

Impact of COVID-19 on the Supply Chain of Poultry Industry, Dairy & Livestock Industry in Bangladesh

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MIP Model: An MIP model for production, transportation, and distribution problem has been developed by Pirkul and Jayaraman to represent a multi-product tri-echelon capacitated plant and warehouse location problem. The model minimizes the sum of fixed costs of operating the plants and warehouses and the variable costs of transporting multiple products from the plants to the warehouses and finally to the customers. The model simultaneously maximizes the difference between return and investment.

System Dynamic: System dynamics is a vibrant methodology based on developing simulation models to improve decision-making, forecasting, or problem-solving performance.

The Simulation Model: The simulation model has the capability to assess the volume of wastes that can be used as the input of by-products.

TTP- Triple Triangle Framework.

BRAC- Bangladesh Rural Advancement Committee

SD-System Dynamic

DLS- Department of Livestock Services

MoLF- The Ministry of Livestock and Fisheries

Abstract: The study explores the effect of COVID-19 on the supply chain of the poultry and dairy industry of Bangladesh. Primary data was collected from Chapia Upazila of Brahmanbaria, Kumarpur, and Badlagachi Upazila of Naogaon Zilla, Rajshahi. The study finds diversity in the supply chains of these industries. To understand the supply chain of the above markets, a survey was conducted with 36 participants for each branch from three different districts. Descriptive statistics analysis was the key method for analyzing the data. While the hypothesis of the study claimed that a change in the supply chain of the poultry and livestock industry occurred due to COVID-19, it was found that the poultry industry remains intact in the supply chain whereas changes are seen in the beef market. The findings of the study also show that large farmers have faced tremendous amounts of pressure during this COVID-19 in both the poultry and livestock industries.

Keywords: Supply Chain, Poultry Farm, Dairy Farm, Players, COVID-19, Impact.

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Introduction

The poultry, dairy and livestock are sectors have been adversely affected in the COVID-19 pandemic in Bangladesh. Livestock accounts for 1.7% of the GDP of Bangladesh (Rasha and Liza, 2018). Poultry accounts for 14% of the total value of livestock output. Poultry meat alone contributes 37% of the total meat production in Bangladesh and 22-27% of total animal protein. There are around 1,50,000 poultry farms in Bangladesh (Hamid and Rahman, 2017).

Poultry farming is a form of animal husbandry. It is a process of different types of birds such as ducks, turkeys, chickens etc for meat, egg, feather or for sale. More than six million people are directly or indirectly involved in poultry production. Poultry employs 14% of the country's labor force (Mahmud, 2020). Dairy farms account for 12% of the agricultural GDP. There are around 58,590 dairy farms in Bangladesh. Each of these farms have 10 or more cows (Rashid and Kamruzzman, 2018). Dairying, also called the dairy farming, is a branch of agriculture which means the raising, breeding and utilization of dairy animals for the production of milk and various kinds of dairy products are processed from it at dairy plants. The financial impact of the COVID-19 crisis on the country's dairy sector has shaken up the milk market. Loss in this sector is approximately \$470 million as farmers could not market milk since mid-March (World Bank, 2020).

In the context of the COVID-19 pandemic, this paper therefore aims to analyze the supply chain of the poultry and dairy markets. As the pandemic has caused a tremendous amount of change in the supply of these goods and their agents in the supply line.

The Rationale of the Study

This paper aims to find the changes in the supply chain of poultry and agro markets, which have an effect on the rural economy of Bangladesh. The findings of this paper will help to determine the extent of the effect of COVID-19 on the rural economy. Previous studies could not address extremities such as COVID-19 (Shamsuzzaman & Jahan, 2017). The current study will therefore seek to add to an understanding of the effect of the COVID-19 pandemic on the supply chain of poultry, dairy and livestock in Bangladesh. The objective will be to pass on experience and findings for more post-COVID-19 studies in similar areas in future.

Objectives

The objectives of the study are to understand the change that occurred within the supply chain of the poultry and dairy industry due to COVID-19. The study also seeks to know what a supply-chain is and how it works; who the main players are; and what differences are there in the supply-chains in the different industries.

Literature Review

The poultry and livestock industries hold great significance in urban life. In this regard, there has been a considerable amount of dependency on these industries to meet up the protein requisite (de Bruyn & Wong, 2015). Explaining why there is a greater demand for poultry in urban society and hinting towards the urban supply side, the paper moves away from explaining the entire supply side. In contrast, our paper covers the whole production

chain from the root-level producer to the retailer. As more villages are heading towards townships, the necessity of poultry to meet up the food scarcity increases (Larive International, 2020). The study focused on the development of the poultry industry, which has led to the exploration of the challenges and the opportunities related to poultry sector development. Whereas, the paper does not reveal information about the supply chain of the poultry industry or the adverse effects that have been faced by the stakeholders which have been addressed in our study and the impact of COVID-19 has been brought to light. A more accurate approach to the development of the sector indicates the development of SME hatcheries, which happens to be an important sector of the supply chain (Shamsuzzaman & Jahan, 2017). This study however incorporates the Triple Triangle Framework on the poultry industry of the country. Although challenges and issues of the industries are indicated in the paper, extreme issues such as pandemics have not been addressed. This is where our paper fills in the gap and explains such extreme conditions as COVID-19. When the first lockdown was implemented in Bangladesh, businessmen were facing a huge loss. A report revealed that these businessmen were not able to sell eggs or poultry products, while the cost of production of 1-day-old chicken was 35 Taka but the selling price was one Taka, the production cost of broiler chicken was BDT 70 per kg, and production cost of the egg was 6 Taka. It was assumed that they would be forced to make a loss worth 100 Crore a day (The Business Standard). The report dives into the financial condition of the poultry farmers and retail sellers who were facing the initial time of the first imposed lockdown in Bangladesh but misses out on crucial information on the overall condition of the supply chain. Even though the financial condition of some of the stakeholders, mostly retailers, are addressed, the report side-lines the entirety of loss faced by the supply chain whereas our paper discusses the impacts based on all the actors of the supply chain.

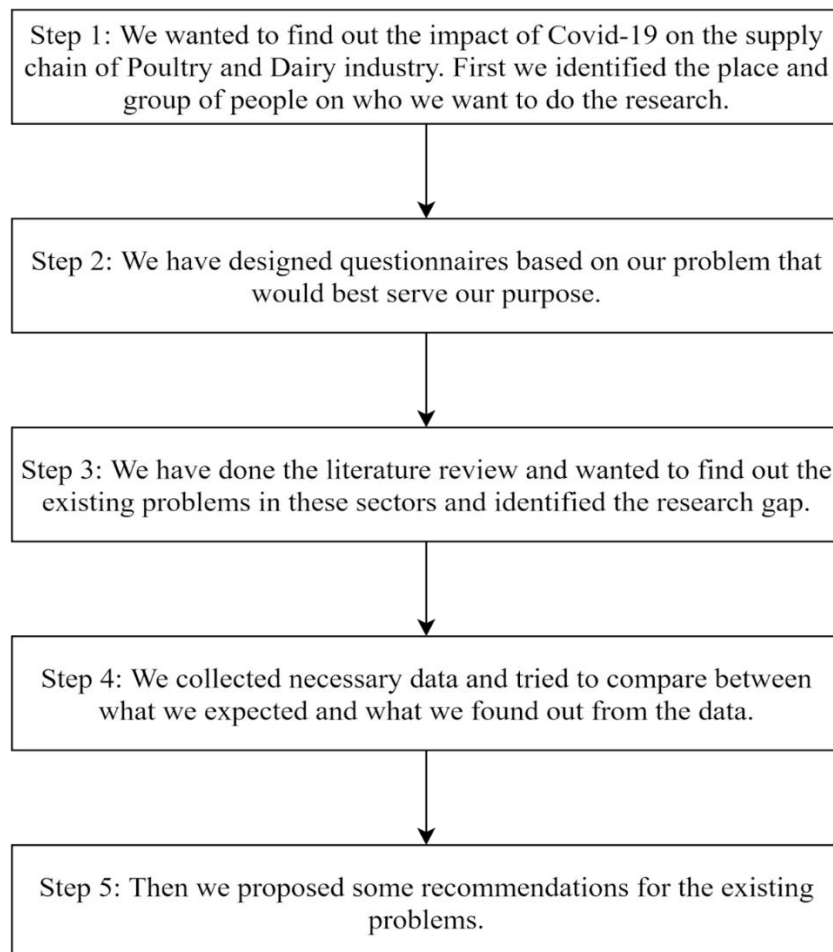
Addressing the consumption, production, and marketing of the dairy industry and ways of improving the conditions in these sectors and patterns of utilization of the labor has been discussed (Halder and Barua, 2003). But have not shown which player has benefitted the most, while our paper exclaims such issues through quantitative data. Whilst the dairy industry was suffering from the effects of COVID-19 indicating disruptions in the supply chain (ADB, 2020). The report encompassed project implementation and investment to recover from losses but has not shown the stakeholder-wise impact in the supply chain which we have included in our paper. In the input side of the market it is seen that the raw materials of animal feed such as soy and maize couldn't be imported (Light Castle Analytics Wing, 2020). But it fails to explain the supplier side of the story, leading to a gap in the segment that we cover in our study explaining the impact on the suppliers. The misconception of transmission of coronavirus due to the consumption of chicken caused the consumption of chicken and eggs to fall drastically (Poultry World, 2020). But the report does not show any impact on the stakeholders of the sector, while our paper illustrates the impact on the supply chain.

On the dairy side, there has been a huge amount of unsold milk in the market during lockdown (The Business Standard, 2020). However, there was no word about the loss of the stakeholders at different stages. Adding to the issue, spillover effects take place (The Financial Express, 2020). The report seemed to bring out the causes as oversupply and

frequent price fluctuation with large price gaps between the urban and rural markets of the country. But did not seem to shed light to the middlemen in the supply chain, which was covered in our research.

It seems that most of this literature addresses the sectors in the fields of development, significance, and even current situations but does not identify the impact on the supply chain. Most of this literature does not address the COVID-19 situation or have been written prior to the situation, as a result, these papers lack relevant information based on COVID-19. The supply chain does not seem to appear as a whole in these papers. Rather these studies indicate only a segment of the supply line or focus on the industry overall. Even though this literature is confined to such topics, it gives a clear idea of the industries. However, the current research tries to accumulate information re-introducing and defining the supply chain which is sidelined in the prior literature. Since the topic of COVID-19 is rather new, addressing the matter and relating it to the supply chain helps give a different perspective to the supply chain.

Framework

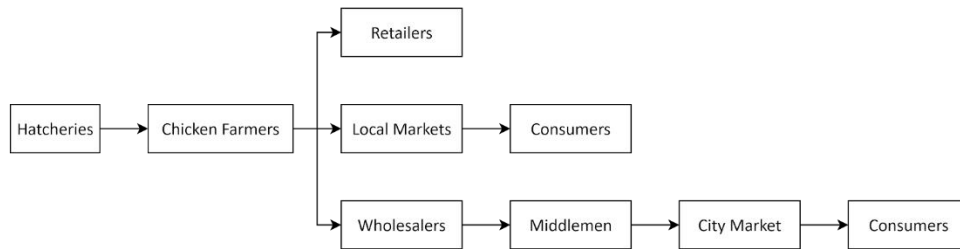
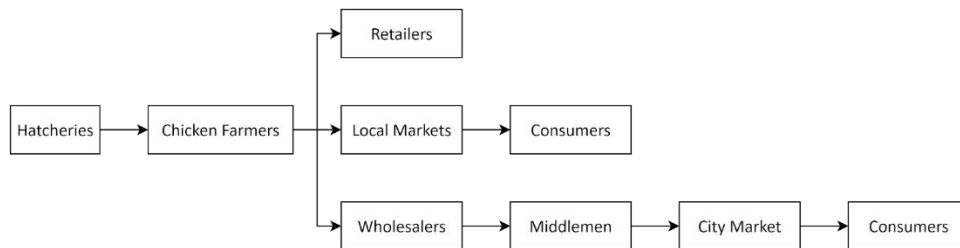
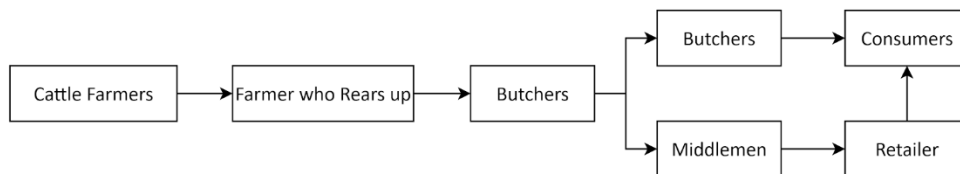
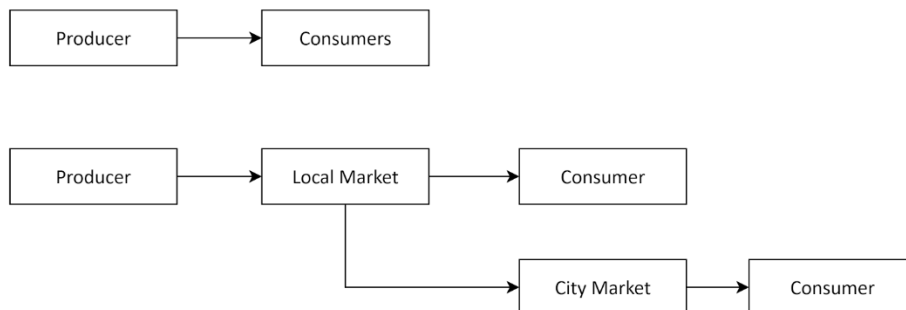


Methodology

The research is a descriptive research. Descriptive statistics analysis has been done. We have taken data for three particular time periods noted as pre-lockdown time (before March 2020), during the lockdown (March-June, 2020), and post-lockdown time (after June 2020). In both of the sectors (poultry and livestock) for each player in the supply chain, the sample size is 36 and for consumers, it is 31 as we have collected data from Badalgachi, Kasba, and Mohanpur Upazila, and the data of consumers was collected from Dhaka city. The sample size was selected by random sampling and the total population size was 525. Data was collected from these three Upazilas and Dhaka districts as we had limitations in collecting data. Because of COVID-19, data couldn't be collected from various districts and regions. Both qualitative and quantitative data have been collected. Qualitative data regarding the definition of the supply chain, what the researchers have already said, which policies have already been suggested- these helped us to know that what steps had already been taken by the government and quantitative data regarding the contribution to the development of these sectors in our economy, how many farms are there and the amount of profit or loss they were making: before, during and after the lockdown-this showed us the impact of COVID-19 on these industries for the above mentioned three time periods, the number of received stimulus packages-whether they have received any or not and if they have received, what was the amount-proper questions were asked to the players regarding all this. This helped us to know the plan of government and the ways and challenges of implementation of these plans regarding stimulus packages. For each of the sectors, wholesalers, retailers, producers, and consumers were asked questions and separate questionnaires were there for each of them and we have conducted the field survey and only the data of the consumer was collected through google forms. We have collected the primary data through proper questionnaires for the above-mentioned three time periods to see the changes in their socio-economic condition and by visiting the field, an interview of the players was taken by us. That is how the questionnaires were structured in accordance with the objectives of the study. As the objective, We have also gathered the data of consumers by preparing a google form. The secondary data was collected from existing literature, articles published in some newspapers and journals of our country, and also from different websites. Both open-ended and closed-ended questions were there. Around 15-20 minutes was taken to fill up the questionnaire. And we have shown the results through charts. We have done the t-test to see the significance of the value of the stakeholders of each market.

Supply Chain

The supply chain shows the process of how good is reached from the beginning stage of sourcing raw materials to the end stage and how value is added at each stage between the firm, suppliers, and the final customers. It can be of different types and the number of players in a particular supply chain again is determined based on the demand of that product and how they want to supply the product and how many industries are actually involved in the market. The more a firm can predict the functions of a supply chain, the more they study and analyze it and take proper steps to modify it from time to time, the better the firm is doing. An industry can have different types of supply chains based on their customer and location. Different kinds of supply chains are shown here.

The supply-chain(poultry) we got from the primary data**The supply-chain(egg) we got from the primary data****The supply chain(Beef) we got from the primary data****The supply chain(Milk) we got from the primary data**

Importance of Supply Chain:

The objective of a supply chain is to reduce costs, ensure efficiency and predict demands. Manufacturers depend on the supply chain to reliably transfer their products. Retailers can avoid the cost of unnecessary inventories through the supply chain. Consumers know the exact location of a product. This saves time and money for the consumers. It reduces the costs of the firms. Products are diversified in these sectors, especially in the poultry sector. Firms have to know the demand of these types in their locality and outside the locality. They have to make sure their products reach in time and know-how many players to involve to supply it in the final market, in which market and profit will be maximized. When a change occurs in these sectors, such as, due to COVID-19, they have to know about the changes in the supply chain. Due to this pandemic, firms realized that they cannot make their desired amount of products to reach the market. They took alternative steps. The supply chain was narrowed down. Looking at their steps and also the amount of information they have and the stories they shared, it will be easier to understand the importance of the supply chain. Due to COVID-19, supply chain disruptions led to huge losses to the players of this sector. This is discussed below.

Stimulus Packages for These Poultry and Dairy Farms

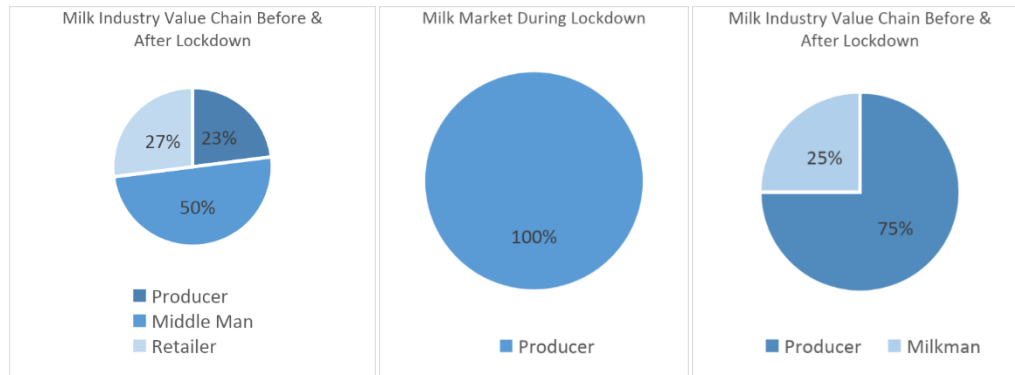
On April 12, 2020, the prime minister announced a stimulus package of 5,000 Crore Taka for small and medium enterprises (Business Line, 2020). DLS and MoLF also came to their rescue. In total 2,00,000 poultry and 4,20,000 dairy farmers in 61 districts are about to receive financial support from the government (The Business Standard, 2020). From the survey in both the poultry and dairy sector, it is seen that some of the farmers have only heard about the announcement but did not receive any, while some others claimed that they did not even hear about the announcements.

Survey Findings

The findings of the paper are based on a sample of 36 observations in four different sub-sectors. And three timelines could be distinguished, namely: Pre-Covid (Before March 17, 2020), During Lockdown (March to June of 2020), and Post Lockdown (Rest of 2020).

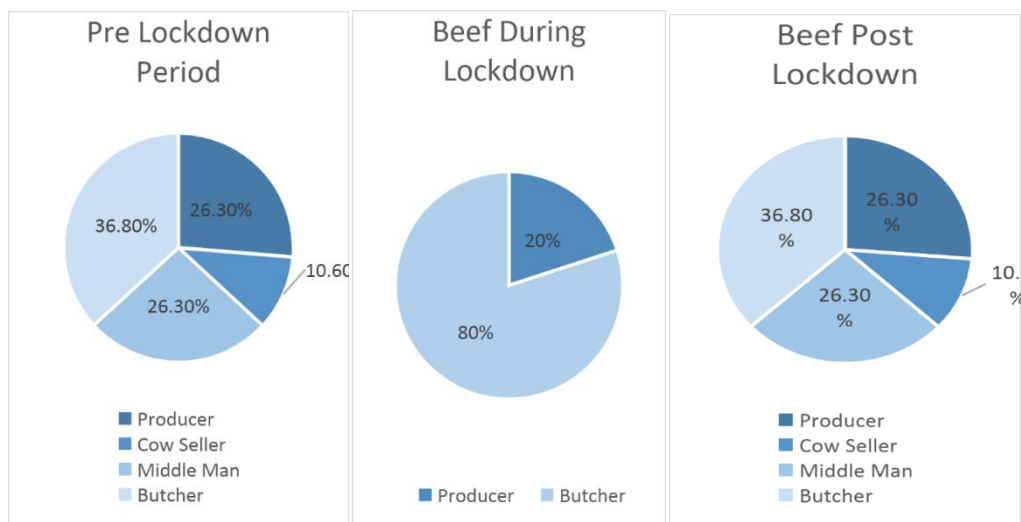
Milk Market

Since the study tried to find out individual findings, it is found out that for all three periods of pre lockdown, during the lockdown, and post lockdown the p-values are less than $2.2e-16$ rendering our sample statistically significant. In the Milk Market, the average price was BDT 50 throughout the country before the lockdown was enacted. For simplicity of representation and calculation, an average amount has been shown for all three values. During the lockdown phase, the price of Milk fell to BDT 30. Survey findings show a reduction in movement of consumers and retailers in the market caused a significant amount of changes to the milk market leading the market to bid down the price. However, it is seen that, during the Eid season in our country, the market rejuvenated and the price was higher. The post lockdown period has milk prices even higher than before. During this period, however, due to decentralization, the most affected were the middle man and the retailer class. In some cases, the milk industry has a supply chain of milk producers and milkmen. Here the milkman earns the biggest share of profit. Whilst, the milk producer earns just a small portion of the profit.



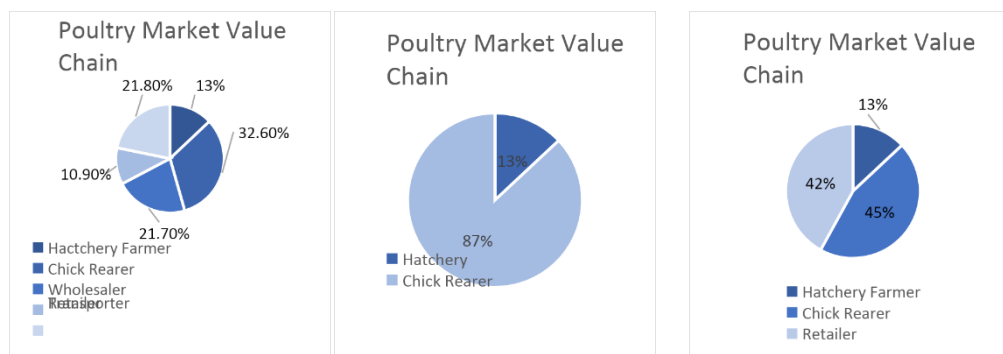
Beef Market

Conducting a t-test gives us a significant result for all three timelines, where the p-value in the pre-lockdown period is less than $2.2e-16$. For the lockdown period, it is 0.0135, and for the post lockdown period, it is less than $2.2e-16$. Thus we deem it statistically significant.



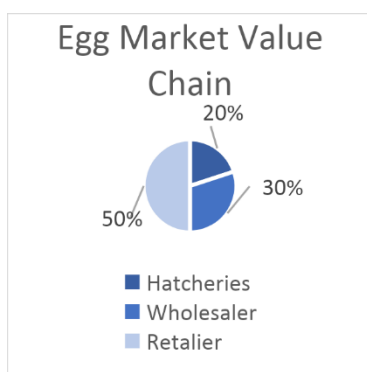
In this market it is seen that there may be different types of supply chains. The most commonly found in the area of Rajshahi and Bramhanbaria has four major agents; Cow Farmer, Cow Seller, Cow Broker (Bepari), and Butchers. During the lockdown period, the supply chain shrank, profiting the butchers or the retail class. As they could now directly deal with the producers. Another group affected were the middlemen of the first and second stages. They suffered a loss till the Eid-UI-Adha and Eid-UI-Fitr. During these two seasons, a lot of customers buy cows and the price hike in the beef market occurs as a result, the market was able to sustain itself as the livestock market had a liberal lockdown during that time.

Poultry Market



The value of the supply chain is distributed. It seems that the value chain has not been altered much in the market. The lock-down temporarily took them out of business for a few months. But none of the agents from the poultry industry seem to be permanently affected. Even though there have been losses incurred in the market, the chicken market didn't seem to have been affected much in the regions. The study reveals that the middle man or the wholesaler just bore additional costs.

Egg Market



The value chain of this field is related to that of the chicken market. In this sector the profit margin was already very minimal as a result this chain was not disrupted.

The market did not seem to suffer huge margins of loss. While the price of rural egg went down to 70 Taka during lockdown the price of farmed brown eggs remained constant

Conclusions

The study tried to analyze the impact of COVID-19 in three different time periods on the supply chain of the poultry and livestock industry. From the analysis, it is seen that in the poultry market temporary, but sustainable loss has been incurred by small farmers while large hatcheries and farms suffered more. But surprisingly, innovation helped few farmers to survive-which was very prominent among the livestock industry (Dairy Industry). Even though all stakeholders may not be present during the lockdown period, recovery was achieved after lockdown. Whilst the livestock (and dairy industry) suffered the most, permanent losses were incurred in the middlemen class of the stakeholders. The paper tried to address the supply chain as a whole. Moreover, COVID-19 being an extreme issue faced in the sector has been illustrated in the paper. Since COVID-19 is a recent issue, the previous papers did not hint at such occurrences. This also caused not to direct towards extreme situations. In such situations, guiding steps or actions have not

been indicated. Moreover, the complex structure of the supply chain has not clearly been illustrated that may help to know the modern-day functions of different players. Whereas the paper tries to address the supply chain and re-introduce different parts of the supply chain in both industries. In addition to that, the values and impacts on different stakeholders of these industries due to COVID-19 seem to give a detailed understanding, which is relatively a new concept. Reactions of different stakeholders through surveys bring a realistic picture of the COVID-19 scenario, which seems to be a different scope of the study.

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