens.

*“We do not provide medicine to the commercial farmers from upazila veterinary hospital because the available medicine in the hospital does not match the disease of the commercial birds. I provide the medicines from the hospital mostly to the backyard farmers.”*

*—GV-7, Public*

### 4.1.10. Suggesting about biosecurity measures

The private veterinarians give suggestions regarding farm management, biosecurity measures, and vaccination protocol while they visit farms and identify any deviations in farming or disease occurrences on the farms. As the public veterinarians do not visit the farms regularly, whenever the poultry farmers bring chickens to ULO and VH for treatment purposes, they also tell them about farm management and biosecurity measures. However, the involvement of private veterinarians is more engaging than that of the public veterinarians in making farmers concerned about farming and biosecurity measures. Some programmes, such as personal counselling, training, motivation, and developing demo farms to create instances for the demotivated or less experienced farmers, are organised more by the private veterinarians while the public veterinarians organise a few trainings to inform them about the biosecurity measures of poultry farms. Both private and public veterinarians are optimistic about their continuous exertion to introduce biosecurity measures at the farm level. However, they also have an opinion to bring about changes in circulating biosecurity practices at the farm level. While public veterinarians are more likely to be satisfied when they see a bottle of disinfectant or a pair of sandals, some private veterinarians have described this as good progress but feel more work is needed to prevent the introduction of diseases.

*“When I started providing service to the farmers, they did not know about biosecurity. Even they did not hear about the word “biosecurity”. But now the farmers are very well known for this. At present, a bottle of disinfectant or spray will be seen on every farm, which was not present when I joined the service. So, we can say development has occurred. But the thing we need is more training for our farmers.”*

*—GV-6, Public*

### 4.1.11. Suggestions about vaccinations

Both private and public veterinarians claim that when poultry farmers come to them to receive treatment, they provide them advice on vaccination poultry and a schedule of vaccinations based on the type of poultry production. Public veterinarians generally deal with backyard chicken cases. They prepare a list of vaccines, including schedule of vaccine administration, dosage, route of vaccine administration, and price, mainly for livestock instead of poultry.

*“The backyard farmers take the vaccine from us. We have a hanging list on the wall of upazila veterinary hospital mentioning the vaccination schedule and the cost of the vaccine. The farmers can take a picture of the festoon or write the schedule from the festoon. I tell the farmers to take the picture to collect the vaccine and to store it in the freezer.”*

*—GV-7, Public*

Private veterinarians especially poultry consultants, are more subtle in providing a vaccination schedule to their poultry farmers. However, the private veterinarians from FCs and PCs also suggest the farmers administer vaccines to the chickens either following their schedule or the company-given schedule.

*“In the past, I prepared the vaccination schedule for day-old chicks to matured birds for farmers. But now I do not do this. At present, in my zone, lots of private company veterinarians are working who provide vaccination schedules. If any farmer comes to me for the vaccination schedule, I tell him to bring the vaccination schedule of the company from whom he has received his chicks. I will adjust the schedule for him because the vaccination schedule is not fixed for the birds.”*

*—GV-6, Public*

*“We provide the vaccine guidelines from our company in our different training sessions. We provide a booklet regarding this issue. At the age of 5, 10, 15, and 20 days of the broiler birds, I suggest providing Gumboro, Ranikhet, Gumboro, and Ranikhet, respectively.”*

*—FV-10, Private*

### 4.1.12. Differences in actions during disease outbreaks

Private veterinarians play a more active role during a disease outbreak situation at field-level. They take some steps when they know about a disease outbreak in any region. Especially, the private veterinarians from FCs suggest the dealers instruct their associated farms about the dangers of diseases and say about strengthening the existing biosecurity protocol during an outbreak in the locality to save a healthy flock from the disease. No other types of veterinarians (neither public veterinarians nor consultant veterinarians) usually do this.

*“There is no assigned job from our company during outbreak situation. But when there is a disease outbreak, I personally make my dealers concerned. As they will know well about their associated farms and the disease condition of the farms, because the dealers are directly connected with the farmers’ loss and profit, I tell them to monitor their associated farms’ biosecurity and to discard the dead birds properly.”*

*— FV-2, Private*

During a disease outbreak at field-level, private veterinarians provide treatment by keeping in mind the loss or profit to the farmer and explain the prognosis of the case to the farmer. Avoiding visiting farms, they provide treatment at the dealers’ points during an outbreak situation. They tell farmers to sell the non-diseased chickens of the affected farm before the death of the whole flock, and they also suggest deep-burying of the dead chickens.

*“Truly speaking, I suggest farmers sell their birds of less than 20 days of age immediately if I find the ND signs (after confirmation by postmortem) in their birds, because ND can kill whole flocks within a few days…I tell farmers to bury the birds but they do not follow this. They throw the birds in the surroundings, and stray wild animals like dogs and foxes eat up those. The farmers stay very upset about the huge mortality on their farms. In this situation, they do not want to dig the soil to make a hole and put the birds. They have a tendency to think that our farms are facing losses. Why will we bother or think about others?”*

*—FV-14, Private*

The private veterinarians from FCs and PCs both do the aforementioned tasks during a disease outbreak situation at field-level where the involvement of private veterinarians from FCs was greater than that of the PCs’ veterinarians. Moreover, the private veterinarians from PCs mostly work to increase the sale of some specific company products targeting certain periods of the year according to disease burden.

*“In general, there is an increase in Mycoplasmosis outbreaks during the winter season. To check for mycoplasmosis, our company has Stiagen containing Tiamulin Hydrogen Fumarate. It works well against mycoplasmosis. Like these products, our company has more rational and popular medicines. The company sets a target for these products’ sales, pointing to seasonal outbreaks or disease occurrences. The company gives us targets of four products’ sales at a time. To get the incentive from the company, I need to fulfill the 100% target for individual four products.”*

*—PV-2, Private*

On the other hand, private poultry consultants (PPCs) also provide treatment and suggest selling the chickens before the death of the whole flock as the private veterinarians from FCs and PCs do.

*“During a disease outbreak, I tell farmers that their birds will not recover from the disease. So, they should cull (which means sell) the birds, while we should tell the farmers to bury the birds. But we do not tell this.”*

*—ACV-1, Private*

During the outbreak at field-level no active action has been seen from public veterinarians. Several public veterinarians posited that they do not get information about disease outbreaks at field-level on time. Conversely, they acknowledge that they hide the outbreak occurrence field-level because of a long and complex confirmation process that is required to help out the marginal farmers with compensation. At the same time, when the government can find a farmer selling sick birds, they are taken to task. Therefore, the public veterinarians stay quiet about the field issues about disease outbreaks.

*“We cannot take any initiative during a disease outbreak situation. We can only investigate the case and find out the causes of the disease occurrence while the department assigns us for this.”*

*—GLV-3, Public*

As a result, private veterinarians do not want to inform public veterinarians about disease outbreaks at field-level. Even on occasions when a private veterinarian informs public veterinarians about a disease outbreak, they are deprecated by the government body.

*“I do not notify the DLS about the disease outbreaks at field-level because after receiving a case of Avian Influenza, I must refer the case to FDIL. They will misinterpret the disease and indicate ND. They do such practices intentionally, and they do not want to expose the occurrence of Avian Influenza at the field-level. The government wants to keep the country free from Avian Influenza. But in reality, they are doing nothing to prevent the disease; instead, the government tries to hide the cases.”*

*—PV-9, Private*

*“Once upon a time, I diagnosed Avian Influenza on a farm and made an oral statement about it. The farmer published the occurrence of Avian Influenza as an article in a newspaper. Then, all details of the disease’s occurrence, like the location of the farm and the farmer's name, were brought to light, including my name, as I diagnosed the disease.* The ULO of that upazila got to know about it and called me, asking if I had written the disease's name and if I could have claimed information about this disease's occurrence. Also, the ULO told me that I was not authorised to expose this.*”*

*—ICV-2, Private*

### 4.1.13. Differences in ethical practice

The private veterinarians working in the field follow some biosecurity procedures, such as: wearing a mask and gloves; changing shoes before entering poultry shed; using shoe covers inside the shed; keeping an extra shirt for visiting the shed; taking a shower after visiting a viral disease-affected farm; and using hand sanitizers. The private veterinarians working in FCs associate central or regional laboratories also maintain distinct laboratory biosecurity practices, including wearing proper personal protective equipment, laboratory safety protocols, and waste disposal systems. In contrast, public veterinarians reported using fewer biosecurity procedures when they visit any poultry farm. In fact, they rarely visit the poultry farms.

*“I usually wear an apron, a mask, and hand gloves. If I don’t carry hand sanitizer by myself, I ask the farmers to share their sanitizer. But if I find viral disease (ND, IBD) on the first farm, I don’t go to the other farms after that. I rescheduled the farm visits for the next day.”*

*—FV-10, Private*

*“I do not wear the apron. We need to wear Lungi (a Bangladeshi cultural outfit for men) during handling delivery and prolapse case at farms.”*

*—GV-12, Public*

### 4.1.14. Differences in training provision for farmers and non-veterinarians

The private veterinarians have reported having greater involvement in training provision for farmers than the public veterinarians (Appendix-Ⅶ). This is because the FCs and PCs where the private veterinarians work are more concerned about the training for the farmers. The FCs allow their veterinarians to organise training at the field-level targeting the company-dealer-associated farmers along with the dealers. Apart from the farmers, private veterinarians also train the vaccinators and sales representatives (SRs) of the company, if there are any. Usually, private veterinarians from FCs do not work more with the salespeople, but one company has been found among the participants in the study that supplies both feeds and medicines except for DOCs, and the veterinarians of that company therefore train the SRs dedicated to medicine marketing. A few FCs incentivize their veterinarians to arrange the training. The training organised from FCs encompasses every topic regarding poultry farming. The model farmers among the participated farmers are also rewarded in these trainings for being able to maintain the progress and farm profit by following the given instructions properly. The farmers are provided with handouts, notepads, brochures, and lunch during the training.

*“The farmers who participate in the training are our company dealer-associated farmers, who take products (feeds and DOCs) from our company. The dealer does not want to allow other farmers from different dealers to participate in the training because there is a business relationship between dealers and farmers. They try to increase the farmers by showing them that the farmers will get free training facilities about farming if they deal with that company dealer.”*

*—FV-14, Private*

On the other hand, the training organised by private veterinarians in PCs are different from those in FCs. The private veterinarians are required to train mostly the SRs of the company, rural veterinary practitioners (RVP), known as *pollichikitshok* or quacks, along with the farmers. They do not have an organised pattern of training for the farmers like most FCs do. Generally, the human resources (HR) department of the PCs organise most of the training programmes at field-level for the farmers and RVPs through the veterinarians working in the HR department, while the SRs are trained by the veterinarians of the companies. Another major difference from that training is that they organise such training for the farmers and RVPs to introduce a new medicine or to promote the company’s regular medicines. Apart from this, through training, many PCs allocate their HR department to prepare their salespeople in a way that they can act exactly like a veterinarian at the farm-level.

*“T*he availability of poultry practitioners' services in our industry is extremely limited. *Except for some specific farms, institutions, and organisations, veterinarians do not provide service to our marginal farmers. So, in rural and remote places, the people who understand poultry diseases or have experience working in the poultry sector are given suggestions by us or their neighbours regarding birds’ diseases. They do not prescribe but recommend the medicinal product to use. The number of such people (quack) is large. Our non-veterinarian personnel in the marketing department always work to promote our products properly. So, we try to train our non-veterinarians to become a bit more knowledgeable about poultry disease and medication and take examinations. We also monitor their field tasks regularly. I can claim that our officers are more knowledgeable and experts about poultry disease and medication compared to any other company in Bangladesh. They can present the products or solve the problems of the farmers as, like, a prescriber.”*

*—PV-7, Private*

Then private poultry consultants’ (PPCs) training activities are intriguing because they offer paid course system training both online and in person for farmers and fellow veterinarians. Some private poultry consultants (PPCs) also get sponsored by the FCs and PCs to organise training for the farmers who are connected with the company. Some of them train certain groups of people to develop their skills in vaccination so that they can vaccinate the farms where they provide treatment.

*“I*f farmers come to me for farming advice, I guide them and charge an honorarium. *In this case, there is no involvement from the dealers. Farmers directly come to me for training, and I admit them to the course with a fee...If the training programmes are arranged by different companies, I do not take honorariums from the farmers or companies. I make it happen to advertise my chamber.”*

*—ICV-4, Private*

In contrast, some private poultry consultants (PPCs), along with a job in a private company, or academy, or government sector, do not involve themselves in training that much; however, they train veterinarians mostly being the resource person in the seminars or workshops of any project or private company.

*“CP and another large international feed company invite me once per month to provide training to the veterinarians of these companies. I train them to perform postmortem and prescription writing. I try to transfer my knowledge to them, and they pay me for this a good amount…I also want to mention one of the tasks for the farmers. I arrange some training programmes for the farmers. I try to help them, and so I arrange a training programme for them, selecting 10-20 farmers. I tell them about the biosecurity measures, or vaccination schedule or other matters related to poultry farming. I can also manage a private company to sponsor the subsidiary cost of the training programme for them.”*

*—ACV-3, Private*

However, many consultants have different opinions about attending the workshops or seminars of private companies because this is also a way of promoting company products on behalf of the company.

*“I never attend the training programmes arranged by different companies, and if any company tells me to attend as a guest in a programme promoting any product, I do not go there.”*

*—ACV-1, Private*

There are two types of training for poultry farmers that the public veterinarians organise: backyard meetings and upazila-to-community (U2C) programme. According to their APA (20-25 training per year), they try to conduct at least one backyard meeting or U2C programme. This arrangement also trains the veterinarians about how to provide training in a participatory way. They get remuneration for organising such field-based training. The veterinarians expressed a positive attitude towards this training and claimed that the programme could be better with more manpower.

*“Not only we work with the backyard farmers but also arrange programmes with the commercial farmers. U2C is a great project. But we cannot do all activities accordingly due to the lack of manpower.”*

*—GV-3, Private*

### 4.1.15. Veterinary engagement with antimicrobial resistance

Private veterinarians are more involved in veterinary provision for poultry farmers, which impacts antimicrobial resistance (AMR) more than Public veterinarians. Often, private veterinarians working in FCs and PCs comply with the dealers’ demands, causing inappropriate medications with the fate of AMR development. Some farmers also want only antibiotics in their prescriptions while there is no need for antibiotics for their chickens, deteriorating the quality of the prescription. Some private veterinarians from FCs reported prescribing from their connected PCs for incentive while the private veterinarians from PCs are inclined towards their company products, causing unnecessary medications. Even the public veterinarians and PPCs prescribe medicine to their connected PCs, with whom they have a deal of incentive.

*“My farmers of my company dealers and other company dealers prefer my treatment service. However, there is a problem among dealers: that they want more and more available medicines of their shops to be prescribed. For example, once upon a time I sat at one of my company dealers’ point regularly. But now I do not visit his point without urgency and he never calls me because I prescribe less medicine. Even he made a complaint to my company in charge about this issue. Then I stopped to guide the dealer.”*

*—FV-9, Private*

*“Marketing is the purpose of private companies. So, private companies invest in incentivizing veterinarians to increase company profit. When I got an offer of incentive, I refused to take it. Then the company representative told me that if I did not take the bundle, they would give it to any other quacks. This is a way of promoting quack. Poultry practitioners prescribe more nutritional products in the prescriptions when they do not have any need to prescribe them due to incentives. I think that getting the incentive is our right as veterinarians.”*

*—GV-3, Public*

The private poultry consultants (PPCs) generally get cases that have been administered different medications multiple times, which makes the PPC prescribe using the banned either combined or broad-spectrum medicine (antibiotics or other antimicrobials) at a higher dosage with the purpose of healing the sick chickens and benefitting the farmers who come to the veterinarians with a hope of better treatment.

*“Farmers go to the dealers or medicine shops at the first stroke of disease. While they fail to identify or cure the disease, they refer the farmers to private company veterinarians. When the private company veterinarians cannot solve the problem, the farmers come to me for treatment. Very few farmers come to me for treatment at the beginning of a disease. This is a problem that farmers come to me with after trying all of their probable treatment. As a result, my choice of drugs for prescribing has decreased. For this reason, sometimes I cannot provide treatment with a single drug or medicine. I need to prescribe combined medicines in excessive doses without thinking of AMR.”*

*—ACV-2, Private*

Beyond all these, private veterinarians play a more active role in reducing the aforementioned problems than public veterinarians because not all veterinarians commit these malpractices regarding antimicrobial usage (AMU), and the veterinarians who are liable for causing unjust AMU have some valid compulsions. The private veterinarians personally counselled the farmers about the adverse effects of irrational antibiotic use and the economic benefits of using less medicine. To avoid AMR, many veterinarians do not prescribe antibiotics before selling, or if any veterinarian prescribes antibiotics before selling, he tells the farmer to sell the birds after one week of medicine application.

*“The farmers have less knowledge about medicine and AMR. I try to explain to them about drugs and antibiotics by using many examples, such as when I tell them, "If we use the bullet before the enemy appears, the gun will be empty and useless for the dangerous time. If we use antibiotics or medicine unnecessarily, then it will not have any positive result at all."”*

*—FV-5, Private*

*“*At 25 days, I do not prescribe antibiotics, even though some birds die at this age. *Rather, I administer alternative medicines for the symptomatic treatment.* In this case, I make a calculation for the farmers. *Suppose I tell them that if he applies the antibiotic, it will cost 10,000 BDT and if he does not, the loss will not be like this amount. I can assume how many birds can die in a diseased flock based on the severity of the disease. I tell my farmer that if you do not apply antibiotics at this stage, you may have a loss of 3.000-4,000 BDT of birds, but the medicinal cost will be more than that. If you use antibiotics now, the bird’s body weight will decrease and due to higher medicinal costs, you will not be able to make a profit. Maximum farmers follow this suggestion.”*

*—FV-20, Private*

## 4.2. The role of non-veterinarians in veterinary provision

The relationship between a veterinarian and a farmer is essential because when the farmer spots an unusual condition on the farm, veterinarians provide a key means for getting treatment for their farm. However, communication between poultry farmers and veterinarians is not always direct and linear, and this relationship is often mediated by other stakeholders who are employed or connected with different service providers (public and private). Along with the activities of private and public veterinarians towards poultry farmers, results from this research have revealed the significance of the involvement of another type of stakeholder in poultry farming activities and chicken treatment processes who are basically non-veterinarians. Additionally, non-veterinary actors, such as dealers, salespeople, neighbouring farmers, vaccinators, and veterinary field assistants (VFA), are all revealed to influence farmers’ access to veterinarians and how they respond to disease to different extents. The following part of the results describes the roles of non-veterinarians connecting with the veterinarians in the study.

### 4.2.1. The involvement of dealers in veterinary provision

Participants revealed that farmers who work with dealers reach out to these dealers first when they notice signs of any disease on their farms. They expressed concerns about this deviation from direct veterinary provision at the field-level. However, farmers have their reasons for seeking support from dealers in this way. Namely, at field-level the private veterinarians are the legitimate veterinary service providers who are more active in the field than the public veterinarians; nevertheless, their excessive workload and intention to benefit the company make their service quality sometimes poor.

*“Gumbora and Ranikhet are endemic in birds, but the farmers do not seek consultancy from the veterinarians for these diseases. They take the medicines from the dealer’s point usually as they know the signs, symptoms, postmortem lesions, and treatment of the disease. They can provide treatment against the disease of the Gumbora and Ranikhet with the help of dealers.”*

*— PV-8, Private*

In addition to not always seeing the need for professional veterinary input, some participants noted that the power relationship and dependency some farmers experienced with dealers due to their credit relationship put farmers in a difficult position—unable to refuse their feed dealer’s advice, even if they would rather seek veterinary support.

*“Most commercial farmers are more helpless than backyard farmers because farming is the main profession of commercial farmers. They collect all the ingredients from dealers in credit, like feeds, chicks, vaccines, and medicines, and somehow build a shed for rearing the birds. They are said to repay the money after selling the birds. As the dealers are spending on the investment of the farmers, he can force the farmers to listen to his command to use medicines. The farmers will also obey the commands of the dealers as they get money and support for farming from them. Whoever I am, I may be a veterinarian, but the farmers will not give importance to my advice because I am not supporting them by paying or giving them money for their business.”*

*—GV-9, Public*

Participants also described how dealers became an issue when they provided veterinary services to the farmers, including prescribing medicines. Even so, they never hesitate to change a prescribed medicine by a veterinarian with an excuse of the unavailability of a given medicine, and they practice this more in the case of credit farmers being judgmental. For this reason, they are being recognised as a quack in the poultry sector, which is alarming for the dealership profession. Many veterinarians wanted to restrict operating capacity up to a certain level through government intervention.

*“Dealers and marketing representatives of pharmaceutical companies play the role of the quacks in the poultry sector. Farmers go to them for treatment, and then they come to us when the treatment fails to recover the birds. They abuse the antibiotics. When farmers come to us for treatment, it becomes difficult for us to provide them treatment with simple medicines.”*

*—ACV-1, Private*

### 4.2.2. Sales representatives influence in veterinary provision

Both FCs and PCs dedicated to the Bangladesh poultry sector employ people in marketing sections who get the entry post as sales representatives (SR) and marketing officer (MO), who work mainly at field-level, travelling from one dealer’s point to another. The SRs of PCs also visit poultry farms. They move frequently from one place to another with the intention of increasing the sale of their company’s feeds and chicks or the sale volume of their company’s medicines. In this situation, the companies, especially PCs, require proactive and proficient salespeople and at one point, they want their SRs to compete with a veterinarian at the field-level. They utilise their salespeople in veterinary provision where the veterinarians cannot reach or in the absence of the veterinarians in any region. But an SR cannot replace a veterinarian, no matter how skilled he is in handling the field cases because every clinical case is essential to dealing tactfully with the particular service provider—according to the sentiment from the veterinarians’ interviews.

*“In the past, farmers could not make a differentiation between the veterinarians and the sales officers. Now, farmers know the veterinarians working, as we are providing quality service from farm to farm. Besides, when we visit the farms, we concern our farmers about the mistakes in the prescriptions made by the sales officers. There is a variation in service provision between the veterinarians and sales officers. Some medicines, like Amoxicillin and Renamycin work in every case. The quacks generally prescribe such types of common drugs in the prescriptions, whereas we (the veterinarian) try to provide specific medicines for specific diseases.*

*—FV-21, Private*

However, many veterinarians believe that limiting the functions of the salespeople up to promoting and transferring details about the medicines to the veterinarians and pharmacists of the medicine shops could be beneficial service of the salespeople for the poultry sector.

### 4.2.3. Influences of other non-veterinarians

Barring the dealers and salespeople, there are some other unconventional service providers influencing the treatment and diagnosis of diseases on poultry farms, such as neighbouring farmers, vaccinators and assistants working with veterinarians. All the stakeholders mentioned in the poultry sector are responsible for delivering service to the poultry farmers to some extent.

If a poultry farmer is new to the sector, they reportedly take preliminary suggestions for farm setup and input from their neighbouring farmer. In fact, such experienced neighbouring farmers may also get involved in veterinary provision, becoming the first port of call for some farmers before dealers or veterinarians.

*“*When a farmer encounters a disease on his farm, he first tries to treat it with antibiotics by himself*. Later, he will consult his neighbouring farmers. Then he will go to the dealers; dealers will do treatment; when they all fail, they will come to me.”*

*—FV-13, Private*

Vaccinators are another type of unconventional service provider. These are actors who perform their specific job of administering vaccines but most of them are general people who have only learned to administer vaccines by seeing it done by others and without any institutional certificate or education. None of the participants in this study reported vaccinators expanding their influence beyond vaccine administration, thus not influencing other aspects of veterinary treatment. Despite their focused work, participants still expressed concern about the negative impact these vaccinators could have on disease spread.

*“*We recognise the vaccinators, but there is no dedicated training facility for them. *They just know about the process of vaccine administration. They do not know about other points or protocols regarding vaccinations like cool chain maintenance of the vaccines. They may provide vaccines on 2-3 farms in a day. This process may spread diseases from one farm to another.”*

*—FV-14, Private*

Another non-veterinary actor who has some influence over the provision of services to farmers is the assistant private poultry consultants. Private poultry consultants (PPCs) often reported having attendants in their chambers for additional support during a case or to cover their absence and serve farmers when PCCs are unable to themselves. Some PPCs train these assistants about performing postmortems so that, in their absence, these assistants are able to perform the postmortem of a chicken and can provide treatment with the PPC’s permission. They are also trained in medicines so that they can sell them from the medicine shops. The farmers benefit from their services, and PPCs think they are not having a negative influence on professional veterinary provision.

*“The employees are trained about the medicine names and the generic names of the medicines so that they can sell the medicine to the customers. By following my prescription, they only provide the medicines to the customers. At present, whenever the farmers come to the shop and want to take treatment from me, I provide them with veterinary service over the phone through video calls. I do not make the employees skilled in performing postmortems because in this way I will prepare a quack by myself.”*

*—ICV-4, Private*

## 4.3. Opportunities and challenges for public and private sector collaboration

Although veterinary service provision exists for poultry farmers in Bangladesh from both public and private veterinarians, gaps in existing service provision could be bridged through a collaborative approach between the private and public poultry sectors. Some activities have been continuing for the betterment of the chicken enterprise at a national, collaborative, and independent level, where a tweak among all efforts can be summoned to coordinate and synchronise the activities. This last part of the results captures the existing challenges and opportunities identified by participants at both a national and independent level for possible collaboration.

### 4.3.1. Increasing veterinary provision for poultry farmers through collaboration

Even after the involvement of private and public veterinarians in veterinary provision for chickens, poultry farmers do not always have access to veterinarians when they require their expertise. From the aforementioned results, it can be said precisely that some existing challenges are making it difficult for both types of veterinarians to ensure healthy and functional veterinary services for poultry farmers. These challenges are different for private and public veterinarians. For instance, the major challenges, private veterinarians face in veterinary provision for poultry farmers are excessive workload and company-benefit-oriented service, while public veterinarians mention the limited number of veterinarians in government institutes for different level of multitasks.

Reputation is also a limiting factor that participants describe as influencing their capacity to work with farmers. The lack of reputation at field-level that private veterinarians struggle with is a consequence of excessive workload. Lack of reputation hampers the service quality of the private veterinarians, and farmers become ignorant about the veterinary provision from the private veterinarians. On the other hand, due to their social recognition and administrative power as government employees, public veterinarians do not report facing difficulties based on reputation like private veterinarians working at the marginal level do.

Results from the interview demonstrate that some private and public veterinarians have negative impressions of the others’ service provision, which could impact their willingness to collaborate in the future. For example, many private veterinarians claim that public veterinarians promote the non-veterinarians where they cannot go for a visit or service provision whether that is a cattle farm or a chicken farm, instead of referring the patient to a private veterinarian. Defending why public veterinarians prefer quacks for any case handling instead of a private veterinarian, public veterinarians assert that private veterinarians are required to be more skilled as they are not dependable for handing over a case to deal with. Additionally, according to the public veterinarians, the private veterinarians should develop their skills and ethics for working at the rural level.

*“Sometimes, I tell the farmers to take fewer consultancies from the company veterinarians because the company veterinarians have pressure to prescribe medicines for their companies to increase company sales. As I have worked in private companies before the government service, I know this. If a private veterinarian does not prescribe a large number of medicines, he will not be able to sit in a dealer’s point. In the case of the government, we do not have such bindings…A conflict arises between private and government veterinarians due to quacks. Private veterinarians believe they will provide treatment at the field-level, while government veterinarians are responsible for promoting them to farmers. However, it is not possible because I am the only veterinarian in the ULO and VH, along with other educated staffs, who have the advantage of providing treatment to farmers. Despite this, new private company veterinarians lack experience and cannot compete with ULO and VH staff. The conflict arises from private veterinarians believing government veterinarians do not promote them to work at the field-level, but instead provide access to their VFA without fines. I need to maintain connections with quacks because they can go to places where we (private and public veterinarians) cannot go to provide veterinary treatment. If I do not keep a connection, I will not be able to save my job as I will not be able to provide treatment to all animals.”*

*—GV-3, Public*

While most veterinarians from both sectors talk about existing incoordination of veterinary provision, many public veterinarians show guardianship in their locality and expressed their perception about the progression of the poultry sector by working together with the private veterinarians and mentioning their dedication towards veterinary provision at field-level. Even many private veterinarians admit that they need to keep good relationships with other private veterinarians from different FCs or PCs because it is helpful that when they cannot reach a farm for veterinary treatment, they can refer the case to another veterinarian who is known to them while the other veterinarian can also deal with the case if it is nearby his working region. Even a few public veterinarians do the same thing. They refer cases to private veterinarians instead of another public veterinarian. However, the ambit of chicken treatment is smaller in the case of public veterinarians, and so they generally refer to cases related to four-footed farm animals.

*“I have been getting help or assistance from the ULO and VH when needed. He sometimes sends farmers to my laboratory for the postmortem or other purposes in the needed cases. Moreover, all the veterinarians in this area, including other feed companies and medicine companies, have a good bond with each other. I have not seen any clashes among the veterinarians.”*

*—FV-4, Private*

*“I am pleased to see more veterinarians working at the field-level. The trust of the farmers in the veterinarians develops by receiving good treatment from the veterinarian and by providing a sound veterinary service. Whenever I see the farmers, I encourage them to get veterinary treatment from private veterinarians because taking veterinary service from a DVM graduate will be more beneficial for the farmers than taking the service from a quack. I always tell my farmers to take treatment from other veterinarians who are available and nearby if they do not get me in need. But I strictly prohibit them from taking service from the quacks or dealers.”*

*—GV-2, public*

In addition, the participants have reported the importance of the skill of handling cases at the field-level, especially in poultry farms. Both private and public veterinarians agree on this point: without skill, no reputation can be built. Farmers never hesitate to take veterinary care from a skilled veterinarian, bypassing their closest non-veterinarians, which is happening in the case of PPCs.

*“I*f I talk about gaining professional recognition, it all depends on me and how I prepare for it. *According to my perception, there is no other way to gain field recognition without having a sound technical qualification. Very few government veterinarians provide veterinary treatment to the poultry farm. At maximum, their service-providing zone is limited to the dairy sector. On the other hand, many private veterinarians are renowned among poultry farmers due to their good service. So, to make a distinguishable recognition, private veterinarians need to be more skilled and strategic.”*

*—PV-2, Private*

Participants of the study believe that a regional association of private veterinarians, including public veterinarians working in the poultry sector, is necessary for the growth of veterinary unity and the resolution of individual or community-level problems among veterinarians. The poultry farmers can also benefit from this association. There are already some poultry associations in use in different areas that bring veterinarians from different sectors together.

*“S*ince my arrival at this ULO and VH, there have been approximately 19 veterinarians, including private veterinarians. *We have developed an association for veterinarians here to maintain a good relationship among us.* We have developed an association for veterinarians here to maintain a good relationship among us. We created this association to save our motives and to protect the veterinarians from humiliation or insult from other people. I try to work with other veterinarians to save our unity as veterinarians and to enrich our sector.*”*

*—GV-6, Private*

*“The name of the association is “Bagura Vet Executive Association”. The purpose of this association is to build recognition and unity among the veterinarians of different companies. Besides, we arranged some voluntary programmes. We helped an orphanage. We organised a free vaccination programme for dairy. Through this association, we can identify the problems of other veterinarians from different companies and follow up on them. We may discuss this with the DLO Sir about various field problems. Some medicine companies arranged technical programmes for us. It is a district association. DLO sir acts as the advisor of this association.”*

*—FV-7, Private*

### 4.3.2. Sharing data between public and private sector veterinarians

As discussed in section 4.1., private veterinarians currently collect more data from farms and more consistently than public veterinarians do. Both the public and private veterinary sectors have data-storage facilities, specifically related to poultry disease incidents. However, according to the participants, in both types of facilities, there are gaps. Explicitly, public veterinarians admit their derelictions in storing data regularly, and only to maintain their APA they do this aimlessly. Along with the shortage of manpower, the public veterinarians mark a lack of regulation as a reason behind such negligence. Again, the FCs appoint their veterinarians to collect data with the purpose of company benefit, but the veterinarians delineate that no systemic utilisation of these real-time farm-level data exists in most companies. To conceal the companies’ remissness, the veterinarians say that the central body of these companies analyses all data, and to some extent, the feed or DOC quality is improved based on these data.

In this situation, sharing data between the sectors can bring a drastic improvement for the sector, according to the participants. Regarding this, private veterinarians are optimistic that there is no reason why the companies will deny sharing their collected data. But for this, they think government intervention is a prerequisite. The public veterinarians also appreciate such a concept if the private companies agree to collaborate.

*“The government can collect data from us, although there are some agreements between the authority of the company and the government where government initiative is highly required. I am just an employee of the company, and I have no power to share data with anyone without the permission of the company. So, there is a need for a systemic approach. From my working experience, I think that the company will not deny sharing the data, as private companies work with the support of the government. For this, the government should increase their positivity and contact the private companies.”*

*—PLV-6, Private*

*“*Private company veterinarians can assist us by sharing data collected from farms. *This will be a resource for the government, and by doing so, the government can easily accomplish their surveillance at the field-level. For example, a veterinarian can come to my ULO and VH if he visits five farms in my region and can share the cases that he has found on those farms. By doing so, I can learn about the field problems in his working area. Another thing is that private company veterinarians can share the reported medicine and vaccine efficacy with us as well.”*

*—GV-4, Public*

### 4.3.3. Comprehensive disease surveillance using collaboration

Most of the participating veterinarians are not used to the activities of surveillance. They recognise the need for better surveillance, including a few companies as examples who survey field-level diseases of chickens using the data collected at farm-level and from affiliated laboratories. However, even in these instances, those companies do not disseminate the results. In fact, despite the government also having a facility, such as FDIL, to use in active investigation of any reported infectious or toxic case at field-level; such an initiative is hardly used in the poultry sector, especially for poultry. Moreover, the participants notify the engagement of FDIL with foreign organisations working in collaboration with an impact on the country, but the initiative, definitely for the poultry sector, is absent in FDIL.

*“If the communication among the veterinarians of the private and public sectors can be increased, the government veterinarians will know about the field status from us. The government can take the initiative to develop disease surveillance by collaborating with private companies.”*

*—PV-9, Private*

Regarding the inertia of the surveillance programme in the poultry sector, especially for chickens, several gaps have been identified by public veterinarians. Among these, lack of government initiative, budget crisis, deficiency of plan, and shortage of connection with poultry farms are mostly highlighted. On the other hand, private veterinarians are not responsible for any type of surveillance programme except for collecting data from poultry farms for company benefit. While the participants talked about the collaborative approach to establishing surveillance activity in the poultry sector, they explained that a key barrier to this collaboration would not come from veterinarians but rather from farmers. They spell out that a compensation facility is a requisite for the poultry farmers in order for any active surveillance to take place.

*“Once upon a time, the government would pay compensation to the AI-affected farms. In 2010 or 2012, one of our farms was affected by AI. We culled more than a hundred thousand birds. The government could not pay us the compensation at that time. They made us run after different government departments for the compensation money. After that time, the government started to deny the presence of AI.”*

*—PLV-7, Private*

### 4.3.4. Modification in vaccine and medicine supply: require for national prescription guideline

Currently, medicine and vaccine provision can be summarised as a balance between price, availability, and quality that divides the use of public and private veterinary services for farmers to source from. The private sector is the biggest supplier of medicines and vaccines for commercial chickens, while backyard chicken growers get these facilities from public providers with a substandard price. From the statements of public veterinarian participants, the scarcity of government medicine and vaccine supply is indicated as a reason for commercial poultry farmers not taking government veterinary service. One participant described the cause of this as stemming from a combination of limited supply to each upazila that was guesswork rather than based on previous sales figures and exacerbated by some illegal sales. This lack of ability to provide medicines as part of their services creates a distance between public veterinarians and commercial poultry farmers. Even the private veterinarians also think that if the commercial poultry farmers get medicines and vaccines from government supply, the farmers can decrease their farming expenses. Additionally, such an initiative can develop interdependence between the public sector and commercial poultry farmers, which is currently absent.

*“*I once inquired with the department's secretariat about the lack of medicine supply in ULO and VH. Then he showed several causes; for example, there are no specific statistics about the demand for medicines and vaccines according to the individual upazila. He also added that the government can increase the budget for the ULO and VH if they can earn more GDP from the sector. Otherwise, the government cannot supply more than the allotted benchmark of medicine supply in ULO and VH.*”*

*—GV-4, Public*

The participants of the study unearth another concerning issue related to the poor quality of the medicines that many companies supply, taking the advantage of the marginal poultry farmers. The veterinarians think that the PPP approach, with initiation from the government, forces the private companies to follow modified protocols in marketing medicines and vaccines at the field-level, and increasing the supply of medicines and vaccines at ULO and VH.

*“T*he company requires a NID card and a trade licence to provide medicine dealerships. Most of the medicine shops have no drug license. The company does not check this because it only thinks of business and sales. If they go to check the drug licences of these shops, about 70% of the business will be cut off because only 30% of shops might have this license. There is adulteration in medicine. There are lots of local medicine companies. The quality of these products is very low. The government should monitor how these companies get certification for doing such business.*”*

*—FV-14, Private*

Currently, participants regularly note the lack of a prescription guideline for veterinary provision—something they feel would improve medicine provision going forward.

*“In the case of human medicine, there is a guideline for medicine application according to the body system and disease. But the sad thing is that we do not have any guidelines for animal treatment, and we need to provide using them our experience, or our seniors’ experience or knowledge. We do not have any resources to prescribe for the animals or to follow any guidelines.”*

*—GLV-3, Public*

### 4.3.5. Training for farmers and non-veterinary service providers

From both public and private companies, there are training provisions for farmers, while the FCs focus on poultry farmers to train them in a more systematic way. PCs also organise training for poultry farmers, including RVPs and SRs. According to the participants, all the organised training from private companies has the inner target of benefitting the company. This perception stems from their belief that company training sessions would lead to company profit.

On the other hand, public veterinarians provide training from government projects under different government departments, for example, *Jubo-unnoyon (Department of Youth Development), Palli Unnayan Foundation and Palli-jibikayon Foundation under the Palli Karma Sahayak Foundation (PKSF),* as well as also from ULO and VH as a task of their APA. The veterinarians think that although the companies invest in training or government budgets for providing training to the poultry farmers, they are not being educated properly in poultry farming due to the lapses and gaps in the initiatives. Rather, they propose that a collaborative approach to training through collaboration among the training providers would be more fruitful. Several private poultry consultants (PPCs) have set examples of organising impactful training by collaborating with private companies. In this way, to organise training for poultry farmers, such partial collaborations already exist. As an illustration, the private veterinarian addresses about the assistance of dealers while they organise training for the poultry farmers. In fact, veterinarians think that a poultry farmers’ association can be a good way of transmitting knowledge among the farmers.

*“I arranged seminars and workshops in the ULO and VH by communicating with the private company staff. I convinced private companies to support me financially to arrange the workshops, as we did not have a budget for this from the government. I told them to work with me as I would have to write the medicines for a different company. So, by helping each other, we may develop a win-win situation for both (company and the farmer). Then different private companies showed their interest to cooperating with me and providing support in arranging the training programmes. In this way, I started to call the poultry farmers to come to the ULO and VH and introduced them to the service systems of the ULO and VH, which made the farmers regular in taking veterinary services from the ULO and VH.”*

*—GV-3, Public*

Participants consider that non-veterinarian service providers, for example, dealers, salespeople, farmers, and vaccinators are also required to be trained because, apart from the veterinarians, the farmers are more connected with them and they are the treatment providers at the field-level. Participants mostly agree that attempting to remove them from the sector would not work properly. Rather, to save the poultry sector, they are required to be trained. Corporate companies are currently involved in training farmers. In addition, a few private veterinarians working in FCs already provide some training to their company dealers to motivate the dealers’ associated farmers informally. PCs also extend their training beyond veterinarians to enhance the skills of their salespeople. Besides, a group of people who like to be involved in vaccination or debeaking chickens are being trained on these by PCs and PPCs to a lesser extent. While not comprehensive or consistent across providers, these training programmes are already partially functioning, showing some capacity for future collaboration between veterinary and non-veterinary actors.

*“There are some vaccinators based on region. They take the training from the experienced vaccinator of the locality. They vaccinate the layer flocks mostly. Besides, when I worked at ACI Pharmaceutical Company, we (company staff) arranged the training programme for the vaccinator. But I do not know any government initiatives to arrange training programmes for the vaccinator for poultry.”*

*—ICV-4, Private*

*“An alternative option to dealers is not the solution to the problem. But in this case, the government needs to monitor the dealers and set some regulations. Dealers need to be trained. Providing training or knowledge to the dealers from the company is tough because the companies are related to the dealers for business purposes. But the government can easily arrange training programmes for the dealers. Over time, through continuous monitoring, our dealers will be cautious. This will improve our dealers.*

*—PV-8, Private*

### 4.3.6. Extending laboratory facilities through collaboration

Participants from both public and private companies agree about the necessity of laboratory diagnostic facilities due to the disease complications of chickens at the field-level. In fact, they describe how poultry farmers are also concerned and want greater access to laboratory facilities. Veterinarians affirm that postmortems are the best way to diagnose poultry diseases. However, this is dependent on experienced veterinarians who are more competent to diagnose a disease by performing a postmortem.

Regarding the availability of laboratory facilities, the private sector is more advanced than that of the public sector, although the number of regional laboratories for marginal farmers from FCs is not sufficient, according to the participants of the study. They say that the companies make the laboratory facilities available for marginal farmers in the poultry-dense zones. Similarly, few FDILs work with laboratory tests to ensure the laboratory requirements of marginal farmers, but the current scene of their activities is occasional and of little benefit to farmers. Even the public veterinarians from ULO and VH do not often use these FDILs due to their poor service. Instead, many public veterinarians take the laboratory service from private laboratories or feel it is better to refrain from doing the laboratory tests. The private veterinarians think that a mini-laboratory in each ULO and VH can solve the existing crisis of laboratory facilities, while the public veterinarians cannot think of a mini-laboratory in ULO and VH without laboratory personnel. At present, the veterinarians report about a slightly existing collaboration between sectors that the private laboratories are using for the public veterinarians. To strike a balance, private veterinarians want laboratory facilities at the government level, which will also help to create close relationship between commercial poultry farmers and public veterinarians.

*“If the government has no intention to develop the diagnostic laboratory in each upazila, they can make collaboration with the private companies that have the laboratory facility for the improvement of the sector.*

*—GV-5, Public*

# Chapter 5: Discussion

Veterinarians are crucial for providing therapeutic and preventive advice to animals and supporting the farmers whose livelihoods depend on them. At present, through the advancement of the sectors, veterinarians have possessed a distinguished position in the poultry sector. The present qualitative study analysed the ambits of different types of veterinarians’ involvement in the private and public poultry sectors. The results also characterised the existing collaboration that was perceived by veterinarians of all types, identified how they foresaw challenges in its implementation, and marked the opportunities for changes in the sector with impactful consequences.

## 5.1. Different employers responsible for variation in veterinary provision in poultry sector

Based on extensive participant interviews, this study has identified and summarised the differences between private and public veterinarians, including how they work differently in the same field due to the differences in their employer and the type of service they provide.

Providing veterinary care services from farm to farm is a compulsory task for private veterinarians (Rimi et al., 2018; Masud et al., 2020; Birhanu et al., 2021). The private companies require veterinarians to work in the marketing section directly (if they join directly in the marketing section) or indirectly (if they join in the technical section) because the main purpose of private companies is to make a profit (Imam et al., 2020). The private companies follow the strategy to reach the farmers, utilising the veterinarians through veterinary provision and using their presence and close relationships with farmers to enhance the company’s product marketing (Ali et al., 1993).

According to the variations among the companies, the activities of private veterinarians also differ from one to another. Along with this, their job affiliations also create differences in their responsibilities, while the target of making a profit on behalf of the company is a must. However, the PCs recruit particular manpower or team for marketing the company’s products and increasing sales. This system of PCs makes the job more difficult for the veterinarians working in the technical section. When it becomes difficult to do the job, the quality of the service raises questions. Regarding this, the private veterinarians from PCs suffer more than the FCs.

In FCs, the company authority has a distinct marketing section to deal with selling feeds and DOCs, payment, sending consignment and monitoring of the deals. For this reason, when the veterinarians join technical service, they can provide services without being pressured by the marketing section or company authority. But the veterinarians face problems when the matter of promotion comes up. After two or three promotions, the veterinarians are promoted to the posts of marketing section in FCs. The companies do not maintain separate organograms for the technical service providers. Rather, it is a benefit for the private companies as they serve their both purposes of technical service and marketing; by utilising a single employee, they can save the salary of the manpower. However, it is essential to have separate tiers of promotion systems for veterinarians in the technical section.

In the case of PCs, usually, the veterinarians are required to work in the sales team as a technical service provider, where they get a manager from the marketing department and need to rationalise the volume of product sale for the company to that manager. Similar to the FCs, there was no distinct organogram for veterinarians; rather, the study exposes that many veterinarians prefer to work in the marketing section, mostly in PCs, as the income and company recognition are more for the people in marketing than the technical service. The veterinarians assert that the company authority makes all the important decisions regarding company benefits or activities, mostly from the employees of the marketing section. All these issues make private veterinarians from FCs and PCs provide veterinary services to poultry farmers by keeping company strategies in mind.

Conversely, public veterinarians are unencumbered by the accountability of making a profit for a particular institute; rather, it is enough for them to fulfill the activities of their APA. In ULO and VH, there are two posts dedicated to veterinarians, while most ULO and VHs have a single veterinarian who is required to serve both farmers coming to ULO and VH for their animals’ treatment and other administrative tasks.

Similar to public veterinarians, this study has identified a distinct type of private veterinarian who is dedicated PPC who either is involved in any government or private service or is independent entrepreneur. Such types of veterinarians also run their business of providing veterinary services with a reputation at the field-level. They resemble the public veterinarians from the perspective of accountability for making profit. They are the proprietors of their service provision, and therefore, they do not require any post or affiliation. They start private practice by being influenced by themselves or by any mentor. The veterinarians, who have been influenced by themselves, are generally dedicated to ensuring veterinary provision for the farmers’ survival by rearing healthy animals. Many veterinarians select their career to work with freedom not being bound by any government or private institutions. They believe that it is better to serve from their own territory than to work in an institution, as they can achieve more success when they work according to their inherent way of functioning. Again, many veterinarians get an ideal mentor in their lives who guides them in the way they want to be and direct them wisely to get their target point of career. Some veterinarians use their working experience in a private institute or in government service to become private poultry practitioners. The job helps them with knowledge, experience, and capacity building through field work and also by developing connections with the farmers. All this dedication to being a PPC acts as the groundwork to being an acceptable and popular veterinarian among the farmers.

It is revealed from the present study that private veterinarians are more connected with poultry farmers in providing veterinary services than public veterinarians. In relation to this, public veterinarians service poultry producers less often from farm to farm. Even so, they get an inadequate number of chicken patients in ULO and VH. This study discloses that poultry farmers know private veterinarians more than public veterinarians, even though they do not know about the available treatment facilities in the ULO and VH for poultry. So, the commercial poultry farmers do not go to ULO and VH for treatment purposes. Although the commercial poultry farmers know about ULO and VH, they do not go to ULO and VH for chicken’s treatment because it costs more to go to ULO and VH with poultry. When a commercial poultry farmer comes to ULO and VH for treatment, they need to spend travel cost for coming to ULO and VH with chickens although they get the treatment for free in ULO and VH from public veterinarians. The poultry farmers do not feel that coming to ULO and VH for getting treatment for their commercial flock is cost-effective, while they do not get any free medicines or vaccines from ULO and VH. The public veterinarians are not responsible for finding out why the poultry farmers do not come to ULO and VH for veterinary provision; rather, their main task is to maintain their official duties. Most public veterinarians like to be an administrative body instead of a veterinarian, who provides treatment to the animals dedicatedly. In that sense, when the commercial poultry farmers do not come to ULO and VH, the public veterinarians do not bother about this, and they know that there are always available private veterinarians who provide veterinary care to the farmers. However, the public veterinarians get commercial chickens in their ULO and VH if, in any way their reputation spread among the locality due to handling any case. Additionally, as backyard poultry farmers get free veterinary care, including free medicines and vaccines, most of the time, they prefer ULO and VH and public veterinarians to get treatment and advice for their poultry.

In contrast to public veterinarians, private companies mostly recruit private veterinarians to connect with farmers and thus providing available veterinary care is a good way for the veterinarians. The private companies mostly emphasise the poultry over other livestock to supply their products (e.g., feeds, chicks, and medicines) because of its large density in the country, and the private veterinarians thus obtain more opportunities to provide veterinary service to the commercial poultry farmer. Regarding veterinary provision, the private veterinarians, mostly from FCs, closely remain in regular and emergency service for the poultry farmers. The farmers collect the feeds and DOCs from a specific company through their respective dealers. The FCs generally attract farmers by making available veterinary care through a veterinarian. A farmer always requires expert suggestions for his farming, and when a company facilitates, this farmer ultimately turns to that company. Besides, the veterinarians from FCs know more about the quality of feed and chicks, which makes them more trustworthy for farmers than any other type of veterinarian. Most of the private veterinarians working in FCs or PCs do not have a chamber (a place from where they deliver veterinary provisions) dedicated to poultry treatment and advice. Instead, the private veterinarians get the chamber facility from their connected dealers. A dealer may be a farmer or not who has a dealership business with FC, or PC, or both. Private veterinarians can give veterinary treatment from the dealer’s point. Every dealer keeps a storeroom for storing the feed sacks and a small exterior for sitting or dealing, which is dealer point, and some dealers make a place for the private veterinarians to provide for veterinary care for their associated farmers.

Most private veterinarians circulate their service intending the company dealer’s satisfaction and provide the maximum necessary veterinary services to their associated poultry farmers, including the farmers of different companies’ dealers. As the FCs have a large business with the dealers, there is an obligation on the companies to render the best service to the dealer’s associated farms. FCs' dealers become upset with the company veterinarians if the company veterinarians are unable to meet the dealers' demand for veterinary services or are unable to provide those services to the dealers' affiliated farms. Due to their own company dealers' service, most FC veterinarians are unable to provide veterinary care to the related farms of other company dealers. In this case, if a dealer does not obtain business veterinarians, he is forced to seek care from PC veterinarians. Because PCs are not obligated to give veterinarian services to a single dealer's affiliated farms, they can provide emergency services in response to any dealer's call. The fact is that dealers favour veterinarians of FCs over PCs.

However, private veterinarians from PCs also engage in similar services to satisfy dealers, although their company may have one or two large dealers who have both a feed-dealership business along a pharmacy (medicine shop) to sell medicine. Some of the dealers have only pharmacies, and they are known as chemists. The private veterinarians from PCs are required to provide veterinary care services according to the dealers’ recommendations and satisfaction, because if the dealers remain pleased with the service of the veterinarians, they will sell the medicines of those veterinarians’ companies. The private veterinarians from PCs also serve the farmers, especially. Some large-scale farmers, mostly layer farmers, are independent farmers who do not need to depend on the dealers to get anything in credit. Such farmers get veterinary services directly from private veterinarians. The private veterinarians from PCs stay closely connected with such large-scale farmers as they require more medicines for their larger chicken flocks. The farmers can get medicines from the PCs directly through their veterinarians. In veterinary provision, the private veterinarians from FCs also have a variation on what is absent in the case of other types of veterinarians that is providing veterinary treatment to FC-affiliated contracted farms. Usually, the FCs recruit particular veterinarians for those farms, but if in any region they do not have specific veterinarians, then they allow the general private veterinarians working in that zone to provide regular and emergency services to those farms. Some FCs have demo farms where farmers collect feed and chicks from specific companies through dealers, follow company veterinarians' instructions, and receive similar services as contracted farmers.

On the other hand, the connection between commercial poultry farmers and private poultry consultants (PPCs) has been exposed in an interesting way in this study. Such veterinarians are highly reliable for farmers. At the beginning of their careers, they visit one farm after another, just as a private veterinarian affiliated with a private company does. To attract the poultry farmers, they set up a mini-laboratory in their chamber. They are skilled in disease diagnosis and divergent in prescribing medicines. They are more confident about what they do with a diseased farm. Farmers believe in their treatment and try to follow whatever they suggest. Through a long process, they achieve such a respected position that they squeeze their activities at the field-level due to the huge number of farmers who want their continuous service from farm to farm. Then they shorten their ambit of field service either within some contracted-large poultry farms or in their chamber. They feel to do this due to their extensive experience and involvement in poultry practice. They have already gained enough experience from fieldworks and now they can understand the expressions of the farmers. However, all the aforementioned features of a PPC not only help a commercial poultry farmer get a good veterinary care but also make it difficult and expensive for him to get treatment from a PPC, especially for marginal farmers.

This study shows that providing veterinary service over the phone is a common practice for veterinarians. The private veterinarians are recruited to provide service across a large area. As a result, sometimes they cannot reach the diseased farms immediately whenever they receive a phone call from dealers or farmers due to their previously settled working schedule. At this time, the veterinarians try to provide treatment over the phone. In the case of PPCs, there are some variations among veterinarians. Some veterinarians are totally chamber-based, meaning they rarely visit farms at the current stage. They are widely known to commercial poultry farmers. Most of them are established in their careers. They do not agree to provide treatment over the phone because they believe that providing treatment after seeing the chickens is the most rational way. Again, they perceive that the farmers give more value to the prescription when they give more afford to get the prescription. For example, usually, the PPCs stay out of reach of commercial poultry farmers. The farmers spend money to come to the chamber from far away with their chickens and then pay a charge for getting treatment from PPCs. The farmers are required to pay again during return, and they know that they will not have free medicines or vaccines from PPCs. Even many veterinarians prescribe costly medicines. Even after all these barriers mentioned farmers come to the PPCs and take veterinary care for their poultry. However, the farmers who generally take services from PPCs they pass through vulnerability in their chicken flocks. They mostly attend the PPCs in the critical situations of their poultry farms. Such veterinarians are generally attached to a profession either in government or private service, but some veterinarians are lone private practitioners. The exclusively involved PPCs keep the option of visiting their large contracted poultry farms. To continue their patient dealing, they prefer to connect with the marginal commercial poultry farmers over the phone using different media, for example, WhatsApp, Facebook, Messenger, and different telemedicine apps.

Other than these differences, most veterinarians use mobile phones for veterinary care because it is mostly related to the sentiment of the farmers. When a farmer calls the veterinarians, he really looks for veterinary care, and if he gets support from the veterinarians, he becomes pleased with him. Although the veterinarians do not give any medicines over the phone, they can comfort them with mental support. Otherwise, the farmers become highly disappointed if they do not get the veterinarians beside them whenever they ask for them. It has a bad consequence for the careers of private veterinarians working in FCs and PCs. However, the extent of providing veterinary service to the poultry farmers over the phone is less in the case of the public veterinarians, as they have less connection with the poultry farmers; nevertheless, to maintain connection with the farmers, they also need to provide service over the phone. Due to the shortage of public veterinarians according to the existing organogram, most of the time, they do not stay at ULO and VH as they are required to attend different types of government meetings or local administrative coordination meetings. In this situation, if the farmers do not get working veterinarian in ULO and VH, they may complain to the authority against the veterinarian, which can hamper the job performance of the public veterinarians.

The poultry farmers get veterinary care services from both public and private veterinarians, whilst most private veterinarians claim in this study that they provide free treatment from farm to farm because the companies monitor their activities. The companies want that the private veterinarians should dedicatedly serve the poultry farmers, as the companies facilitate the veterinarians with travel allowance and daily allowance for visiting one farm to another, except for salary. Hereby, the veterinarians think that farmers do not properly evaluate the free treatment because, at present, the availability of private veterinarians has increased at the field-level. Whenever the farmers require a veterinarian, they can get him through their connected dealer or over the phone, and get suggestions from a veterinarian. Besides, the veterinarians visit the farms routinely, even if the farmers do not call them. Sometimes, several veterinarians, often recruited in poultry-concentrated zones by their FCs or PCs, can visit a single diseased farm multiple times a day to establish a good relationship with farmers and visit them when they become aware of any diseased farm. This creates an opportunity for the farmers to judge the treatment of the veterinarians. Then the farmer creates a new prescription of medicine from several veterinarians’ prescriptions without following a specific one and provides medications to the chicken as he prefers. Many private veterinarians confess that they take a fee from the poultry farmers without informing the companies. It is kind of an open secret to the companies. Surprisingly, in many regions, the farmers know that the veterinarians working for private companies take a fee for veterinary provision from farm to farm, and the farmers give them a set fee according to that region. The private companies do not have any written obligation that their veterinarians are not permitted to take fees, and chamber works but they have an unsaid restriction for them. Mostly the FCs have such an attitude toward their veterinarians, while the PCs do not think of this as an issue; rather, they think that if any veterinarian from their company starts private practicing for poultry farmers, ultimately this will contribute to their company’s sale of medicines.

In contrast, all the PPCs have a fixed amount fee for veterinary provision for the poultry farmers; either they provide treatment going to the farm or the farmers take veterinary service from the veterinarian coming into his chamber. In the case of public veterinarians, they do not take any fee from commercial poultry farmers if they come to ULO and VH. If they provide these services after or before office hours, they take a fee from the poultry farmers, although there is no government chart about the fees for the treatment of poultry.

In the process of treatment, generally, veterinarians, both private and public, prefer performing postmortems on commercial chickens as the best tool for disease diagnosis in poultry. Sometimes private veterinarians provide treatment only by visiting the poultry farms without doing a postmortem. They perform postmortems on the premises of the farm during visits, and the public veterinarians perform postmortems in their ULO and VHs. However, as public veterinarians provide less service to commercial chickens, they mostly provide treatment to backyard chickens in ULO and VH. In the case of backyard chickens, the veterinarians do not prefer performing a postmortem because there are 10-20 backyard chickens in the household, which is not beneficial for farmers to do a postmortem on the chickens. If several backyard chickens die of the disease and the farmer brings samples to perform a postmortem, the veterinarians do the postmortem.

Over time, laboratory facilities for disease diagnosis have become popular, barring postmortem. Both government and private companies have diagnostic laboratory facilities, but their performance is not fulfilling the current demand. In private industries, several FCs have introduced laboratory facilities at the regional level. However, the main purpose of company-associated laboratory facilities is to increase the profit of the company. Most of them prioritise laboratory facilities for the betterment of their company-associated farms, e.g., GP stock, PS, integrated broiler, or layer farms. Some FCs have food processing plants for which they have laboratory facilities for pre-slaughtering tests and pre-processing food tests. They keep central laboratory facilities where they provide service to their associated aforestated farms. They keep the best laboratory facilities as per their capacity in the central labs, including serological tests: haemagglutination inhibition (HI) test, haemagglutination (HA) test, enzyme-linked immune sorbent assay (ELISA), bacteriological culture preparation, antimicrobial sensitivity test (CS test), molecular test (Polymerase chain reaction, Reverse transcriptase-polymer chain reaction: isolating *Pasteurella multocida*, Infectious bronchitis, Newcastle Disease, Avian Influenza and Mycoplasma), environmental sample tests (air and hygiene test), and water test (bacterial load, pH test). They have regular information on every flock in detail. Before starting their GP stock or PS, the companies collect environmental samples and do the test to confirm the disease-free shed. Then they collect chick-samples to keep regular updates about the health status and production performance of the poultry. They go through bacterial culture tests up to molecular tests for the development of chick quality. They prefer regular serological tests for the alteration and upgrade vaccination schedule. The equipment suppliers of the private laboratories keep regular attachments with the companies to maintain the calibration of the equipment. Some companies have separate laboratory facilities for their food processing unit where they test the ready birds before slaughtering and after slaughtering—before processing food products, even including the environmental tests of the process plant. In the regional laboratories, the facilities vary according to the company variation; for example, haemagglutination inhibition (HI) tests, haemagglutination assay (HA) tests, rapid kit tests for some diseases, such as Salmonellosis, Colibacillosis, Mycoplasmosis, Avian Influenza, etc., including cultural sensitivity (CS) tests. The private companies run the corporate business, as a result, they analyse the profit before starting the local laboratory facilities at the field-level. That is why most of the established regional laboratories are situated in poultry-concentrated regions.

As a strategy to get the farmers used to taking laboratory services, a few companies offer all the diagnostic facilities at no of cost at the beginning of the laboratory to the farmers who take the feeds and DOCs of that FC. Over time, they take a token fee for laboratory facilities from the farmers. These laboratories are open to marginal commercial poultry farmers. Some companies confine these facilities for the farmers who are the beneficiaries of their companies, as they offer these testing facilities at a reasonable price to them. Again, from some laboratories, any type of farmer can get laboratory facilities for their chicken flocks by paying. To perform all these tests, specific veterinarians work in these laboratories of FCs. The farmers go to these laboratories both for laboratory facilities and treatment. The field veterinarians of FCs and PCs also refer to the nearby private laboratories for tests. At present, farmers are more advanced and ask for laboratory tests, especially large-scale farmers and layer farmers.

In the case of government laboratory facilities, the veterinarians of FDIL perform mostly the postmortem of the chicken samples received from different ULO and VHs. Very occasionally, they can do some laboratory tests to keep the equipment of the FDILs running; otherwise, they manage the arrival of dead chickens from ULO and VH only by doing postmortem. In Bangladesh, there are 9 FDILs, of which 3-4 are running as they receive samples from nearby ULO and VHs. According to the APA, the veterinarians from FDIL are accountable for doing the laboratory tests of the obtained samples from ULO and VH, and they are assigned to go to the outbreak regions whenever a disease outbreak at the field-level is reported by the veterinarian or ULO of an upazila. But this is not happening because of the lack of coordination between ULO and VH, and FDIL. There is no rational requirement from ULO and VH about the quantity of tests that they want for poultry. The included ULO and VHs of an FDIL send lump sum samples whenever they find this feasible for them. Besides, there is no advanced equipment in the FDIL. Paradoxically, if any sample suspected of Avian Influenza or Newcastle disease outbreak is brought to FDIL, they become capable for identifying only the respiratory signs of the diseases instead of diagnosing the organism. No FDILs have molecular testing facilities. As a result, the veterinarians from ULO and VH do not find the service of FDIL suitable; instead, only to maintain their APA, they send samples to FDIL. Rather than using the FDIL services, this study reveals that a few public veterinarians who provide treatment to commercial chickens send samples to private laboratories whenever they require it instead. This is because, according to them, the diagnosis is faulty in FDIL. Even private veterinarians have the same opinion about the existing service in FDILs. In FDIL, there is a shortage of manpower, according to the existing organogram. Besides, the organogram of FDIL is not ideal for the functions of FDIL. The newly recruited veterinarian in FDIL gets the post as an SO who has worked at the laborator for 4-5 years. After getting used to the activities of FDIL, they get promoted and also transferred to ULO and VH. Again, the veterinarian from senior ULO comes to FDIL after promotion before their retirement stage. Therefore, the FDILs do not get any reliable person who will work to bring about changes in the functions of FDIL. No budget is granted for the equipment and reagents for these FDILs. Whenever the veterinarians pass any budget for FDIL, the authority wants the previous results of the tests, in which an imbalanced situation has been going on in the system from the very beginning. Even the veterinarians from ULO and VH do not want to introduce a mini-laboratory that has been proposed from the Livestock and Dairy Development Project (LDDP) project without the employment of assigned veterinarians for this.

However, the public veterinarians are considered more independent during medicine prescribing in this study because they are not influenced or pressured by any institute companies to prescribe any particular company medicine or vaccine. Rather, they prescribe the medicines from government supply to the backyard chickens and also give those medicines without a fee, although they cannot give free medicines or vaccines to the commercial poultry farmers. Surprisingly, this study conveys that public veterinarians are involved in taking incentives or being committed with many PCs to prescribe medicines from their companies. In the poultry sector, this practice is popular among the public veterinarians in the poultry-dense region. As aforesaid, the public veterinarians provide free veterinary service in ULO and VH to commercial poultry farmers; instead, they collect incentives for the commercial chickens' prescribed medicines. Likewise, the private veterinarians from FCs and PCs prescribe medicines from their connected PCs, though the private veterinarians from FCs are more free-thinking than the veterinarians from PCs. As the veterinarians of PCs are employee of those PCs, they are bound to prioritise their company’s medicines.

Such practices in veterinary provision by the private veterinarians of PCs reduce their service quality, and farmers and dealers choose them less for treatment purposes. When veterinarians provide the majority of the medications from their PCs, farmers, and dealers find it unwise and biassed since they want a proper prescription. They think that veterinarians do not prescribe for the health benefit of chickens but rather for the incentives from their companies. When a veterinarian suggests medication from a specific manufacturer but the chickens do not recover, farmers and dealers feel the same way, as do PC veterinarians. Prioritising their companies’ medications, however, benefits the private veterinarians of PCs as they maintain incentive programmes for their veterinarians for boosting prescription sales. Furthermore, the sale of the products increases as more veterinarians promote their companies' products. As a result, the veterinarians can improve their job performance, which is helpful for their promotion and salary increment.

In contrast, private veterinarians from FCs are not required to prescribe the medicine for a particular product. They get the opportunity to think about the quality and brand of the medicine that will be helpful in curing the poultry. Despite of this, many veterinarians of FCs become connected with PCs. They take transport service from the SRs of the PCs, which makes them accountable for prescribing the medicines of that company as the veterinarian has received lift from that company. Notwithstanding these, private veterinarians frequently prescribe a range of drugs that are quite beneficial to poultry. Due to the companies’ shared working environment, they are aware of the well-known private veterinarians of FCs and provide incentives for their product recommendations.

To get recovery from a disease, along with prescribed medicines and suggestions regarding management and vaccination systems, the private veterinarians recommend. As they visit the farms regularly, they keep talking about improving biosecurity measures for the poultry farmers. Regarding this, the involvement of veterinarians from FCs is greater than that of the veterinarians from PCs because, generally, the veterinarians of PCs visit the farm less frequently than the private veterinarians of FCs. Mostly, the SRs of the PCs visit one farm after another and one dealer after another. When the SRs inform their veterinarians about the necessity of visiting the farms of certain regions or specific dealers, they go for visiting those farms. Then, they medicate the chickens and also suggest to the farmers that they improving different biosecurity measures. On the other hand, the private veterinarians of FCs always remain attached to their company dealers and associated farms. They, therefore, keep advising the farmers on biosecurity precautions. They suggest about the importance of this measure, especially to the dealers, because the farmers are more used to heeding the advice of their dealers and also following their recommendations. Private poultry consultants (PPCs) and public veterinarians, on the other hand, advise farmers on biosecurity measures as they visit them for treatment; nonetheless, they convey the value of maintaining biosecurity measures through their training programmes. The veterinarians from FCs always counsel the farmers personally, develop demo farms by making good relationships, and motivate new farmers by showing the improvement of the results of the demo farms along with training programmes. The veterinarians from PCs can also suggest biosecurity measures to the farmers through personal counselling while visiting farms, mostly.

Aside from these activities, the current study uncovers that some veterinarians, particularly PPCs, want to change the way veterinarians work to inform farmers about biosecurity measures because a farm cannot be considered biosecurity-controlled or an appropriate farming system to prevent disease occurrence at the farm-level unless three stages of biosecurity measures (structural, conceptual, and operational) have been executed. However, while the public veterinarians are pleased with poultry farmers’ improvement, the private veterinarians of FCs are dissatisfied with the farmers’ delayed or non-progress in biosecurity measures at the field-level, as their contribution to influencing farmers about biosecurity improvement is significant. In the case of maintaining a proper vaccination schedule in poultry farms, both private and public veterinarians’ contributions have been proven through this current study, although the influence of public veterinarians is more in backyard chickens than commercial chicken farms, on which the private veterinarians and PPCs work more. The public veterinarians get some supply of government vaccines, e.g., BCRDV (baby chick Ranikhet disease virus), RDV (Ranikhet disease virus), and fowl pox vaccine from the Livestock Research Institute (LRI) in ULO and VH, which is not sufficient to fulfill the demand of the total chicken population in Bangladesh (Directorate General of Drug Administration 2018; Khan et al., 2021). They intend to give the vaccines mostly to backyard poultry farmers rather than commercial poultry farms. Even if they give the vaccines to only one or two commercial chicken farmers, the entire community of commercial poultry farmers will learn about them. In this case, public veterinarians will not administer government vaccines. As a result, they largely inform backyard chicken growers. They primarily tempt backyard poultry farmers to acquire these vaccines. Some ULO and VHs also organise free vaccine campaigns so that backyard poultry farmers come to receive the vaccines. It is the task of the public veterinarians from their APA to ensure the distribution of supplied medicines and vaccines in ULO and VH. In some situations, they provide these vaccines to their subordinates, for example, VFA (veterinary field assistant) or LSP (livestock service provider) from the LDDP project to administer the vaccines to backyard chickens of different village. However, private veterinarians or PPCs are not involved in distributing the vaccine; rather, they suggest that commercial poultry farmers be regular in administering vaccines to their poultry. At best, they provide the schedule of vaccinations to the farmers whenever they go to the veterinarians for treatment. They also adjust the vaccine schedule for individual farmers according to the requirements based on the disease occurrence on the farms.

The study examines the responses of private and public veterinarians to the AMR issue. Veterinarians are also to blame for AMR because of their illogical prescriptions and lack of strict monitoring. However, private veterinarians play the most important role in reducing this problem by persuading, encouraging, and training farmers. As the poultry farmers and their dealers are closely connected with them, their suggestions also impact the farmer. Personal counselling and motivation by showing examples of the benefits to the farmers of demo farms can change farmers’ perceptions towards the use of antibiotics, and the private veterinarians from FCs do all these. They also strive to convince farmers of the benefits of taking a little antibiotic through estimation, although it is challenging to prevent farmers from using antibiotics when their flocks are infected with high-mortality diseases.

Another activity of the private and public veterinarians is organising training for farmers and different non-veterinarians. Regular training organisation is a job responsibility of the FCs' veterinarians. Many FCs incentivize their private veterinarians for this effort, and many veterinarians promote this task of organising training on behalf of the companies. Different companies have different training and organising plans. Several companies prefer two trainings per month, while others organise only one training per year for the farmers. However, whenever private veterinarians of FCs organise such trainings for farmers, they involve their dealers. The companies utilise these trainings to increase the number of associated farmers among their company dealers. The private veterinarians bring the farmers into the training through dealers, and dealers include only their connected farmers in this training. When other farmers except for this training organising company see that this company also trains the farmers who take the feeds and chicks of that company, then they are also motivated to be the farmers of that company’s dealers. Regardless of the purpose of these programmes, FCs offer higher-quality training than other organisers like PCs or even government programmes. They create training modules on chicken rearing protocol, biosecurity measures, feeding systems, curtain management, vaccination measures, and so on. They also provide leaflets, pens, brochures, and notepads to the farmers. The FCs bear most of the costs. To some extent, the dealers also spend on this training.

PCs also organise trainings, while many veterinarians do not find their purpose of training wise for the farmers because the PCs organise a single training per year on launching a new medicinal product of the company and introducing the products to the farmers. They make the farmers familiar with a medicine’s indication, dosages, and application. It harms farmers more than it helps them. This study also discovers the training system of the PPCs, who are regarded as poultry specialists in the sector. Different types of PPCs organise or attend training for farmers in different ways. The private poultry consultants (PPCs), who are entrepreneurs, organise paid training courses in a systematic way, either through the internet platform or directly in batches. They also educate the farmers on the ins and outs of poultry rearing, although they refuse to teach poultry medicinal products. Besides, they also have paid training courses for the junior veterinarians who enter the job field newly or any veterinarian who is willing to have training on poultry farming and veterinary care of poultry. Private poultry consultants (PPCs) from academics typically attend several sessions on campus or via an internet portal for poultry farmers invited to any project. They also serve as trainers for the field veterinarians of FCs being invited by the companies.

In the case of the public veterinarians, they organise backyard meeting and U2C programme for indigenous chicken-holders in households and small- to medium-scale commercial chicken farms. Due to the primary restriction of a shortage of personnel, they are not very advanced in arranging trainings for farmers; yet, they manage to conduct at least a backyard gathering and a U2C programme to satisfy the goal of their APA. They held the backyard meeting on a large ground in front of a village home, inviting the neighbouring dwellers who also rear indigenous chickens in their households. Most of the participants in the backyard meeting are village women who rear 10-20 indigenous chickens in their households. Regarding the discussion of the backyard meeting, there is mostly emphasis on the vaccination and disease occurrence of the indigenous chickens, as there is nothing to maintain the biosecurity measures in the backyard farming system. The public veterinarians convince the village women to come to the ULO and VH to collect vaccines and medicines at a cheaper rate during these trainings. Further, they find the U2C is the most successful and effective training for the farmers, where both backyard and small- to medium-scale commercial farmers are trained. In the U2C programme, the backyard farmers are trained in the method of participatory disease surveillance (PDS), where the farmers prepare a map of their village to show the source and spread of a disease. Beyond that, they educate the farmers on the significance of biosecurity measures for commercial poultry farmers and provide them with a list of 16 measures as part of this event. This is accomplished by visiting two commercial chicken farms. The farmers are then given the freedom to evaluate their own operations and choose one or two biosecurity measures from a list in order to better understand the advantages of maintaining farm biosecurity and to consider additional steps if they find the current measures to be advantageous.

Barring farmers, the private veterinarians are involved in training provision for non-veterinarians. In the list of non-veterinarians, first come the dealers who stay in close contact with the private veterinarians from FCs. Although there is no formal training provision for the dealers from the companies, the veterinarians train them in person so that they can improve the farming practices of their associated farmers. Apart from this, the private veterinarians from PCs train the SRs working in the sales team so that when they visit farm to farm, they can talk over their company products efficiently. The SRs are also taught how to perform postmortems so that, in case the responding veterinarians are unable to arrive immediately, they can do so and call the veterinarians to receive medications for the ill poultry. Then the veterinarians of PCs also train the vaccinators about vaccine administration. Some of the PPCs who are entrepreneurs develop a group by training on vaccine administration and debeaking so that they can get support from the trained vaccinators while they serve in their connected poultry farms.

Private and public veterinarians acquire farm-level data in different ways; however, it is a routine task for private veterinarians of FCs to collect farm-level data, such as chicken information (farm demography), chick mortality rate, attained body weight, and amount of ingested feed. The involvement of veterinarians in real-time farm-level data collection, processing, or use varies according to the FCs; for example, Aftab, Nourish, Kazi, CP, and Paragon generate the methods of data collection, collation, and result synthesis. Some companies, for example, Nourish, Aftab, Kazi, and Paragon, also accumulate lab-related data, including disease data, at the farm level.

The veterinarians of FCs collect all this data from farm-level regularly, either manually or using an app, and fulfill their monthly report. Most FCs have developed apps for data collection at the farm level. After collecting the data, they enter the data and obtain the result if the company assigns them to get the result; otherwise, they send the data to the central team of the company for further utilisation of the data. The veterinarians influence the farmers to store by providing record-keeping sheets from the companies or showing the benefit of the record-keeping sheet. Many companies have contracted farms and demo farms where the private veterinarians put more effort into maintaining the data record. They visit those farms once per week. They use the results of the demo farms in future training to motivate new farmers to follow the advice of the veterinarians about chicken rearing, feeding, biosecurity, medications, and vaccination. Many companies keep award facilities for the demo farmers who benefit from the farms gradually. Such types of activities are not observed in private veterinarians from PCs in this study; instead, many of them are unwilling to record data at the farm level. They do not find the benefit of farm data keeping without any certification for the developed farms. In this study, the private poultry consultants (PPCs) are seen to be stoic in their data record-keeping. However, some practitioners are also interested in introducing modern data storage systems in their chamber but are unable to do so because of a heavy workload. Some private poultry consultants (PPCs) who work in both academia and private practice allow their students to work with them to gather patient data for their studies, but they lack a structured method of data preservation. However, they tell their farmers to keep the previous prescription as a record of the medications in the flock for better treatment. Conversely, the public veterinarians also gather data on the chickens manually and through the use of the software BAHIS, though some inconsistencies are found in the data collection procedures in this study. One key issue facing ULO and VH is the specific staff shortage. For which the public veterinarians only manually store the chicken's data. Although it is the responsibility of the veterinarian working in ULO and VH, the non-veterinarian staff maintains the patient record in most ULO and VHs. Even when they save the data, they abuse data quality by not ensuring the accuracy of the information, given a lack of time and a heavy workload. In addition, when they retrieve data in BAHIS, they alter the quality of the data. A lack of expertise in software operating hampers its activity, which is observed by many public veterinarians. They do not feel comfortable using the software. In fact, this software has not been introduced in FDIL till now.

Taking action during disease outbreaks is another important responsibility that this study implies private veterinarians endow, but public veterinarians trail behind. It is noteworthy how FCs’ veterinarians attempt to persuade farmers to choose alternate, more logical steps when their farms suffer significant losses during disease outbreaks. They instruct their dealers to be extra concerned about the biosecurity measures of their connected farms whenever they learn about the occurrence of any high-mortality diseases, for example, Newcastle Disease or Avian Influenza, as farmers mostly heed dealer advice. Additionally, the dealer offers advice to the farmers since he must cover the biggest loss that any of the farms connected to him would suffer. During prescribing on such an outbreak-affected farm, the private veterinarians consider the profit of the farmers, tell them about the prognosis of the disease, and leave them to make the decision about whether they will invest in the diseased flock or not. At this time, they do not visit the farms and prefer to provide treatment from the dealer’s point. It is part of their ethical practice. They also advise the farmers to bury the dead chickens to prevent the spread of the disease, which actually goes in vain because when the farmers see extreme hazards on their farms, they do not stay calm and follow any kind of advice. Even the private veterinarians cannot tell the farmers not to sell chickens because, if the farmer destroys his infected flock, he will lose his money and also not get any compensation from any source. This creates a bad situation. Instead of saying this, they can only recommend improving biosecurity measures and the probable prognosis. Even the role of PPCs, who are dedicatedly involved in the poultry sector and have a reputation, says the same thing. When they get any flock affected by the aforementioned diseases, they prescribe for the farmers and tell them about the prognosis along with some suggestions regarding biosecurity measures. While there are no visible actions by public veterinarians during disease outbreaks at the field-level that are discussed in this study, even most public veterinarians do not have evidence of Avian Influenza outbreak occurrence at the field-level. Even they refuse to acknowledge the occurrence of Avian Influenza at the field-level. As there is no government compensation facility for the farmers, the public veterinarians relinquish to the farmers whatever they do with the sick birds. The public veterinarians argue that the private veterinarians fail to notify them promptly when an epidemic occurs. When they find out, it's too late to look into it. Again, they state that when they get a report of an outbreak of Avian Influenza at the field-level, samples must be sent to FDIL for confirmation. There, the provisional diagnosis of an Avian Influenza outbreak is modified to Newcastle disease. The public veterinarians also confirm that there is a rule that requires farmers to be prosecuted if they sell sick hens in the market. Most of them admit to an absence of action during disease outbreaks in the poultry enterprise; however, certain initiatives are highlighted in the case of large animals.

Regarding following ethical practices, the private veterinarians are more advanced than the public veterinarians, and it is wise because the private veterinarians get more access to the farm. So, as per possibility, they use face masks and shoe covers while visiting farms. They also use disinfectant before entering the shed. They ask the farmers to provide disinfectant if he cannot take it with him. They also perform the postmortem outside of the shed on the premises of the shed and bury the dead chicken. Many veterinarians visit only two farms a day because they take a shower before visiting each farm. They even avoid visiting other farms if they go to a viral disease-affected farm. In contrast, as public veterinarians provide less treatment to commercial chickens, they lack the means to maintain all these measures.

It is interesting that, despite having veterinarians dedicated to the same species, there are numerous variations belonging to the private and public that this theme has already explored. However, in order to harmonise veterinary care in the poultry sector, it is necessary to identify current discrepancies between veterinarians employed by commercial and government employers. All of these discussions will hinge on the functions and engagement of other non-veterinarians in this sector, followed by the current scope of public-private partnership inauguration, which will aid in implementation by identifying the significant impediments to this endeavour.

## 5.2. Non-veterinarians’ involvement in veterinary provision except for veterinarians

Except for the veterinarians who provide treatment in the field, they are generally non-veterinarians and considered informal veterinary service providers (IVSP). At the field-level, dealers and sales representatives are common service providers to poultry farmers other than veterinarians (Masud et al., 2019). Besides, this study also identifies the influence of neighbouring farmers and vaccinators as non-veterinarians who served the poultry farmers in anyway.

Among all IVSPs, the dealers are strongly connected with the farmers because the farmers get feeds, chicks, vaccines, medicines, and other subordinate elements (e.g., litter and brooding materials) from their connected dealer, often on credit. The dealers also help the farmers sell their ready broilers. According to the findings of this study, veterinarians have both positive and negative interactions with dealers. The veterinarians in this study were asked if they desired an alternative to the dealers. Surprisingly, many veterinarians respond that it is not easy to develop an alternative to the dealers because of their expanded roles in the poultry sector and for farmers across the country. They acknowledge that most marginal-scale farmers are employed in poultry farms because of credit from dealers, despite the fact that dealers provided medicines, particularly antibiotics, irrationally to their associated poultry farmers and with an additional profit on the regular feed and DOCs prices. When chickens get diseased, the farmers go to their connected dealers to notify them about the issues since dealers are the friends that most commercial poultry farmers require. Credit farmers must notify the dealers of any disease incidence since they are required to reimburse their credit money after selling the ready chicken. Thus, farmers are shielded from responsibility for farm losses. When a farmer in this instance visits the dealer's point with any sickness condition of their flock, the dealers typically provide them certain drugs, including antibiotics, rather than contacting a veterinarian. They do this because many dealers maintain pharmacies alongside their dealership businesses in order to increase their earnings. Over time, a significant number of educated farmers, including literate and concerned dealers who are dedicated to their own financial success as well as the farmers', enter the poultry farming industry and seek medical care from veterinarians. Previously available public veterinary services are now supplied on the ground by veterinarians engaged by private companies. However, as the number of chicken farms increases consistently, it is no longer sufficient for commercial chicken producers.

Furthermore, private companies employ veterinarians initially for company benefits, and later the task of providing good and balanced veterinary care to farmers comes. Both FCs and PCs recruit their veterinarians with a responsibility for large areas, for example, in one or three districts. According to the public veterinarians, a single veterinarian often works in most ULO and VHs, resulting in inadequate veterinary care for the upazila's farmers, even though, under the organogram, two veterinarians are expected to work in a ULO and VH for an upazila at the government level. As a result, veterinarians from public and private companies cannot enable to provide enough veterinary services to poultry farmers. In this situation, it is difficult for a veterinarian to manage one or three districts alone. However, many veterinarians are now able to offer veterinary treatment to poultry farmers due to the financing of several companies. This is the type of circumstance in which marginal farmers' needs are handled only superficially by private veterinarians, while state veterinarians, notably PPCs, are scarce in poultry care.

In this circumstance, dealers remain on hand for farmers. When veterinarians provide medicine, the dealers tell the veterinarians to prescribe drugs accessible in their pharmacies. In contrast, if the veterinarians are unable to reach them right away after receiving a call from the dealers, they urge the dealers to do a postmortem and remember any past prescriptions, and the dealers readily agree, considering this as adding fuel to the fire. Typically, private veterinarians also compromise with the dealers whenever they want to apply the available medicines in their pharmacies. The private companies (FCs or PCs) want a good relationship between the veterinarians and dealers to increase the sale volume of their products (e.g., feeds, chicks, or medicines). However, in the absence of veterinarians, it is vital to treat the sick flock. When they are unable to travel to the farms, they use dealers to access the service. Other than distributing medicines by changing veterinarians' prescriptions or persuading veterinarians to prescribe certain company medicines, no significant drawbacks for the dealers have been highlighted. As a consequence, dealers have become a double-edged sword in the poultry distribution network.

The next most important IVSP is the sales representative (SR), or the people who work in the marketing section of the corporate companies involved in the poultry sector in Bangladesh. All FCs and PCs have a distinct marketing section, and the entry post for that section is SR or MO. They get promoted to managerial posts, for example, marketing manager, territory manager, area manager, and regional sales manager, after working for 15-20 years in the marketing section of corporate companies. Hereby, the SRs of FCs deal with only dealers while the SRs of PCs visit one farm to another; one dealer’s point to another. They are trained by their companies in different skills related to veterinary treatment as well. The companies give them training on different diseases of poultry and medicines, including performing postmortems. They provide treatment to poultry, including antibiotics, by convincing farmers and selling medicine at a low price to the farmers (Hasan et al., 2021). They give lifts to the private veterinarians of FCs from farm to farm through their motorbikes. Then they prescribe the medicines of their (SRs) companies. Again, the SRs visit the reputed poultry practitioners to convince them about using their company products. They play a significant role in this sector in promoting the good products and services of private companies. However, many veterinarians try to make the activities of the SRs permissible in the farms providing treatment and giving antibiotics by saying that they just tell the name of the antibiotics to use in a certain problem of the poultry. Even those veterinarians do not think it unjust that they are influencing farmers to use antibiotics without following the government rule of taking antibiotics without the prescription of a registered veterinarian. As a result, their roles are being exposed negatively instead of being a boom for the sector.

Regarding neighbouring farmers, who are also poultry farmers and have experience in poultry farming. It is natural that a new farmer can be influenced by his neighbouring farmer and also receive suggestions from him regarding farming and shed preparation (Zheng et al., 2021). Along with the management, the neighbouring experienced farmer can even share medicines with the new farmer to apply to their flock, which is not expected. Sometimes, the farmers become so convinced by their neighbours that they change their minds about their usual farming practices. Sometimes, many new farmers do not administer vaccines to their flock by following their neighbours. For this reason, neighbours are always important, but if they are not learned, they may be harmful for new farmers as well.

Another effective non-veterinary service provider is the vaccinator, who vaccinates the chickens from farm to farm without maintaining proper protocol of vaccination; even they do not have any training or certification for doing vaccination from farm to farm. The current study explains that some people who have a course from Jubounnyan or working experience in a farm as a worker of the farm or in a company as SR previously start doing vaccinations from farm to farm. Many PCs deal with such people about vaccines. They sell vaccines to them, and they convince the farmers to administer vaccines from them. They do business with the farmers. Without maintaining protocol, the vaccinators administer vaccines from one farm to another, which can be a potential source of spreading disease from one farm to another. Many private poultry consultants (PPCs) train some people in the vaccination and debeaking of the chickens for the purposes of their good service. Ignoring the adverse sides of the vaccinators, their acts in this sector are important, which can be better with more nourishment.

A veterinary field assistant (VFA) is another non-veterinarian animal handler who can be added to the list of IVSPs. VFAs are government employees who work as subordinates of the VS or ULO of a ULO and VH. The role of VFAs in the poultry sector is insignificant, despite their dominance in the field of veterinary care for large animals. When public veterinarians become overloaded with administrative duties at the ULO and VH, they employ the VFAs to visit the poultry farms. However, they believe that requiring VFAs to be educated in commercial chicken vaccination will benefit the poultry sector. Creating a skilled group of immunisers is an excellent idea, but if their work is not adequately monitored, it might lead to develop other unscrupulous veterinary service providers in the sector. When the VFAs are given basic vaccination education, they will begin offering drugs to the poultry, similar to what they do presently for large animals.

It is clear from the explanation that follows how veterinarians are not entirely opposed to these IVSPs but rather prefer them to be used in a more structured way for the development of this sector of the economy. But the disparities that exist among veterinarians, particularly between public and private veterinarians, allow the IVSPs to engage in various malpractices. Because these IVSPs primarily serve as intermediaries between veterinarians from public and private organisations by coordinating their actions, it is crucial to limit the activities of IVSPs in order to avoid public health dangers such as AMR or any potential pandemic from poultry. Collaboration between public and private veterinary service providers can help in various ways to overcome the gaps currently present between the two sectors of the poultry industry. For instance, due to credit facility farmers mostly depend on dealers. As a result, despite working largely with poultry farmers, private veterinarians are unable to steer the farmers to refrain from receiving veterinary care from dealers because they do not have the administrative powers that public veterinarians possess. To establish the impact of private veterinary provision at the field-level, which is relatively more than that of the public sectors and PPCs, some alterations in the private companies' approach that they employ for their veterinarians may be necessary. Currently, public veterinarians are less connected to marginal poultry farmers, but bridging between public and private veterinarians can strengthen their relationship with the farmers. It is not viable to entirely eliminate the aforementioned IVSPs from the poultry distribution network; however, by engaging with private veterinarians, it is possible for public veterinarians to make them mindful of their legal responsibility in this sector. A continual training programme using the PPP technique is also an option for mitigating their drawbacks in the sector. Therefore, the IVSPS are important stakeholders in the PPP approach for benefitting the poultry industry.

## 5.3. The potential for collaboration to improve veterinary services in Bangladesh’s poultry sector

In Bangladesh, veterinarians become divided only by their employers and the system or protocol of their working sector and cannot bring unity among them—the harsh reality of the sector; nevertheless, such bondless activities of the same community allow IVSPs and cause inconsistencies and discrepancies in the poultry sector. It requires some comprehensive initiatives of collaboration among different types of veterinarians, more specifically between private and public veterinarians.

The result section of this study specifically shows that the involvement of public veterinarians is extremely poor in the poultry sector, while that of private veterinarians is spread extensively in every point of the poultry sector. Even after the greatest efforts from private veterinarians, the poultry farmers are closer to dealers whenever they require any veterinary care services. Hereby, collaboration can be introduced between private and public veterinarians with a larger projection of developing the sector.

The result claims that public veterinarians take assistance from RVPs for providing clinical service to large animals, which is a way of promoting RVPs involvement in veterinary treatment. Similar to this, they can promote the private veterinarians working in their upazilas. Although private veterinarians are more well-known to poultry farmers, they nonetheless have less respect on the ground because of their service approach, which requires them to follow business tactics for company advantage before considering the reputation of their field service. Public veterinarians, on the other hand, have the most administrative power and reputation in the community, which they may utilise to help private veterinarians serve marginal farmers who work for private companies without any government support. The public veterinarians in this research were questioned about why they did not refer the cases to private veterinarians and about the distinction between public and private veterinarians in terms of providing veterinary care to poultry producers. The study uncovers several intriguing viewpoints from public veterinarians regarding the lack of communication between public and private veterinarians during patient handling. First off, due to their significant participation in the big animal industry and their administrative responsibilities, public veterinarians are less active in the provision of veterinary care for poultry. The lack of abilities of private veterinarians is therefore highlighted, and their royal attitude towards working in the field diminishes their working effectiveness. However, they think that by making universities effective at the field-level, they may contribute positively to the development of veterinarians. They also believe that there is a need for a government database regarding the veterinarians participating in private poultry practices or private companies. Then they can collaborate with private companies so that the private companies recruit their veterinarians near their home district so that the veterinarians do not have to travel long distances or can work more diligently to properly distribute the veterinary provision across the country rather than recruiting the veterinarians in poultry-concentrated zones. Based on this, the government can reward private companies for their assistance in the growth of the poultry industry alongside the government, and it can also influence veterinarians who work in private poultry practices for their important veterinary services to farmers through government accreditation and awards. Referring cases between the public and private veterinarians is also a proposed collaboration approach obtained from this study. The public veterinarians, therefore, can take the initiative of promoting the private veterinarians by referring patients whenever they get stuck in any meetings. In many upazilas, the veterinarians are directly involved in veterinary provision; they get more patients, including poultry, and they can introduce the farmers to the private veterinarians to take their services. It is unfortunate that there is no list of the graduate veterinarians in the country, including where they are working. This is required to be systematic to reduce the accusation of a lack of veterinarians to get available veterinary services from registered veterinarians (Asfaw et al., 2021).

A collaborative approach would not only make the veterinary provision easy-accessible for the poultry farmers but also would direct the development of a strong database regarding poultry diseases at the field-level. This study has already discussed the role of private and public veterinarians in data collection, including how and what type of data different types of veterinarians collect. The involvement of private and public veterinarians in data collection from poultry farmers is really significant, although the shortcomings of the activities are difficult to ignore. The private veterinarians collect data for their company benefits, but no reflection of that valuable data utilisation is found at field-level. Proper utilisation of the collected real-time farm level data by the private veterinarians could be a resource for both the company and the country. On the other hand, public veterinarians also store data; even they have distinct software for this. The government has a central epidemiology unit (Central Epi Unit) that is active in developing country databases on the disease burdens at field-level in animals, including poultry. The Central Epi Unit gathers these data from the ULO and VH, but unfortunately, these data are mostly non-representative and incomprehensible. Despite the fact that there are two different records for large animals and poultry, the public veterinarians claim that they can hardly ever incorporate the history of each of their daily patients in their record-keeping books. On a holiday, they include all the data from the previous week, or the veterinarian can assign this task to another office employee (who is not a veterinarian). As a result, the obtained data loses its authenticity. Similarly, the private veterinarians also modify data when they do not see the utilisation of these data and do not emphasise the quality of the data while collecting those from farm level. When they do not perceive the companies using this data to improve the quality of the feeds or DOCs through data analysis, they distort the data to their advantage. Many veterinarians may change real data to cover up poor product quality. For instance, farmers may sell their feed sacks without feeding their chickens, causing the feed conversion ratio of the feed to rise. The company will be anxious as a result. Therefore, instead of receiving actual information from the farm, the veterinarians just entered a number on the data sheet. All these issues indicate the lack of coordination and importance of doing this task. Collaboration between public and private companies in defined areas can increase the accountability of the veterinarians to collect real-time data from farm level for a purpose. It is necessary to develop a disease database at the field-level for the sake of the sector. However, the private companies collect data for their own benefit, and they will have trust issues in sharing all this data where they can involve third stakeholder, for example, the Bangladesh Poultry Industries Central Council (BPICC) or the World Poultry Science Association Bangladesh Branch (WPSA-BB), to bridge with public veterinarians. Here, they can involve epidemiologists from the veterinary universities in the country. The epidemiologists from the universities can act as a medium of data storage for private companies and then collate and produce results. Moreover, an intermediary can share the outcomes obtained from the data storage with both private companies and the government. This collaboration would not evolve only to meet the purpose of any individual institute. Through this, the country could have a functioning disease surveillance program. The database is a core element for developing a plan for any disease surveillance at any level (WHO, 2017).

The study discusses the amenability of poultry farmers to the dealers in our country due to a lack of having capital. Furthermore, they face losses on their farms due to various types of disease occurrences. The farmers are very neglectful about the farming protocol and do not even bother about how they are contributing to spreading diseases from one farm to another (Rimi et al., 2017). Rather, the farmers show the proclivity to hide about the diseases that are frequently affecting their farms because there is no incentive from the public or private sector. However, when the farmers report that any diseases affect their poultry, the market price decreases for the flock, although the available care from both public and private veterinarians is not apt (Delabouglise et al., 2016). Additionally, farmers may be ordered to destroy diseased flocks or rear for longer periods to complete antibiotic doses and maintain withdrawal periods, resulting in losses and increased poultry-rearing costs. There is no step from the government to concern the farmers about this issue. On the other hand, due to their working performance, the private veterinarians offer their services to the marginal farmers during their crisis period, although the private companies do not allocate the veterinarians to serve the marginal farmers during any disease outbreak. The collaboration between the government and private companies could eliminate the barriers to conducting the disease surveillance properly.

Routine surveillance is required from the real-time disease data for early detection of localised disease outbreaks and notifiable disease outbreaks (Delabouglise et al., 2016). The farmers must be convinced to be interested in surveillance systems, if only for passive surveillance. Veterinarians are responsible for making them realise how the surveillance programme may help farmers reduce farming expenditures and be independent decision-makers for their farms rather than relying on dealers. The incentive programme may have an impact on whether farmers choose to take part in this PPP approach. When a structured surveillance plan can be established, the preventive and control measures will be easy to adopt, and the existing measures can be modified accordingly. To sustain the surveillance programme, securing compensation facilities for poultry farmers is significant. In Bangladesh, there is a compensation facility for livestock rearers if their animals get affected by highly contagious diseases (e.g., trans-boundary diseases) and zoonotic diseases, including poultry farmers who experience Avian Influenza outbreaks on their farms (Ministry of Fisheries and Livestock, 2008). However, this facility is not in use as a consequence of government fiscal constraints. This study discusses the misinterpretation of a possible case of Avian Influenza because, anytime public veterinarians encounter such a case, they must compensate farmers before destroying the sick chickens since the chicken farms are the only means of income for them. The Bangladesh government can negotiate here with the corporate companies about a portion of the compensation they should provide the farmers. The farmers are purchasing feed and DOCs from these companies. They are connected with these companies. The companies should be partners of the government while defeating the crises of the country. Private companies typically operate at various levels in the sector based on their benefits, and they can collaborate with the government to enhance the acceptability of their services among farmers, ensuring their benefits are maximized. The government is able to influence this by introducing an award scheme for such business companies. Each time a commercial entity participates in a PPP method that benefits the country's people, while also helping the government overcome financial barriers, the company will be able to gain governmental acknowledgment for its commitment to government livestock progress.

Every time there is a need for disease surveillance, sophisticated data collection methods are necessary, though raw data can still be used to build databases. To confirm diseases at the field-level, laboratory tests are required. The connectivity between the government and private laboratories could solve this problem. The private veterinarians get vast exposure from visiting farms, and they get to know the disease occurrence at the farm instantly in their working territory. It is not a big deal for them to send the diseased samples regularly to FDIL, or Central Disease Investigation Laboratory (CDIL), including the obtained field-level data (Delabouglise et al., 2016). If FDIL or CDIL feels the burden of testing, they can pair up with the private laboratories. This will increase the liability of private companies that they are contributing to the country along with the government. This is also respectful of the private companies. When private enterprises perceive the government's interest and engagement in laboratory work, they will not be afraid to spend more on laboratory work to enhance the existing facilities for the growth of poultry farmers. Government affiliation helps gain prestige for the institution, allowing companies to gain popularity among farmers about their laboratory facilities. Therefore, this requires a comprehensive collaborative plan between the government and private companies to bring about remarkable changes. Furthermore, because of the built infrastructure and regulation-related laboratory operations for the poultry sector, it will be simple to obtain international accreditation through the sponsorship provided by international funding actors. To address the previously indicated weaknesses at the public level, the first step should be to activate the FDILs through an efficient regulatory framework, then through advancement and collaboration with private enterprises. In fact, the national statistics offices and the resource people from universities and academia, especially the epidemiology unit, could be included in this collaboration for a favourable outcome.

Following the aforementioned collaboration regarding laboratory facilities, including sample transfer between government and private laboratories, could be a prospective step to normalise taking laboratory assistance from both farmers and veterinarians. This study identifies the existing partial collaboration between public and private veterinarians, where private veterinarians from regional laboratories of private companies get referred samples from public veterinarians. Even the public veterinarians involved in poultry practice acknowledge that they send samples to private laboratories. Furthermore, commercial enterprises receive national accreditation for the quality of DOCs of GP stock imported from overseas delegates from CDIL. Both sectors rely on one another to achieve their goals. Through cross-sector collaboration, this laboratory diagnostic facility would be able to access even the most remote poultry farms. At present, a number of educated, experienced, and concerned people are involved in poultry farming. They are investing more in their business. They ask for advanced treatment. They are concerned about AMR issues and require cultural sensitivity tests to get specific treatment from the veterinarians. This is a positive sign among the farmers that is necessary to emphasise. Sometimes, small-scale farmers do not want to do laboratory tests due to distance laboratories, misconceptions about getting results lately, or faulty results, including the high expense of tests. While both the government and private companies will agree on anything to preserve their profit margins intact, they should put forth a PPP concept to standardise laboratory facilities. All pessimistic thinking is hazardous for a country’s development. This study discloses that many veterinarians are neglectful to laboratory diagnosis because they believe postmortem is the best tool for disease diagnosis and providing medication, whether they are experienced or do not have laboratory support. There is no room to think that performing a postmortem is not important; rather, it is crucial to move towards a laboratory test (Hasan et al., 2010). In fact, an antimicrobial sensitivity test is a prerequisite for conducting AMR surveillance. In early 2007, in Colombia, such a surveillance programme was conducted through an integrated approach between government and non-government institutes (Donado-Godoy et al., 2015). The university academics and intellectuals in this joint endeavour can speed up the activities, as they are involved in continuous research activities in their institutes. This study reports that the FDIL works in collaboration with the Poultry Research and Training Centre (PRTC) under Chattogram Veterinary and Animal Sciences University (CVASU) and a UK-based Fleming Fund project. Similar to this, the private companies take the laboratory facilities from the laboratories of universities. In this way, both governmental and private activities are somewhat interconnected, which may be used to develop a helpful and workable plan for the poultry industry.

Collaboration between the government and private companies is required to modify the existing medicine and vaccine supply system. There is no scope to ignore the fact that most of the poultry farmers get their necessary treatment and medicines, including antibiotics, from their connected dealers and other IVSPs, and that are alarming for the whole country. It is normal that when the chicken flock is diseased, the farmers will be tensed and will go to places where they can easily get treatment for their poultry. This is the gap in the poultry sector, where the poultry farmers get instant service from the IVSPs of the sector; nevertheless, the farmers take clinical service from them, while this is the duty of veterinarians. The veterinarians, however, cannot be blamed as the main accountable actors for this crisis. According to this report, the poultry industry oppresses the private sector in addition to poultry farmers. Because, on the one hand, farmers are compelled to comply with dealer orders because of their credit business with them, but private veterinarians are required to operate for the advantage of their recruitment companies. On the other hand, it is uncommon to find many public veterinarians considering veterinary care for commercial poultry farms. In this situation, a collaborative intervention is highly required to address the problem of AMR. In Bangladesh, the law permits prescribing antibiotics only to registered veterinarians and legalises selling antibiotics only by registered pharmacists (Imam et al., 2020). Very few people related to this sector know these acts; otherwise, IVSPs will not be implicated for breaking the laws. The dealers are selling medicines abundantly without any licence; even the PCs do not require the drug selling licence before selling medicines to the dealers. Rather, many dealers also take medicines on credit from the companies and pay the money after selling these medicines to the farmers.

Along with the dealers, the SRs are also found at field-level selling medicines (Imam et al., 2020). The private veterinarians cannot do more than stop visiting certain dealers who force them to prescribe excessive or irrational medicines that are available in their pharmacies. On the other hand, the veterinarians find the availability of the medicines at market level, which is not standard. The manufacturers of these medicines try to provide more incentive for their product sales. Many veterinarians become manipulated by these companies and go for unethical practices. The government revised the Drug Act in 2022, where the authority prohibited selling antibiotics without a prescription from a registered veterinarian, fixed penalties for selling expired medicines, and sold medicines by vending from one place to another (Rohoman, 2022; Tribune Desk, 2023). Besides, drug manufacturing, importing, distributing, stockpiling, displaying, and selling are punishable, except for proper authority and registration (Rohoman, 2022). Following this law, many actions were taken that were reported in an article in “The Business Standard”, while this study revealed that the laws were stated, but only those are being implemented at the field-level. However, the article did not specify the health sector, which might be the human health sector, where those appreciable actions were taken. Such prompt and drastic actions are also required in the livestock sector, especially in the poultry sector. Many private veterinarians think that the government veterinarians remain shut off from taking any effective action against this unlawful sector because of the incentive. Even many government veterinarians superficially support fewer antibiotic prescriptions while doing more of this. However, in defending this accusation, the government acknowledges the limitations of their regulatory actions. The public veterinarians have limited administrative power because while they go to raid the medicine shops, they should have a magistrate or any administrative body with them (Barua, 2023). It takes a long time to get a magistrate or any administrative body free for this mobile court (a conventional judicial system of the Bangladesh government). According to the APA, the ULO is responsible for this, although the Veterinary Surgeon-in-Charge of the ULO (where there is a single veterinarian in a ULO and VH) is required to do at least one mobile court per year. As they find it time-consuming and a complex process to organise a mobile court, most public veterinarians show apathy towards this. However, they may monitor the activities of the medicine shops by visiting them regularly without making any fines for the illegal activities of the chemists, but that is not very impactful. There is a conflict of interest between the DLS and the Directorate General of Drug Administration (DGDA) have a conflict of interest in drug monitoring, as DLS only issues pro forma invoices at the request of the pharmaceutical companies, while DGDA regulates the veterinary products production including antibiotics, hormones, and vaccines [personal communication, Islam SS]. Furthermore, regarding the reluctance of public veterinarians towards the activities of dealers and chemists, another fear is the political impact. Many dealers and chemists work in society using the power of the local political leaders, which creates difficulties in the activities of the public veterinarians to implement their administrative power. Another issue is that the medicine and vaccine supply in ULO and VH is less than the requirements of the animals. However, in a report by the DGDA, it was acknowledged that they could not produce a sufficient amount of vaccines according to the demand of the animals (DGDA, 2018). The public veterinarians suggest that this problem of misinformation reaching the government can be solved if they can provide exact data on animals in the upazila, including real-time disease data. During sending the consignment of medicines and vaccines to every upazila, the government follows the given demand for medicines and vaccines from the upazila. On the one hand, currently, the Livestock Research Institute (LRI) has the capacity to produce 320 million ($3 million), which is 12% of the total vaccine requirements of vaccines, and the remaining part of the vaccine requirement is fulfillled by the private sector, which imports almost US$47 million worth of vaccines, of which $25 million is cost-only for the poultry sector (Kabir, 2023). As private companies have the biggest share, the government does not look at this. In contrast, the poultry farmers are required to pay more for these vaccines, whereas there is no security of vaccine efficacy, according to the private veterinarians.

If the government and private companies could take a collaborative approach to extending the supply of medicines and vaccines in ULO and VH, that would be a grace for the farmers, as they are playing a role in fulfillling the protein demand of the nation. Apart from this, the recently passed Drug Act 2022 has not mentioned the criteria for fixing a drug’s price or the function of the Drug Price Fixing Committee (Rohoman, 2022). This section of the act may benefit poultry producers by preventing them from being deceived by sellers who keep the prices of medications from the farmers. Apart from this, a prescription guideline is required for poultry diseases to lessen the problems related to the supply of medicines and vaccines and veterinary provision. This guideline will be useful in informing IVSPs about the standard of veterinary care that should be rendered as well as their specific, limited role as suppliers of primary first-aid care for poultry. Additionally, the veterinarians can prescribe with more confidence for the farmers, which will help the farmers to change their perceptions about using more medicines, more antibiotics, or expensive and broad-spectrum drug usage (Haque, 2022). Such a delicate area of veterinary care must be altered with the assistance of knowledgeable poultry practitioners from both the public and private sectors. Their practical knowledge of a variety of topics, such as the use of certain drugs for a specific disease or how the drug producer should contribute, as well as the execution of government laws, is required to modify the finer aspects. Thus, definitely, collaboration between the government and private sector could make all these happen easily.

Another consequential outcome is that sustainable training for farmers could be established through collaboration between the government and private companies. Some private companies and the government have several existing events to train farmers on various aspects of farming. Even after that, when the One Health Poultry Hub, Bangladesh (OHPH,B) organised a 2-day training session only for 15 farmers in the training room of the ULO and VH, the farmers shared their feeling that they had never had such influential training before. This training was arranged by involving private veterinarians, public veterinarians, PPCs, and academicians, including a human physician, in an integrated approach. So, collaboration could help something be more organised and fruitful to achieve its purposes. Currently, the study indicates that when the private veterinarians of FCs organise training, they get assistance from the dealers; even they share money for lunch to make the training more vivid.

When the veterinarians from PCs address their training, they cannot mention anything fruitful; rather, they consider it a get-together to become familiar with the newly launched products of the companies. Then the training courses from the PPCs can be good for the farmers, although these trainings are expensive. Lastly, the training from public veterinarians is just a run to achieve their targets for their APA because of the shortage of manpower. Considering all the shortcomings deriving from the training providers, the best solution can be considered to be collaboration among all the training providers. As the main purpose of training is to educate the farmers, it is necessary to find out the best way to educate them, and the prognosis of such an effort is sustainable. When the OHPH,B team approached to organise such training, the participating private and public veterinarians were surprised at the success of the training, while farmers received the training gracefully. For this reason, a collaborative approach to continual training is the best alternative to anything. Through collaboration, a few points are required to be clarified among the partners of the public and private companies, for example: assessing the need for poultry farmers’ training by interdisciplinary people in the sector; developing a common training module for poultry farmers; introducing a budget scheme among the partners of the collaboration with a scheduled calendar; considering ULO and VH as the centre for training provision; and nesting the One Health approach with farmer’s training. These trainings will include an intensive course on farming, including the topics of farm management, litter management, curtain management, brooding management, feeding management, farm biosecurity measures, and marketing of the ready broiler. Through this training, the farmers can be included in a certification scheme where they will get a little bit more money for following the farming protocol properly. These trained farmers can be the evidence of any sentinel surveillance showing the improvement of the farms. Hereby, academia can be the best intermediary, as it produces lots of young veterinarians who are enthusiastic about disseminating their knowledge at the field-level. This could be a great opportunity for young veterinarians who would be the voluntary trainers of these trainings for learning by teaching. Similar to the farmers, another group from the poultry sector is required to be trained.

From the aforementioned discussions, it is clear to understand that the poultry sector is not only served by veterinarians from government and private companies but also by other non-conventional service providers denoted as IVSPs. The study found that the roles of these IVSPs were not unreasonable; instead, the shortages in the existing policies, facilities, and framing of the sectors gave them advantages in the sector. These IVSPs are notable for the sector until a great revolution does not take place. IVSPs are also maintaining their livelihoods through whatever they are doing now, good or bad. They have investments in this sector. However, proper direction can turn them into blessings in lieu of unpleasant actors for the sector. On this account, the government and private companies can collaborate and increase connections with them. They are required to be informed about government policies, including the benefits and necessities of following these regulations. Some collaborative approaches are necessary to bring the dealers under government license. They can act as catalysts to influence the farmers to give importance to the suggestions and recommendations of the veterinarians. Likewise, it is mandatory to modify the way the SRs’ promote the medicinal products of the companies. As the companies train them on poultry diseases or medicines, it is not necessary to increase the sale of the product. When the companies improve their product quality, the veterinarians will prescribe the products, and even the farmers will ask for those medicines as the farmers are so advanced these days. And then come up to the vaccinators, whose activities are worthy of mention because they administer the vaccines to chickens, which is vital for chicken farms. In spite of their contribution, there is no initiative from the government or private level to train them about vaccination protocol. Some PCs organise a few trainings for them, who are the importers of vaccines. For increasing their sales of vaccines, mainly they do this, while it should be their responsibility to develop the manpower with skills. Collaboration between government and private companies can unfold the opportunities to progress the sector, along with every stakeholder engaged in the sector.

There is a proverb that “unity is strength"—this attribute is necessary for the veterinarian community, whether he is a private or public veterinarian. Otherwise, the poultry sector and, in fact, the livestock sector will not see the progression unless there is a slow coach. Bangladesh AMR Response Alliance (BARA), a name of a joint community that involves both public and private veterinarians against the world-striking issue "AMR," fits this part of the collaboration (Department of Livestock Service, 2020). This study has proven the existing blame game among public and private veterinarians. The criticism within the community not only impacts individual growth but also affects the working environment. However, this study also reported that many senior veterinarians supported the junior veterinarians working in the same field. Even many PPCs and public veterinarians were exemplified as the career guides of many successful entrepreneurs, private veterinarians, and public veterinarians. This study proposes an association between veterinarians who are involved in the poultry sector. These associations can support the new field veterinarians when they feel low while providing veterinary service at the field-level. When a public veterinarian joins ULO and VH as a VS, he gets ULO or administrative bodies as his support while providing veterinary service at the field-level, whereas private veterinarians mostly work under the marketing team under the pressure of company benefits along with the social contemptuousness and excessive workload at the field-level. The role of private veterinarians in the poultry sector is unimaginable. Sometimes, due to the sarcastic remarks and criticism by senior veterinarians, the judgmental approach of the farmers, the dominant nature of the dealers, and a lack of social recognition, the improvement of the private veterinarians is constrained; even these situations push them to leave the job. In such a situation, when they get a place along with the senior private and public veterinarians, they feel comfortable and confident about their status and role. A regional association, along with the veterinarians from different institutes, can develop a centre for their recreation and discussion. They can share the incidents happening in the field. Ultimately, this is pointing to the first step, which is that a good relationship among the veterinarians will enable good veterinary service for the poultry farmers.

# Chapter 6: Conclusion, recommendations, limitations of the study and future direction

## 6.1. Conclusion

Keeping focus on the inter-professionalism of field veterinarians involved in the field-level veterinary service for poultry farmers in the livestock sector in Bangladesh, this study interviews various types of veterinarians to explore their activities, challenges, and opportunities in their job, including their perceptions and expectations towards the roles of other stakeholders for connecting the courses of PPP.

The obtained information from the study reveals the shortcomings of public veterinarians, for instance, insufficient manpower, budget, and skill, which are the obstacles for public veterinarians in providing efficient veterinary provision to poultry farmers. Contrarily, private veterinarians struggle in the sector due to a lack of company appraisal, a crisis of field recognition, challenges in difficult situations, handling at the field-level, and insufficient skills. Besides, from both types of veterinarians, some common accusations, for example, less involvement in the poultry sector, lack of infrastructure, equipment, skills for work, excessive workload, large working area, lack of funding, and supremacy of ISVP, were found. Then the issues created from their activities due to the problems in their job facilities, for example, lack of communication among the veterinarians, inconsistency in collected data quality, the inadequacy of disease surveillance, discrepancies in vaccine and medicine supply, limited laboratory facilities, lack of sync in the organised trainings for the poultry farmers, and lack of strong community among the poultry experts, were noted.

In terms of interprofessionalism, to introduce partnerships between public and private companies, the veterinarians shared their opinions. From several veterinarians’ perceptions, the inclusion of PPP in the poultry sector is a non-viable approach, while many aspirations have come from most veterinarians with the expression of PPP introduction in the poultry sector. A public-private partnership is feasible in the poultry industry if the government adopts a liberal and generous stance, but the private sector must also accept this stance on an equal footing. The government should take a forward step to convince the private companies by proving their loyalty and the capability of maintaining confidentiality in every action of the PPP approach. Private enterprises, on the other hand, have a mindset of achieving the most for the poultry industry, while they should be more committed to working for the welfare of the nation and its citizens.

## 6.2. Recommendations

This study has proposed the follow-up recommendations:

1. The rate of veterinary provision for poultry farmers is needed to be increased. Despite of the inadequate involvement of public veterinarians in poultry sector, they can help to increase veterinary provision for poultry farmers by promoting private veterinarians through PPP approach.
2. A robust database in the poultry sector is crucial for disease management, AMR reduction, safe poultry products, and potential export expansion. The government should support this by offering incentives, encouraging private sector collaboration, and engaging academics if necessary.
3. Government should show integrity with the private companies and involve them in government action regarding tackling disease outbreak situations at field-level.
4. The private companies can take initiative along with government regarding their training and awareness programmes (AMU, AMR, Zoonosis, Food safety) provision to make the events more effective for farmers. Even they can be the initiators by coupling with government to train and progress the IVSP.
5. The existing exchange of laboratory facilities between private and public veterinarians is essential to be increased and normalized with a comprehensive approach between the sectors.
6. A local association including private and public veterinarians should be established to encourage cross-sectorial collaboration while PPP policies will be implemented.

## 6.3. Limitations of the study

All 62 interviews in this study have been conducted online through Zoom meetings. While this has extended access to participants around the country, it has limited the possibility of observation. There is a need to acknowledge that for some participants, speaking digitally has allowed them to manage time in a convenient medium for this study interview as they are too busy in their regular lives. As a result, they have opened up information in a way that an in-person interview would not. Additionally, the core interviewers are veterinarians. This is an advantage in many ways for this study, as the participants have felt comfortable to share genuine information without hiding or polishing the real situations.

## 6.4. Future direction

This qualitative study has earmarked the existing veterinary provision in the poultry sector, including the prospects of public-private partnerships (PPPs) for the advancement of the sector. Having sought to find out the scope of collaboration between sectors for effective poultry disease management, this study has also revealed areas that need to be expanded with further research projects to fully address them. Some areas are mentioned below.

1. The study can be expanded to explore what the higher authority in Bangladesh (e.g., administrative authority from the public and private sectors) thinks about the opinions of the veterinarians regarding veterinary provision and PPP in the poultry sector, who work closely with commercial poultry farmers at the field-level.
2. A qualitative study could be conducted to include the poultry farmers and informal veterinary service providers and investigate their particular responses about their roles and PPP approach in the poultry sector.
3. A qualitative study could be conducted mentioning the roles of veterinary institutes regarding PPP approach in the poultry sector.
4. A qualitative study can be conducted with the participants from the foreign delegations who are involved in PPP in the poultry sector.
5. Then, following the significant findings from the qualitative study, a risk assessment of the PPP approach can be directed, including some quantitative research to find evidence of success to introduce the policies regarding PPP in the poultry sector, including some interventions along the farmers, IVSPs, private companies, universities, and the government.

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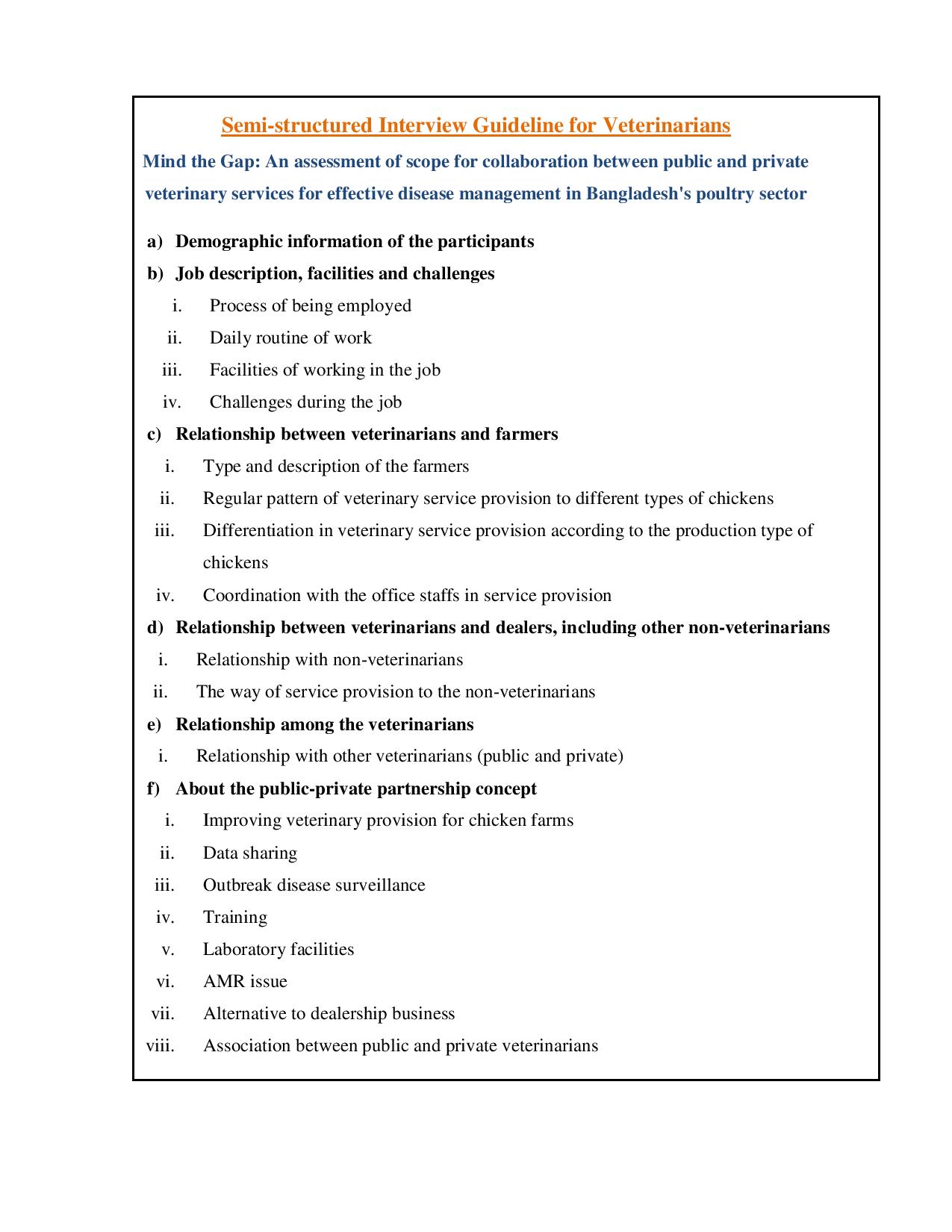
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# Appendices

## Appendix-Ⅰ: Semi-structured interview guideline for veterinarians



## **Appendix-Ⅱ**: Distribution of the veterinarians (N=62) in the study based on the particular employers from June 2021 to July 2023

|  |  |  |
| --- | --- | --- |
| **Type of Institute** | **Varieties of the Institutes** | **Number of the veterinarians** |
| **Private (N=48)** | Feed and DOCs producing Companies | **21** |
| Laboratories of Feed and DOCs producing Companies | **7** |
| Pharmaceutical Companies | **9** |
| Private Poultry Consultants including being involved in private and public institutes | **11** |
| **Public (N=14)** | Upazila Livestock Office and Veterinary Hospitals | **11** |
| Field Disease Investigation Laboratory | **3** |

## **Appendix-Ⅲ**: Demography of the participated veterinarians (N=62) in the study from June 2021 to July 2023

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Gender** | **Age (years)** | **Working division** | **Working Experience** | **Type of veterinarian** | **Designation** | **University** | **Master’s Degree** | **Ph.D Degree** |
| FV-1 | Male | 25 | Rangpur | 1 year | Private | ISO/ DO | SAU | No | No |
| FV-2 | Male | 31 | Chattogram | 4.5 years | Private | CSO | CVASU | No | No |
| FV-3 | Male | 31 | Chattogram | 7 years | Private | Senior- ETS | PSTU | No | No |
| FV-4 | Male | 30 | Chattogram | 4 years | Private | CSO | CVASU | Yes | No |
| FV-5 | Male | 28 | Chattogram | 1.5 years | Private | TSO | CVASU | No | No |
| FV-6 | Male | 33 | Chattogram | 7 years | Private | ZC | BAU | No | No |
| FV-7 | Male | 32 | Rajshahi | 8 years | Private | AM\*- TSO | HSTU | No | No |
| FV-8 | Male | 38 | Chattogram | 12 years | Private | Senior- ETS | CVASU | Yes | No |
| FV-9 | Male | 30 | Chattogram | 3 years | Private | Senior-TSO | CVASU | Yes | No |
| FV-10 | Male | 27 | Dhaka | 3 years | Private | TSO | SAU | Yes | No |
| FV-11 | Male | 28 | Dhaka | 2 years | Private | Executive-TSO | PSTU | No | No |
| FV-12 | Male | 27 | Khulna | 4 years | Private | Senior-CSO | PSTU | No | No |
| FV-13 | Male | 25 | Dhaka | 1 year | Private | TSO | SAU | Yes | No |
| FV-14 | Male | 30 | Chattogram | 4 years | Private | Senior- TSE | CVASU | No | No |
| FV-15 | Male | 28 | Dhaka | 1 year | Private | TSO | SAU | Yes | No |
| FV-16 | Male | 26 | Chattogram | 1 year | Private | TSO | SAU | No | No |
| FV-17 | Male | 30 | Rangpur | 6 years | Private | Senior-CSO | HSTU | Yes | No |
| FV-18 | Male | 29 | Rangpur | 5 years | Private | AM\* | PSTU | Yes | No |
| FV-19 | Male | 26 | Chattogram | 1 year | Private | TSO | SAU | No | No |
| FV-20 | Male | 39 | Dhaka | 9 years | Private | RM | PSTU | No | No |
| PV-1 | Male | 28 | Chattogram | 3 years | Private | SEO | CVASU | No | No |
| PV-2 | Male | 30 | Chattogram | 5 years | Private | SEO | CVASU | Yes | No |
| PV-3 | Female | 30 | Chattogram | 4 years | Private | TSO | HSTU | No | No |
| PV-4 | Male | 26 | Chattogram | 1 year | Private | AM | HSTU | Yes | No |
| PV-5 | Male | 30 | Chattogram | 3 years | Private | TSE | CVASU | Yes | No |
| PV-6 | Male | 26 | Chattogram | 7 months | Private | TSO | CVASU | No | No |
| PV-7 | Male | 37 | Rajshahi | 13 years | Private | RSM | BAU | Yes | No |
| FV-21 | Male | 34 | Khulna | 11 years | Private | DM | PSTU | Yes | No |
| PV-8 | Male | 29 | Khulna | 6 years | Private | Senior-CSO | PSTU | Yes | No |
| PV-9 | Male | 29 | Khulna | 6 years | Private | Senior-TSO | PSTU | Yes | No |
| PLV-1 | Male | 28 | Dhaka | 2.5 years | Private | ETS | BSMU | No | No |
| FV-22 | Male | 27 | Dhaka | 3 years | Private | Executive-CSO | SAU | Yes | No |
| PLV-2 | Male | 30 | Dhaka | 5 years | Private | Senior Officer-Lab | CVASU | Yes | No |
| PLV-3 | Male | 31 | Khulna | 7 years | Private | Lab-in charge | CVASU | Yes | No |
| PLV-4 | Male | 38 | Dhaka | 14 years | Private | Lab-in charge | CVASU | Yes | No |
| PLV-5 | Male | 37 | Dhaka | 13 years | Private | Senior Manager- in lab | CVASU | Yes | No |
| PLV-6 | Male | 38 | Dhaka | 13 years | Private | Manager- lab in charge | SAU | Yes | Yes |
| PLV-7 | Male | 40 | Rangpur | 16 years | Private | AGM- lab in charge | SAU | Yes | Yes |
| ICV-1 | Male | 36 | Dhaka | 11.5 years | Private | NA | PSTU | No | No |
| ICV-2 | Male | 40 | Chattogram | 13 years | Private | NA | CVASU | Yes | No |
| ICV-3 | Male | 40 | Dhaka | 13 years | Private | NA | SAU | Yes | No |
| ICV-4 | Male | 35 | Dhaka | 13 years | Private | NA | CVASU | Yes | No |
| GV-1 | Male | 40 | Rajshahi | 15 years | Private | ULO | BAU | Yes | No |
| GV-2 | Male | 30 | Rajshahi | 2.5 years | Public | VS | CVASU | Yes | No |
| GV-3 | Male | 38 | Sylhet | 13 years | Public | VS- in charge ULO | CVASU | No | No |
| GV-4 | Male | 52 | Mymensingh | 22 years | Public | ULO | BAU | Yes | No |
| GV-5 | Male | 40 | Chattogram | 14 years | Public | ULO | CVASU | No | No |
| GV-6 | Male | 52 | Chattogram | 22 years | Private | ULO | BAU | No | No |
| GV-7 | Female | 34 | Chattogram | 6 years | Public | VS- in charge ULO | CVASU | Yes | No |
| GV-8 | Male | 36 | Khulna | 9 years | Public | VS- in charge ULO | PSTU | Yes | No |
| GV-9 | Male | 32 | Barisal | 4 years | Public | VS- in charge ULO | PSTU | Yes | No |
| GV-10 | Male | 34 | Khulna | 4 years | Public | VS- in charge ULO | CVASU | Yes | No |
| GV-11 | Male | 40 | Chattogram | 15 years | Public | ULO | CVASU | Yes | No |
| GV-12 | Male | 38 | Chattogram | 14 years | Public | ULO | BAU | Yes | No |
| GV-13 | Female | 38 | Chattogram | 13 years | Public | ULO | PSTU | Yes | No |
| ACV-1 | Male | 41 | Dhaka | 13 years | Private | Associate Professor | SAU | Yes | Yes |
| ACV-2 | Male | 56 | Chattogram | 30 years | Private | Professor | BAU | Yes | Yes |
| ACV-3 | Male | 60 | Chattogram | 35 years | Private | Professor | BAU | Yes | Yes |
| ACV-4 | Female | 40 | Mymensingh | 11 years | Private | Professor | BAU | Yes | Yes |
| GLV-1 | Male | 33 | Sylhet | 6 years | Public | SO | HSTU | Yes | No |
| GLV-2 | Male | 42 | Chattogram | 15 years | Public | SO-attachment in ULO | BAU | Yes | No |
| GLV-3 | Male | 38 | Rajshahi | 6 years | Public | SO | HSTU | Yes | No |

[FV= Feed company veterinarian, PV= Pharmaceutical company veterinarian, PLV= Private laboratory vet, ICV= Independent consultant veterinarian, GV= Government veterinarian, ACV= Academic consultant veterinarian, GLV= Government laboratory veterinarian, ISO= Integration Sales Officer, DO= DVM Officer, CSO= Customer Service Officer, TSO= Technical Service Officer, ETS= Executive Technical Service, TSE= Technical Service Executive, SEO= Senior Executive Officer, RSM= Regional Sales Manager, AM= Area Manager, AM\*= Assistant Manager, DM= Deputy Manager, ZC= Zonal Consultant, RM= Regional Manager, AGM= Assistant General Manager, ULO= Upazila livestock officer, VS= Veterinary surgeon, SO= Scientific Officer, NA= Not applicable, Lab= Laboratory, CVASU= Chattogram Veterinary and Animal Sciences University, SAU= Sylhet Agricultural University, BAU= Bangladesh Agricultural University, HSTU= Hajee Mohammad Danesh Science and Technology University, PSTU= Patuakhali Science and Technology University, BSMRAU= Bangabandhu Sheikh Mujibur Rahman Agricultural University]

## **Appendix-Ⅳ**: Different organogram was obtained from the participants of the study working in different companies from June 2021 to July 2023

|  |  |  |
| --- | --- | --- |
| **Type of Companies** | **Name of Companies** | **Existing organogram** |
| Feed and Day-old chicks producing Company | Aftab Bahumukhi Farms Limited (Aftab) | ETS< Senior ETS< AM< Senior AM< DM< Manager |
| Aman Feed Limited (Aman) | EO< SEO< AM |
| CP Bangladesh Limited (CP) | DO/ISO< SM< DM\*< GM< EVP< Vice-President |
| Kazi Farms Limited (Kazi) | Branch Manager (vet), Accountant and Supervisor **(Contract Farming System)** |
| Mega Feed Limited (Megafeed) | TSO< SSO< DM< Manager < SM\*< AGM< Senior AGM < DGM< GM< Senior GM < Executive GM< Director **(Combined for both technical and marketing section)** |
| New Hope Agrotech Bangladesh Limited (NewHope) | TSO< Senior TSO< AM\*< RSO< AM |
| Nourish Poultry and Hatchery Limited (Nourish) | CSO< Senior CSO< AM< Manager< Senior Manager< Junior AGM< AGM< GM |
| Paragon Group Limited (Paragon) | TSO< Senior TSO< SSO |
| Provita Feed Limited (Provita) | ARM< RM< DM<SM\* |
| Eon Group of Industries (Eon) | TSO< Senior TSO< AM **(Combined for technical and marketing section)** |
| **Pharmaceutical**  **Company** | Elanco Bangladesh Limited (Previously, Novartis Bangladesh Limited) | **Sales section:** MM< Senior MM< TM< ASE< RSM< CH/KAM  **Technical section:** TSO< Senior TSO< SO/Manager |
| ACI Limited (ACI) | **Technical section:** CSO< Executive CSO< Senior CSO< **Marketing department** (2 parts): **In sales section**: SM\*\*< ZM and so on, and **In head office** **(PMD)**: PM< APM< PE and so on |
| Square Pharmaceuticals Limited, agro vet division (Square) | EO< SEO< Manager (Sales Section) |
| Renata Pharmaceuticals Limited (Renata) | VE< Senior TSO< CM (equivalent to AM of Marketing)< PM |
| Haychem Bangladesh Limited (Haychem) | AM\*-TSO< RSM< DM< DM\*< CM\* |
| Pharma and Firm | **Marketing section:** SPO< Senior SPO< TM< AM\*< RSO  **Technical section:** TSE< Senior TSE< SAM< MM< GM |
| Opsonin Pharma Limited (Opsonin) | TSE< Senior TSE< AM< Manager of PMD |
| Government | Upazila Livestock Office and Veterinary Hospital (ULO and VH) | VS< ULO< DLO< DD< Director< DG |
| Field Disease Investigation Laboratory (FDIL) | SO< PSO< CSO< DD< Director< DG |

[ETS= Executive Technical Service, DM= Deputy Manager, EO= Executive Officer, SEO= Senior Executive Officer, AM= Assistant Manager, DO= DVM officer, ISO= Integrated Sales Officer, SM=Section Manager, DM\*= Departmental Manager, GM= General Manager, EVP= Executive Vice-President, VP= Vice-President, TSO= Technical Service Officer, SSO= Senior Sales Officer, SM\*= Senior Manager, AGM= Assistant General Manager, DGM= Director General Manager, GM= General Manager, AM\*= Area Manager, RSO= Regional Sales Officer, MM= Marketing Manager, TM= Territory Manager, ASE= Area Sales Executive, RSM= Regional Sales Manager, CH= Country Head, KAM= Key Announce Management, SO= Sales Officer, CSO= Customer Service Officer, SM\*\*= Sales Manager, ZM= Zonal Manager, PMD= Product Management Department, PM= Product Manager, APM= Assistant Product Manager, PE= Product Executive, VE= Veterinary Executive, CM= Clinical Manager, PM= Production Manager, CM\*= Country Manager, SPO= Sales Promotion Officer, TSE= Technical Service Executive, SAM= Sales Assistant Manager, VS= Veterinary Surgeon, ULO= Upazila Livestock Office, DLO= District Livestock Officer, DD= Deputy Director, DG= Director General, SO= Scientific Officer, PSO= Principal Scientific Officer, CSO= Chief Scientific Officer, ARM= Assistant Regional Manager, RM= Regional Manager]

## **Appendix-Ⅴ**: Different laboratory activities according to the participants of the study from different feed and day-old chicks producing company laboratories from June 2021 to July 2023

|  |  |  |  |
| --- | --- | --- | --- |
| **Name of the company associated lab** | **Purposes** | **Location** | **Activities** |
| Nourish Poultry and Hatchery Limited  (Central: 1, Regional: 7) | Central | Gazipur | **Beneficiaries:** Company associated farms (GPS, PS, hatcheries, integrated broiler and layer farms, feed mill, food processing plant, less amount commercial farm sample ) |
| **Postmortem**  **Laboratory facilities:** Bacteriological culture preparation, Serological tests (HI, HA, ELISA), Environmental sample tests (air, hygiene test), Water test (bacterial load, pH test), Molecular test (RT-PCR: isolating *Pasteurella multocida*, Infectious bronchitis, Newcastle Disease, Avian Influenza, Mycoplasma), CS test, Mycotoxin tests |
| **Samples:** Swab, Chick sample, Blood, Feed, Water, Ante-mortem and postmortem sample of ready broiler |
| **No antimicrobial residue test facility** |
| **No free service for the commercial farmers: but give discount** |
| **No systematic accreditation system** |
| **Provide treatment** |
| Regional | Comilla, Rajshahi, Tangail, Cox’s Bazar, Bhairab, Khulna and Pabna | **Beneficiaries:** Commercial farms (broiler, layer, Sonali or other) |
| **Postmortem**  **Laboratory facilities:** HI test, Rapid kit test (Salmonella and Mycoplasma), Water tests, CS test |
| **Samples:** Blood, Live bird, Dead bird, Water |
| **No antimicrobial residue test facility** |
| **Free service** |
| **No systematic accreditation system** |
| **Provide treatment** |
| Kazi Farms Limited  (Central: 1, Regional: 3) | Central | Panchagarh | **Beneficiaries:** Company associated farms (GPS, PS, hatcheries, integrated layer farms) |
| **Postmortem**  **Laboratory facilities:** Bacteriological culture preparation, Serological tests (HI, HA, ELISA), Environmental sample tests (hygiene test), Water test (bacterial load, pH test), Molecular test (RT-PCR: isolating Infectious Bursal Disease, *Pasteurella multocida*, Infectious bronchitis, Newcastle Disease, Avian Influenza, Mycoplasma), CS test, Mycotoxin tests |
| **Samples:** Swab, Chick sample, Blood, Feed, Water |
| **No antimicrobial residue test facility** |
| **No free service** |
| **No systematic accreditation system** |
| **Provide treatment** |
| Regional | Gazipur, Feni and Bagura | **Beneficiaries:** Company associated hatchery and integrated broiler farms, Local Sonali hatcheries, Commercial farms (broiler, layer, Sonali or other) |
| **Postmortem**  **Laboratory facilities:** Bacteriological culture preparation, Serological tests (HI, ELISA), Environmental sample tests (hygiene test), Water test (bacterial load, pH test, iron test), CS test, Mycotoxin tests |
| **Samples:** Swab (air exposure, floor, cages), Blood, Live bird, Dead bird, Water |
| **No antimicrobial residue test facility** |
| **No free service** |
| **No systematic accreditation system** |
| **Provide treatment** |
| Aftab Bahumukhi Farms Limited  (Central: 1, Regional: 2) | Central | Kishoreganj | **Beneficiaries:** Company associated farms (GPS, PS, hatcheries, integrated broiler and layer farms, feed mill, food processing plant, commercial farms ) |
| **Postmortem**  **Laboratory facilities:** Bacteriological culture preparation, Serological tests (HI, HA, ELISA), Environmental sample tests, Water test (bacterial load, pH test), Molecular test: (PCR, RT-PCR), Histopathological tests, Parasitical test, CS test, Mycotoxin tests |
| **Samples:** Swab, Chick sample, Blood, Feed, Water, Ante-mortem and postmortem sample of ready broiler |
| **No antimicrobial residue test facility** |
| **No free service** |
| **No systematic accreditation system** |
| **Provide treatment** |
| Regional | Tangail and Rajshahi | **Beneficiaries:** Commercial farms (broiler, layer, Sonali or other) |
| **Postmortem**  **Laboratory facilities:** ND titer test, CS test for *E.coli* and *Staphylococcus sp.* |
| **Samples:** Blood, dead birds |
| **No antimicrobial residue test facility** |
| **Free service** |
| **No systematic accreditation system** |
| **Provide treatment** |
| Paragon Group Limited  (Central: 1, Regional: 1) | Central | Gazipur | **Beneficiaries:** Company associated farms (GPS, PS, hatcheries, integrated broiler and layer farms, feed mill, food processing plant) |
| **Postmortem**  **Laboratory facilities:** Bacteriological culture preparation, Serological tests (HI, HA, ELISA), Environmental sample tests, Water test (bacterial load, pH test), Molecular test (PCR), CS test, Mycotoxin tests |
| **Samples:** Swab, Chick sample, Blood, Feed, Water, Ante-mortem and postmortem sample of ready broiler, equipment samples |
| **No antimicrobial residue test facility** |
| **Free service** |
| **No systematic accreditation system** |
| **Provide treatment** |
| Regional | Barisal | **Not much active** |
| Public  (Regional 9) | Field Disease Investigation Laboratory | Sirajganj, Manikganj, Joypurhat, Jessore, Gopalganj, Chattogram, Gaibanda, Sylhet, Barisal | **Beneficiaries:** ULO and VH, Projects, Commercial farmers |
| **Postmortem**  **Laboratory facilities:** Bacteriological culture preparation, Serological tests (HI, HA), Water test (bacterial load, pH test), CS test, Mycotoxin tests |
| **Samples:** Blood, dead birds, feed |
| **No antimicrobial residue test facility** |
| **Free service** |
| **No systematic accreditation system** |
| **Provide treatment** |

[GPS= Grand-parent stock, PS= Parent stock, HI=Haemaglutttin Inhibition Test, HA= Haemaglutination Assay; ELISA= Enzyme-linked Immuno Sorbent Assay, PCR= Polymer Chain Reaction, RT-PCR= Reverse Transcriptase Polymer Chain Reaction, CS test= Cultural Sensitivity test]

## **Appendix-Ⅵ**: Involvement of different feed and day-old chicks producing companies in data collection and utilisation process obtained from the participants of the study from June 2021 to July 2023

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Companies** | **No of farm visit** | **Data collection** | **Data storing** | **Give record-book** | **Report** | **Data analysis** | **Feedback on reported data** | **Name of website** | **Obtained information** | **No of model farm** |
| Aftab Bahumukhi Farms Limited | Daily: 2-8 dealer-based, Average: 80-100/ month | Manually (1, 2) | A, B | a | No\* | Company analyses data | 1a | **MY AIMS** | FCR data, Management data, Disease data, Production data | 1-6 farms per vet: collect data from 1 farm/ week |
| Nourish Poultry and Hatchery Limited | Daily: 4-7 dealer-based), Average: 40/month (regional lab) | Manually (0); Now use an app | A, B | a | Yes\* | Company (Central team: Customer Service Department) does it | 1a | **Nourish app** | Farm’s demography data, FCR data, Diseased data | 13-14 (Antibiotic free farm) |
| Kazi Farms Limited |  |  | A, B | a | No | Company analyses | Nothing | **Online website** | FCR data and Disease data | Collect from demo/Trial farms |
| C. P. Bangladesh | Daily: 2 (Dealer-based) | Manually | A | a | Yes | Veterinarian analyses | Nothing | **Online website** | Dealer based: FCR data, Management data, disease data, Farmer and farm’s demography data, Costing data in contracted farms | 5 farms per branch, collect data rotationally per week |
| Paragon Feed Limited | Daily: 1-2 dealer-based | Manually (2,3) | B | b | Yes\* | Company (Technical Head) analyses | 1a, 1b | Online website | Farmer and farm’s demography data, FCR data, and Disease data, Costing data (contracted farms) | 5-10 farms/vet (Contracted) |
| New Hope AgroTechBangladesh Limited | Daily: 4-5 dealer-based) | Manually | A, B | a | Yes | Company analyses | Nothing | Online website | FCR data and Disease data |  |
| Aman Feed Limited | Daily: 10 farms | Manually | A | c | Yes\* | Company probably analyses | Nothing | No | FCR data | 5-10, collect data twice/week |
| Eon Group Industries | Not organised | Manually | A | c | Yes | Company probably analyses | Nothing | No | FCR data, Production data and Disease data | 10-12, collect data |
| Provita Feed Limited | Daily: 6-7 dealer-based) | Manually | A | c | Yes | Company analyses | Nothing | No | FCR data, production data, Disease data | No |

[**Data Collection:** Manually (the vet collected previously= 0, using notebooks= 1, using record keeping forms= 2, using complaint form=3, collect previously given filled forms= 4)

**Data Storing:** MS Excel= A, Company Website= B

**Providing record-keeping book to the farmers:** Yes (company associated farmers)= a, Model farms= b, No= c

**Report preparation:** Not prepare report, send data anytime= No, Not prepare report, but send collected daily data to central authority= No\*, Require to prepare daily report using the collected data= Yes, Require to prepare weekly and monthly report using the collected data= Yes\*

Feedback on reported data: Result is shared with vet to distribute among model farmers and company associated farmers= 1a, Take action according to the complaint of feed and chicks= 1b

**Obtained information:** FCR data= data about amount of feed intake and body weight of chickens, Farmer’s demography= name and cell no, batch no, shed no, Farm’s demography=, chick received date, total number, death no in box, source weight, chick’s condition (weak/good), Disease data= Vaccination, Medication, Mortality, Costing data= No of death birds, unsold birds, Starter feed, Grower feed and Finished feed with amount used and left over feed, No of sold and weight, including medicine, electricity, labour, litter]

## **Appendix-Ⅶ**: Trainings organised by different institutes for the farmers according to the participants of the study from June 2021 to July 2023

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Type of the company** | **Name of the company** | **Honorarium for vet** | **Type of training** | | | **Training frequency** | **Involvement of the event organisation** | | **Participants** | **Materials** | **Budget** | |
| Feed and Day-old chicks producing company | Nourish Poultry and Hatchery Limited | No, but helps for promotion | Regular training in laboratory | | | * Per month: 2 (before COVID) * Per month: 1 | Company and dealers | | * All the farmers of any company feed taker * Dealers associated farmers | Farm related topics: Farm management, biosecurity, and vaccination: PowerPoint in English and Bengali | Company and dealers: lunch, pens, notepads, brochures | |
| Pocket seminar (at a dealer’s point) | | | * Per month: 1 | * Dealers and Dealer’s associated 10 farmers | Discussion on different topics about chicken farming |
| New Hope Agrotech Bangladesh | * Per seminar: 1000 BDT * Per training: 500-1000 BDT | Seminar with large no farmers | | | Seminar: Dealer’s point | Company and dealer | | 30-35 farmers | Basic topics of farm management: farm management, feeding system, vaccination, biosecurity, litter management, curtain management, farm management according to the seasonal variation including diseases and medicines | Company: lunch, handouts and printed booklets | |
| Training with small number of farmers | | | On-spot training: Dealer’s point | 5-6 farmers |
| Eon Group Industries |  | Spot training | | | * While visiting farm | Company, sales representative and dealer | | Dealer associated farmers | Farm management and biosecurity, brooding management, litter management, vaccination | Company | |
| Regular training | | | * Per month: 2 |
| Paragon Feed Limited |  | Regular training (at dealer’s point) | | | * Per month: 1 or 2 | Company and dealer | | Dealer associated farmers and other company farmers | About farm management through PowerPoint presentation | Company: small gifts, and lunch | |
| Kazi Farms Limited |  | Training programme | | | * Per year: 2 | Company and dealers | | Dealers and farmers | Farm management | Company | |
| Provita Feed Limited |  | Training programme | | |  | Company | | Company feed taker- dealers help to select them |  |  | |
| C. P. Bangladesh Limited | **No organised training: whenever the veterinarians visit the farms, they discuss on various topics regarding farming** | | | | | | | | | | |
| Aftab Bahumukhi Farms Limited |  | Regular training | | * Per month: 2 | | | Company and dealers | Company associated dealers | Discuss on farm management techniques, biosecurity, seasonal precautions in farm, vaccination schedules, and other relevant topics | Company | |
| Training on Dealer’s point | | * While visiting farm | | |
| Pharmaceutical Company | Eskayef Pharmaceuticals Ltd. |  | At dealer’s point | | * Occasionally | | | Company |  | Discuss on farm management, vaccination and biosecurity measures |  |
| Renata Pharmaceuticals Ltd |  | **At three months interval** | | | | | | | | |
| Haychem Pharmaceuticals Ltd |  | **No organised training: whenever the veterinarians visit the farms, they discuss on various topics regarding farming** | | | | | | | | |
| ACI Pharmaceuticals Ltd |  | **Organise training** | | | | | | | | |
| Elanco Pharmaceuticals Ltd |  | **Organise training** | | | | | | | | |
| Square Pharmaceuticals Ltd |  | **Organise training** | | | | | | | | |
| Opsonin Pharmaceutical Ltd |  | Training for poultry farmers | * Per month:1 | | | Company | | Dealers and Farmers | Discussion on farm management, disease management, and mostly medicine | Company |
| Training for dairy farmers | * Per month:1 | | |
| Government institute | Upazila Livestock Office and Veterinary Hospital |  | Backyard meeting | According to APA | | | Government veterinarians, veterinary field assistant | | Backyard chicken grower | Discussion about biosecurity measures and vaccination programmes | FAO and DLS |
|  |  | U2C | According to APA | | | Government veterinarians, veterinary field assistant | | Commercial chicken farmers | Discussion about biosecurity measures through PDS and Farm assessment |

[FAO= Food and Agricultural Organization, DLS= Department of Livestock Service, U2C= Upazila-to-Community, PDS= Participatory Disease Surveillance, APA= Annual Performance Agreement]

# Brief Biography

**Meherjan Islam** passed her Secondary School Certificate (SSC) examination in 2011 and Higher Secondary Certificate (HSC) examination in 2013. She obtained GPA-5.00 in both SSC and HSC. Meherjan Islam passed Doctor of Veterinary Medicine degree in 2020 from Chattogram Veterinary and Animal Sciences University (CVASU) securing a CGPA 3.76. Now she is a candidate for the degree of MS in Epidemiology under the Department of Medicine and Surgery, Faculty of Veterinary Medicine, CVASU. She is interested in Applied Epidemiology, Risk Assessment of Emerging Diseases and Qualitative Study Designs.