WILLINGNESS TO PAY ANALYSIS

ACTIVITY 1.2.6.2: ANALYSIS OF CONSUMER AND VENDOR WILLINGNESS TO PAY FOR POULTRY FOR IMPROVED BIOSECURITY: A STUDY IN LIVE BIRD MARKETS OF DHAKA CITY *

***FORMERLY TITLED IN Y3 WORKPLAN:** "A PRELIMINARY REPORT DESCRIBING THE DETAILED METHODOLOGY IMPLEMENTATION PROCESS WITH DATA COLLECTION TOOLS, PARTICULARLY FROM INITIAL PHASES"

A Report from STOP Spillover Bangladesh

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CONTENTS

STOP SPILLOVER

Strategies to Prevent Spillover (or "STOP Spillover") enhances understanding of the complex causes of the spread of a selected group of zoonotic viruses from animals to humans. The project builds government and stakeholder capacity in priority Asian and African countries to identify, assess, and monitor risks associated with these viruses and develop and introduce proven and novel risk reduction measures. "Spillover" refers to an event in which an emerging zoonotic virus is transferred from a non-human animal host species (livestock or wildlife) to another, or to humans.

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INTRODUCTION

Highly pathogenic avian influenza (HPAI) viruses have been identified as a major public health concern, especially in Asia, because of their transmissibility to humans [1], high fatality rate in humans [2] and pandemic potential [3]. Eighteen countries have reported H5N1 in humans [4]. In Bangladesh, the HPAI H5N1 virus has now become endemic in poultry [5]. Eight human cases of influenza A (H5N1) and three human cases of influenza A (H9N2) have also been reported since 2008 [6, 7].

In Bangladesh, live bird markets (LBMs) represent a high-risk interface for HPAI virus transmission [8, 9]. Multiple poultry species, including chickens, ducks, geese, pigeons, and quail, are typically sold together in LBMs, which contributes to inter-species transmission of avian influenza viruses (AIVs) in these settings [10, 11]. Many other businesses, including vegetable, fish, beef, and other grocery operate businesses in the same area [10]. Millions of people visit the wet markets every day and become exposed to live poultry potentially infected with HPAI viruses. A cross-sectional study revealed that poultry shops where poultry are slaughtered, kept unsold on premises overnight, , or kept sick and healthy birds together were more contaminated with AIVs compared with shops that did not engage in these practices [12]. Poor biosafety and personal hygiene practices at LBMs and farms can facilitate AIV transmission between poultry and humans. Therefore, poultry workers and consumers are at risk of contracting AIVs, which can have severe consequences for public health and lead to outbreaks with widespread implications in Bangladesh and beyond. Year-round circulation of AIV in poultry, including H5N1, in LBMs in Dhaka has been reported [13, 14].

In Bangladesh, interventions to prevent AIV have typically focused on cleaning, disinfection, and major infrastructure changes at LBMs, such as provision of water supply, designated slaughterhouses, use of biogas, and designating specific areas for compost plants [15, 16, 17]. For example, although substantially fewer HPAI outbreaks were reported and no clusters of infection were found during the implementation of the STOP AI intervention from 2008 to 2010, the effect on the incidence of disease was limited to a few months after completion — highlighting the challenges of sustaining progress [15]. Other interventions have focused on training poultry workers on biosecurity measures and distributing gloves, masks, disinfectants, and spray machines [18]. However, an evaluation by icddr,b reports that interventions that target only behaviour change without addressing infrastructural barriers do not bring about any substantial change in biosafety practices, mostly due to a lack of self-perception of risk and proper infrastructure to adopt the recommendations [10]. No destocking (not holding any chicken inside the shop) for cleaning or disinfection activities were observed or reported during the weekly closure days, which were perceived as being associated with financial loss by shop owners and workers, even after the dissemination of biosecurity recommendations during the intervention. Gloves, masks, and disinfectants distributed during such interventions were often

discarded or stored and never used by vendors and other stakeholders working along the poultry value chain [10].

During a recent stakeholder engagement workshop as part of USAID's STOP Spillover study (activity 2.2.2.1), LBM stakeholders mentioned that developing LBM infrastructures and improving hygiene practices in LBMs can increase the operation cost, resulting in a higher price for chicken in the renovated LBMs. To manage such increased cost, the willingness to pay (WTP) of the relevant stakeholders has to be considered. Willingness to pay is the maximum amount a consumer is willing to pay for a given product or service [19, 20]. In this particular case, WTP is the maximum a consumer is willing to pay for a given set of safer and more hygienic poultry products or a given quantity of goods and services that ensure safer products and more bio-secure setting where poultry product purchasing takes place.

Studies regarding consumers' WTP for safe, environmentally friendly, and quality chicken meat have been conducted in many countries such as Nigeria [21], Switzerland [22], Ghana [23, 24], the United Kingdom (UK) [25], United States of America (USA) [26], Indonesia [27], and Bangladesh [28, 29]. However, there is little empirical evidence on appropriate indicators of improved bio-secure LBM attributes that consumers might understand and use in their purchasing decisions, or their preferences for these attributes, and whether their WTP for such attributes can sustain safer practices in LBMs. Exploring chicken vendors' WTP for developing and maintaining LBMs that ensure bio-secure and hygienic practices is also of immense importance to ensure the sustainability of interventions targeting bio-secure LBM attributes.

The contingent valuation method (CVM) is a widely used approach for valuing non-market goods and services through market surveys, where respondents express their preferences regarding hypothetical market scenarios [30, 31]. This technique has widespread use in economics, marketing, transportation and other studies [32, 33, 34, 35, 36]. We aimed to generate evidence on indicators of improved bio-secure LBM attributes that consumers use in their purchasing decisions and how much they are willing to pay for these attributes using CVM [28, 29, 37]. We also assessed the willingness to pay of chicken vendors for improved and more bio-secure poultry handling practices.

SPECIFIC OBJECTIVES

- Objective 1: To identify attributes of safe LBM products that guide consumer decision-making, with particular consideration to perceptions of food safety, quality, and handling, as well as this price.
- Objective 2: To assess consumers' willingness to pay for poultry products processed using improved poultry handling practices (e.g., are consumers willing to pay more for a product that is deemed to be safer and/or of higher quality due to vendor adherence/compliance with biosecurity protocols).

- Objective 3: To assess chicken vendors' willingness to pay for establishing and maintaining improved biosecurity practices in LBMs.

METHODOLOGY

To assess consumer's and vendor's willingness to pay for safer poultry products, we conducted a mixed-method study comprising qualitative and quantitative components among chicken consumers and vendors in two city corporations of Dhaka city: Dhaka South City Corporation (DSCC) and Dhaka North City Corporation (DNCC). For consumers' WTP, the study was conducted in three phases (Table 1). In the first phase, a qualitative study was conducted to analyze the consumers' perception of buying chicken and the attributes they preferred for improved market structures and practices. In phase 2, expert consultation meetings were conducted to narrow down the list of attributes identified in phase 1. Finally, in phase 3, a quantitative study was conducted among consumers to rank the attributes and elicit their WTP for chicken in an improved bio-secure LBM using CVM. We also conducted a quantitative study and assessed the WTP of chicken vendors using the same CVM method for one-time capital cost and recurring cost for different line items in an improved bio-secure LBM. The team also used Informal observation as a research tool to understand the infrastructural status of the LBMs and contextualize survey responses.

Table 1: Different phases of this research activity

Willingness to pay study with chicken consumers
Phase 1: Attribute elicitation
▪ In-depth interviews (IDIs) with chicken consumers
Phase 2: Attribute validation and finalization
▪ Expert consultation meeting
Phase 3: Attribute ranking and eliciting willingness to pay
▪ Quantitative survey with chicken consumers
Willingness to pay study with chicken vendors
▪ Informal observation of infrastructural status of LBMs
▪ Quantitative survey with chicken vendors

STUDY SITES AND PERIOD

In phase 1, we planned to capture the perspectives of different types of consumers about their willingness to pay a higher price to buy chicken from an improved LBM. We selected LBMs based on various criteria (Table 2). Phase 1 was conducted from October 2022 to January 2023 in 17 LBMs and four supermarkets in Dhaka city. We recruited some consumers from supermarkets to understand their perception of buying chicken meat from these shops and explore their willingness to buy chicken from LBMs, where biosecurity and hygiene measures were in practice. Some of these LBMs covered multiple criteria.

Table 2: Market criteria at phase 1

LBM selection criteria	Supermarket selection criteria
1. Popular and City Corporation markets accessed mainly by high and middle-income groups 2. Private/non-intervention market 3. LBMs previously intervened by different organizations 4. Small-sized (<10 shops) market 5. Markets accessed mainly by low-income groups	1. Popular 2. Largest 3. Selling live chicken 4. Selling processed chicken

To narrow down the consumers' stated attributes of improved LBMs, the expert consultation meeting at phase 2 was conducted at icddr,b in May 2023. In phase 3, we utilized a list of LBMs obtained from a census of the Department of Livestock Services (DLS) conducted in 2016 [38] and used a proportionate stratified random sampling method to select LBMs for Phase 3 data collection based on the number of wards in DNCC and DSCC (Table 3). The survey was conducted in 60 LBMs: 35 from DSCC (seven city corporation markets and 28 private markets) and 25 from DNCC (5 city corporation markets and 20 private markets). We conducted the survey from June 2023 to July 2023. The survey started just before Eid-ul-Adha (a Muslim festival) in Bangladesh when the demand for chicken varies more from the regular time due to the increased availability of red meat to the consumers. Pricing and demand for chicken could vary before and after Eid. To mitigate this limitation, the team conducted the survey in three phases: before Eid, one week after the Eid and two weeks after the Eid.

Table 3: Market criteria at phase 3

Type of variables	DNCC	DSCC	Total
Number of wards	54	75	129
Number of selected LBMs	25	35	60
▪ **Number of city corporation LBMs**	5	7	12
▪ **Number of private LBMs**	20	28	48

PARTICIPANT ENROLLMENT

Chicken consumers

In phase 1, consumers of different genders, ages, and income groups were interviewed. The team observed them during their shopping experience and purposively selected and interviewed them when exiting from the chicken shop. The criteria for the purposive selection were: a man and a woman consumer for each of the 17 LBMs and four supermarkets; informants were at least 18 years or above; a balanced mix of high-, middle- and low-income

group consumers in each type of LBM, but in LBMs- mainly accessed by low-income groups, we selected only the consumers who were in the low income group; no more than one consumer from one shop. Consumers were defined as those buying chicken for their own family or households; people like household maids or helping hands, who came to buy chicken for household or family they worked for, were excluded, as they were incapable of making financial decisions for the households for whom they are buying chicken.

Phase 2 consisted of conducting expert meetings and did not include any prospective data collection from consumers or vendors regarding WTP, therefore data from this period are omitted from this report.

For phase 3, ten consumers were selected from each LBM for the survey. During data collection, vendors within the market area were numbered and then selected randomly for the survey by lottery. Initially, the first consumer was interviewed from the randomly selected vendors' shops. Then, the research team members collected data from the consumers in the whole LBM area from every fourth consumer using systematic random sampling method. However, to ensure gender representativeness, the team selected female consumers conveniently whenever they were available, and all participants provided consent for the interview.

Chicken vendors

From each of these 60 LBMs, we randomly recruited 25% of the total number of vendors operating in the LBM or at least two chicken vendors, whichever is higher. Vendors within the market area were numbered starting from the right side of the market and then selected randomly by lottery. Enumerators selected their first vendors according to an ascending order. If any selected vendor did not provide consent for the interview, other vendors were randomly picked from the remaining list. Vendors selling any of the broiler, *Sonali* or *Deshi* chicken were included in the selection. Vendors with temporary arrangements or fully operating as wholesale sellers were excluded from the selection. The reason behind this is that the temporary vendors were unlikely to make any infrastructural changes, and the wholesale vendors were not supposed to have direct connection with household level retail consumer and were not supposed to trade chickens from retail price points. Chicken vendors were defined as shop owners who can independently make financial decisions; chicken shop workers working as vendors were not included in this survey, since they are not the financial decision makers; they are just salaried staff who are not related with profit or investment making decisions.

TRAINING AND STANDARDIZATION

The team members selected to conduct IDIs (Phase 1) received a six-day training that included training on qualitative methods, interview techniques, and utilized mock trials of the interview

guides to increase consistency among all interviewers. Data collectors for the quantitative part (Phase 3) received a five-day training on respondent selection, observation and survey tools. Review sessions were also arranged, and data collection tools were revised based on pretesting for phases 1 and 3 during the mock trials.

DATA COLLECTION

Chicken consumers

Attribute elicitation is a rapid sensory analysis method that uses untrained participants to evaluate attributes of a product to determine which attributes will drive consumer preferences. Several types of attribute elicitation procedures such as free elicitation (FE), hierarchical dichotomization (HD), and Kelly's repertory grid- are used in marketing research [39]. In phase 1, this study applied the FE technique during in-depth interviews (IDIs). In the FE technique, the informants are asked to describe the attributes of different product categories that they consider relevant based on their own perceptions [39]. The research team conducted IDIs with consumers of both LBMs and supermarkets using semi-structured guidelines to explore consumers' perceptions of buying chicken from the shops and perspectives about their WTP to purchase chicken from an improved LBM. The interviewers asked the informants to describe the attributes they consider most important in their consumer decision-making. The team used memory probes (e.g., different conditions of LBMs, slaughtering processes, etc.) to assist the informants in triggering the elicitation process.

Using the qualitative findings of phase 1, potential attributes of LBMs that the consumers preferred were identified, and a list of attributes was prepared from those findings in phase 2. An expert consultation meeting [40, 41] was conducted where the final list was prepared based on the expertise, experience, and knowledge of the experts. The expert consultation meeting was conducted with relevant experts from different sectors (composed of an economist, biosecurity expert, veterinarian, and public health professional, among others). The list of participants in that meeting can be found at annex 1. During the meeting, participants narrowed down the list of attributes by combining similar attributes, merging according to different themes, and excluding the ones that are not relevant to biosecurity and hygiene. The final list was used in the consumer survey of phase 3.

Using the final list from phase 2, the team developed a survey questionnaire for the consumers of the LBM products. In phase 3, the survey team asked the consumers about their gender, education, occupation, marital status, religion, number of household members, number of household members under 18 years, and income range. In the interview, the team asked the consumers to rate the importance of each attribute on a five-point Likert scale (most important = 5, important = 4, neutral = 3, unimportant = 2, and very unimportant= 1) [29].

We prepared a video clip that compared the current average condition of LBMs with the design of an improved LBM based on STOP Spillover designs. The video was presented to consumers to give them an idea of improved LBM structures and features (Annex 2). The video gave consumers a brief idea about the changes necessary to develop and maintain such an improved bio-secure LBM (Annex 3), which helped the participants to speculate the costs that stakeholders (including consumers, vendors, market committee, poultry business associations, and government) would need to take on to enact such biosecurity changes. A one-time investment is the capital cost of the intervention, such as infrastructural development, for which payment has to be made only once. Recurring cost is the cost for the maintenance of the items for which payment has to be made regularly, like daily or monthly by stakeholders along the LBM value chain. Based on the video presentation and brief, the survey team asked consumers whether they wanted to pay more for chicken in an improved bio-secure LBM. If they replied positive, they were asked to elicit their actual WTP for different types of chicken, broiler, *Sonali* and *Deshi,* whichever they consume, based on the current price on interview day [42, 43]. Consumers' WTP for chicken from bio-secure LBM was measured following the CVM. In CVM, different elicitation techniques can be used to measure the highest and lowest WTP among consumers and vendors. We used open-ended questions and asked the consumers for the highest price per kg or per bird that they would like to pay in an improved bio-secure LBM of a similar design to the one shown in the video. They were also asked about the reasons behind paying more for the chicken and whether they would change their regular consumption with the increased prices of the chicken. If they were not in favor of paying more for chicken products in an improved bio-secure LBM, they were also asked why.

Chicken vendors

For the chicken vendors, we collected sociodemographic information, such as gender, education level and religion along with some basic information about their shops, such as type of ownership, types of chickens sold, and the average daily sale of chickens of different types. We also assessed how much the chicken vendors would like to contribute to an improved bio-secure LBM for a one-time capital cost for renovation and recurring increased costs for maintenance. The vendors were presented with the same video of the improved LBM as consumers to give them a brief idea about the structures and features of a bio-secure LBM (Annex 2). They were also given a brief idea about the one-time cost items and recurring cost items for creating and maintaining such an improved bio-secure LBM and were briefed about the possible stakeholders who might cover the costs. Then, they were asked about their WTP for two types of costs: one-time capital costs and recurring costs (Annex 3). Vendors were asked whether they wanted to pay for one-time capital costs to build that kind of LBM. If they were willing to pay, they were asked about their maximum amount for the one-time capital cost and the reasons behind that proposed payment. For vendors, we also used open-ended questions to contextualize their WTP. If they denied interest in paying for a one-time capital cost, we also asked why that decision was made.

Vendors were also asked about whether they are willing to pay more for their monthly recurring cost, based on their current average monthly recurring costs, for the improved LBM. If they replied positively, they were asked about the current average monthly costs, and based on that, the highest amount they would be willing to pay as their regular monthly maintenance cost for different line items in an improved bio-secure LBM. Like one-time capital cost, vendors were also asked about the reasons behind the willingness to pay more. Vendors were asked about the lowest price they were expecting from the consumers per kg or per bird (broiler, *Sonali* and *Deshi*) in that improved market setting, based on the current price on each interview day.

The vendor survey was conducted at the same LBMs as the consumer survey. During the survey with chicken vendors, we also conducted an informal observation of the infrastructural status, such as the total number of shops, the existence of a common slaughtering house, materials used for the walkway, roof and floor of the shops; ventilation, lighting and water arrangement of the shops; drainage system of these LBMs to get an overview of different components of these LBMs that were prioritized by stakeholders.

SAMPLE SIZE

Chicken consumers

In phase 1, the team conducted 48 IDIs in both LBMs and supermarkets. Among them, 40 IDIs were conducted with 40 chicken consumers who purchased chicken from LBMs and eight IDIs were conducted with eight chicken consumers who purchased chicken from supermarkets. The research team conducted two IDIs in each LBM, and only one IDI was conducted at each supermarket outlet.

For phase 3, since no study is available on WTP for improved bio-secure LBMs, we assumed that the prevalence of WTP for chicken in an improved bio-secure market would be 50%. We assumed that inter-cluster correlation of 0.06 for market-level clustering of ten consumers and the market level design effect would be 1.5.

With 50% prevalence, 5% desired precision, and 95% confidence interval, we needed a sample size of 385. Considering the design effect of 1.54 for market-level clustering (ten consumers per market), we needed a sample size of 385*1.54 = 593. For our convenience, we selected 600 consumers from a total of 60 LBMs for this study. So, using the tool, the survey was conducted among 600 consumers recruited in equal numbers from 60 LBMs in Dhaka city (Table 4).

Table 4: Sample size in each type of different activities

Willingness to pay study with chicken consumers	Frequencies
Phase 1: Attribute elicitation	
▪ In-depth interviews (IDIs) with chicken consumers	48
Phase 2: Attribute validation and finalization	
▪ Expert consultation meeting	1
Phase 3: Attribute ranking and eliciting willingness to pay	
▪ Quantitative survey with chicken consumers	600
Willingness to pay study with chicken vendors	
▪ Informal observation of infrastructural status of LBMs	60
▪ Quantitative survey with chicken vendors	203

Chicken vendors

The vendor survey was conducted at the same LBMs as the consumer survey. From each of these 60 LBMs, we recruited 25% of the total number of vendors operating in the LBM or at least two chicken vendors, whichever was higher. Based on the data from the list of Dhaka city LBMs, we assumed to reach at least 120 vendors for this survey. Following this procedure, we successfully recruited 203 vendors for enrollment in this survey (Table 4).

DATA ANALYSIS

Qualitative (Phase 1 with consumers)

We derived the detailed findings from the interviews based on audio recordings. Each transcript was coded inductively. To triangulate information obtained through IDIs, the team conducted observations to understand chicken slaughtering and processing practices, biosecurity practices, hygiene practices, and the environment of LBMs. The research team took audio recordings of the interviews and notes from the observations, discussed findings, and reviewed guidelines at the end of each day to ensure consistency in the assessments. Thematic analysis was done under broader themes for each component.

Quantitative (Phase 2 and Phase 3 with consumers and vendors)

To analyse the data, the team used a multifaceted approach, utilizing both descriptive and econometric methods to address the research objectives. Descriptive methods were applied to examine the socioeconomic characteristics of the study participants (consumers and vendors), providing a comprehensive overview of their demographic profiles, including age, education, experience, and income. The perception of the consumers on each attribute was scored according to five options (very unimportant to very important) of the Likert scale. Then we estimated the ranking of the attribute according to the mean score from the Likert scale. An index-based approach was utilized to conduct a perception analysis among consumers. The

study quantified consumers' perceptions of LBM attributes and preferences by formulating perception indices associated with improved LBM infrastructure. The perception indices provided a structured means to assess consumer views and attitudes toward bio-secure LBMs. Econometric analyses, such as bivariate and logistic analyses were utilized to demonstrate correlations between the socioeconomic variables and consumers' and vendors' WTP for bio-secure market and poultry product improvements. We converted the currency outcomes from BDT to USD according the currency rate at the midpoint of the survey [44].

ETHICS STATEMENT

We obtained ethical clearance from the Institutional Review Board (IRB) of icddr,b, Dhaka, Bangladesh and Tufts Health Sciences Institutional Review Board of Tufts University. At the beginning of each interview, the data collectors gave detailed information about the study's objectives. They assured the participants that their participation would be entirely voluntary and that respondents had the right to refuse to answer any questions and to discontinue the interview at any time, even after consenting to the study. Informed written consent was obtained from each respondent before collecting data.

RESULTS

WILLINGNESS TO PAY STUDY WITH CONSUMERS

Attribute elicitation (phase 1)

In Phase 1, 48 in-depth interviews were conducted: 40 with consumers of LBMs and eight with consumers of supermarkets. Among the 48 participants, 29 were male (60.4%). The age of participants ranged from 24 to 70 years, and the average age was 44 years. Fifteen out of 48 belonged to the low-income group (31%), 12 (25%) belonged to the middle-income group, and the rest of the participants fell into the high-income category (44%) (Table 5).

Table 5: Demographic information of the informants in phase 1

Variables	N	(%) N= 48
Gender		
Male	29	(60)
Female	19	(40)
Age		
21-30	4	(8)
31-40	19	(40)
41-50	13	(27)
51-60	5	(10)
61-70	7	(15)
Income group		
Low	15	(31)
Middle	21	(44)
High	12	(25)
Education		
Uneducated	1	(2)
Primary (1-5)	7	(15)
Secondary (6-9)	8	(17)
Secondary School Certificate (SSC)	5	(10)
Higher Secondary Certificate (HSC)	5	(10)
Honours	10	(21)
Masters and above	12	(25)

The study team identified 44 attributes by analyzing data collected from the 48 interviews (Annex 4). The consumers were mostly concerned about the infrastructural issues of LBMs. They preferred the separation of chicken shops into one corner of the market for zoning of the chicken shops, that would make the consumers of other products less exposed from the chicken market. Consumers reported, and also the study team observed, that the walkways inside the LBMs were not adequately tiled, leading to difficulties in cleaning and disinfection.

Tiles for the walkways, which would be easily washable, were suggested by consumers to maintain cleanliness and hygiene in LBMs. Keeping slaughtering and processing of chicken out of individual poultry shops could play an important role in improving the biosecurity of LBMs, and a common slaughtering place for all chicken shops, which might help limit the spread of waste, was considered necessary by some consumers. A minimum distance of one meter between the consumers and the place where chickens are kept was also recommended to prevent splattering of chicken body parts and blood. Disposing waste in designated covered bins and regular waste collection from chicken shops and markets also needed to be arranged so that no waste is visible, and odor is reduced in the LBM environment.

Consumers preferred regular (daily) cleaning and disinfection of chicken cages, slaughtering and processing areas, and drains to reduce the stench from the chicken market. They said that for regular cleaning and disinfection, the water supply for each shop must be ensured during business hours. Along with regular water supply, an effective drainage system consisting of improved and wide drains connected with a central drainage network was also deemed necessary to the consumers to ensure proper cleaning and disinfection activities.

Consumers also emphasized attributes such as implements that could improve chicken keeping, slaughtering and processing practices. They said that cages, slaughtering cones or drums, processing tables, and defeathering machines made of stainless-steel materials would help with cleaning and disinfection.

> *"A table should be used for processing chicken. A pipe can be used to connect it to the drain below. A basin can be added besides this for handwashing."*
>
> - IDI with an LBM consumer, 47-year-old male

The study team observed that using unclean water for cleaning and scalding chicken, and mixing slaughtered chicken in slaughtering barrels were common practices in the LBMs. The consumers suggested that such practices should be stopped, and they prefer their chickens to be processed in front of them. Consumer preference for *halal* slaughtering practices was apparent in our exploration, and they also expressed their concerns about getting dead chicken instead of their chosen live birds when visiting LBMs.

Hygiene practices, such as washing hands after slaughtering and processing every batch of chickens were also considered important by consumers. Some participants suggested wearing gloves, masks, and separate clothing throughout the selling, slaughtering and processing of chickens, providing safety for all - vendors, workers, and consumers. As one consumer stated:

> *"Suppose I am going to someone's chicken shop, and that person decorated it nicely, placed a table in front, kept it clean, created a separate system for chicken waste, arranged water supply, and he is wearing an apron…It will be*

okay if he charges 10 or 15 taka extra per kg." - IDI with a supermarket consumer, 68-year-old male

Some participants suggested improving lighting arrangements and using green shades as roof materials for controlling high temperature and that can also attract the consumers to bio-secure LBMs as well. Improving the ventilation system was also recommended by some consumers; however, most of them considered it necessary for consumer comfort, not as an improvement for biosecurity and hygiene. Proper ventilation would have a dual effect on the comfort of vendors and customers and also to remove contaminated aerosols from the enclosed market.

Consumers also expressed their displeasure regarding the lack of knowledge among the chicken vendors and workers regarding cleanliness and hygiene. They proposed training that NGOs, city corporations, and market authorities could arrange for the vendors. Developing appropriate rules and guidelines and regular monitoring by city corporations and market authorities was suggested to ensure recommended measures are implemented and in practice. Some participants also recommended the use of signboards displaying awareness messages inside and outside the LBMs to raise consumer awareness about hygiene and cleanliness. One consumer described their perspectives on the importance of LBM disinfection and enforcement:

> *"Proper management is needed for these people (LBM actors). They should be trained on how they can maintain cleanliness. They won't be able to use chemicals (disinfectants) without training…they should develop laws with these recommendations and follow them. They (market committee) will monitor whether these laws are followed. It's meaningless if only rules are set but not enforced."*
>
> - IDI with an LBM consumer, 62 years-old male

Attribute validation and finalization (phase 2)

From the qualitative findings of phase 1, the experts narrowed down the list to 17 prioritized attributes in phase 2 (Table 6):

Table 6: Selected attributes in phase 2

Sl. No.	Selected attributes in phase 2
1.	The walkway inside the market (alley) will be easily washable
2.	All the poultry shops are separated in a corner of the market
3.	A designated chicken slaughtering and processing (removing skin and offal and cutting meat) table
4.	There is a common slaughtering place for slaughtering and processing all the chicken from chicken shops in the market
5.	Easy washable surfaces and implements

Sl. No.	Selected attributes in phase 2
6.	Regular (starting from opening of shop until closing) water supply for each shop
7.	Improved (wide drains connected with central drainage network) and concealed drainage system in every shop
8.	Workers using masks and gloves
9.	Improved ventilation, lighting and fan in the shop
10.	Performing slaughtering and processing in front of consumers
11.	Washing hands with soap after chicken slaughtering and processing (of each batch)
12.	Regular (daily) cleaning and disinfection of chicken cages, slaughtering and processing areas, and drains
13.	All waste is disposed of in designated waste bins; no visible waste in the shop
14.	Keeping distance (one meter) between chicken cages/slaughtering place and consumers to prevent splattering of chicken body parts and blood
15.	Separating sick chicken from healthy ones and separate arrangements for dead chicken disposal
16.	Using signboards inside and outside the market to display rules and awareness messages for raising consumer awareness of cleanliness and hygiene
17.	Regular monitoring by market authority and city corporation

Attribute ranking and eliciting willingness to pay (phase 3)

Demographic information of the participants

Among the 600 consumers and 203 vendors, 44% of the consumers and 45% of the vendors were within the age range of 31–45 years. Two-thirds of the consumer participants were male, and only one vendor was female (Table 7). Most of the participants were Muslim. Private service and business were commonly reported occupations of the consumers. Forty percent of the consumers had an average monthly income between 20,100 and 40,000 BDT, whereas 43% of the vendors earned less than ≤ 20,000 BDT (Table 7).

Table 7: Demographic information of the participants in phase 3

Variables	Consumer (N = 600)		Vendor (N = 203)	
	n	(%)	n	(%)
Age				
18-30	153	(25)	58	(29)
31-45	266	(44)	92	(45)
46-60	141	(24)	41	(20)
60+	40	(7)	12	(6)
Sex				
Male	370	(62)	202	(99)
Female	230	(38)	1	(1)
Education				
Uneducated	22	(4)	10	(5)
Able to sign only	33	(5)	20	(10)
Primary (1-5)	93	(15)	62	(30)
Secondary (6-9)	88	(15)	55	(27)
Secondary School Certificate (SSC)	77	(13)	29	(14)

Variables	Consumer (N = 600)		Vendor (N = 203)	
	n	(%)	n	(%)
Higher Secondary Certificate (HSC)	101	(17)	18	(9)
Honours	89	(15)	8	(4)
Masters and above	97	(16)	1	(1)
Occupation				
Government service	38	(6)		
Private service	169	(28)		
Business	127	(21)		
Daily wager	28	(5)		
Homemaker	178	(30)		
Shopkeeper	10	(2)		
Student	33	(5)		
No employment	17	(3)		
Marital status				
Married	530	(88)		
Unmarried	57	(9)		
Widowed	10	(2)		
Divorced	3	(1)		
Religion				
Islam	571	(95)	202	(99)
Hindu	27	(4)	1	(1)
Buddhist	0	(0)	0	(0)
Christian	2	(1)	0	(0)
Income				
Did not disclose	16	(3)	3	(1)
≤ 20,000	169	(28)	88	(43)
20100 – 40000	238	(40)	75	(37)
40100 – 60000	100	(17)	25	(12)
60100 – 80000	26	(4)	5	(3)
80100 – 100000	31	(5)	2	(1)
> 100000	20	(3)	5	(3)
Household size	**Mean**	**[Median]**		
Household members	5	[4]		
Number of household members under 18	**Mean**	**[Median]**		
Household members under 18	1	[1]		

Nearly three-quarters (73%) of the vendors had rented space for the shops, while only 7% had self-ownership of their shops. The majority of the vendors sold broiler (78%) and *Sonali* chicken (85%) (Table 8).

Table 8: Shop information of the vendors

Variables		Vendor N= 203 (%)	
Ownership of the shop			
Self-ownership		15	(7)
City corporation (lease)		40	(20)
Rent		148	(73)
Types of chicken sold in the shop			
Broiler		159	(78)
Sonali		172	(85)
Deshi		81	(40)
Amount of chicken sold daily from the shop	**n**	**Mean**	**[Median]**
Broiler (sold as kg)	159	111	[90]
Sonali (sold as kg)	169	70	[50]
Sonali (sold as whole bird)	7	50	[50]
Deshi (sold as kg)	68	29	[20]
Deshi (sold as whole bird)	16	21	[20]

Consumer perception towards improved LBM

Most of the participants perceived that all 17 attributes were important or very important (Table 9). A washable walkway, regular water supply, improved concealed draining system, and separating sick and dead chickens were considered very important for almost half of the consumers. Consumers had mixed opinions about common slaughtering places in the LBM, as 24% did not rate this attribute as 'important' or 'very 'important' (Table 9).

Table 9: Perception of the consumers towards the attributes of LBMs and ranking of the attributes

Category	Attributes	Very Important n (%) N= 600	Important n (%) N= 600	Neutral n (%) N= 600	Unimportant n (%) N= 600	Very Unimportant n (%) N= 600	Mean score from 1-5 (very unimportant to very important)	Standard Deviation	Rank
Infrastructure	The walkway inside the market (alley) will be easily washable	290 (48)	308 (51)	0 (0)	2 (1)	0 (0)	4.47	0.52	1
Infrastructure	Regular (starting from opening of shop until closing) water supply for each shop	283 (47)	316 (52)	1 (1)	0 (0)	0 (0)	4.47	0.50	2
Infrastructure	Improved (wide drains connected with central drainage network) and concealed drainage system in every shop	277 (46)	318 (53)	4 (1)	1 (1)	0 (0)	4.45	0.52	3

Category	Attributes	Very Important n (%) N= 600	Important n (%) N= 600	Neutral n (%) N= 600	Unimportant n (%) N= 600	Very Unimportant n (%) N= 600	Mean score from 1-5 (very unimportant to very important)	Standard Deviation	Rank
Infrastructure	All waste is disposed of in designated waste bins; no visible waste in the shop	227 (37)	369 (60)	2 (1)	1 (1)	1 (1)	4.37	0.52	5
Infrastructure	All the chicken shops are separated in a corner of the market	244 (40)	336 (56)	10 (2)	10 (2)	0 (0)	4.36	0.60	6
Infrastructure	A designated chicken slaughtering and processing (removing skin and offal and cutting meat) table	185 (30)	404 (67)	10 (2)	1 (1)	0 (0)	4.28	0.50	11
Infrastructure	Easy washable surfaces and implements	182 (30)	406 (68)	7 (1)	5 (1)	0 (0)	4.27	0.52	12
Infrastructure	A common slaughtering place for slaughtering and processing of all the chicken from chicken shops of the market	179 (30)	279 (46)	54 (9)	71 (12)	17 (3)	3.89	1.05	15
Biosecurity	Separating sick chicken from healthy ones and separate arrangements for dead chicken disposal	270 (45)	324 (53)	1 (1)	5 (1)	0 (0)	4.43	0.55	4
Biosecurity	Regular (daily) cleaning and disinfection of chicken cages, slaughtering and processing areas, and drains	226 (37)	370 (61)	3 (1)	1 (1)	0 (0)	4.37	0.50	5
Biosecurity	Performing slaughtering and processing in front of consumers	233 (39)	333 (55)	21 (3)	12 (2)	1 (1)	4.31	0.65	8
Biosecurity	Washing hands with soap after chicken slaughtering and processing (of each batch	217 (36)	360 (60)	10 (2)	13 (2)	0 (0)	4.30	0.61	9
Biosecurity	Workers using masks and gloves	203 (33)	378 (63)	11 (2)	8 (1)	0 (0)	4.29	0.57	10
Biosecurity	Keeping distance (one meter) between chicken cages/slaughtering place and consumers to	197 (32)	367 (61)	25 (4)	10 (2)	1 (1)	4.25	0.63	13

Category	Attributes	Very Important n (%) N= 600	Important n (%) N= 600	Neutral n (%) N= 600	Unimportant n (%) N= 600	Very Unimportant n (%) N= 600	Mean score from 1-5 (very unimportant to very important)	Standard Deviation	Rank
	prevent splattering of chicken body parts and blood								
Biosecurity	Improved ventilation, lighting and fan in the shop	170 (28)	415 (69)	9 (2)	6 (1)	0 (0)	4.25	0.53	13
Institutional	Regular monitoring by market authority and city corporation	237 (38)	330 (55)	30 (5)	2 (1)	1 (1)	4.33	0.60	7
Institutional	Using signboards inside and outside the market to display rules and awareness messages for raising consumer awareness of cleanliness and hygiene	138 (23)	399 (67)	42 (7)	21 (3)	0 (0)	4.09	0.66	14

Washable walkways and regular water supply were scored the highest, followed by an improved concealed draining system (Table 9). In contrast, common slaughtering places scored lowest, followed by using signboards inside and outside the market.

WTP for improved LBM

The majority of the consumers (73%) and almost two-thirds of the vendors were willing to pay more (one-time or recurring) in an improved bio-secure market (Figure 1). Among consumers willing to pay more, 85% would consume the same amount of chicken at their stated increased price (Figure 2).

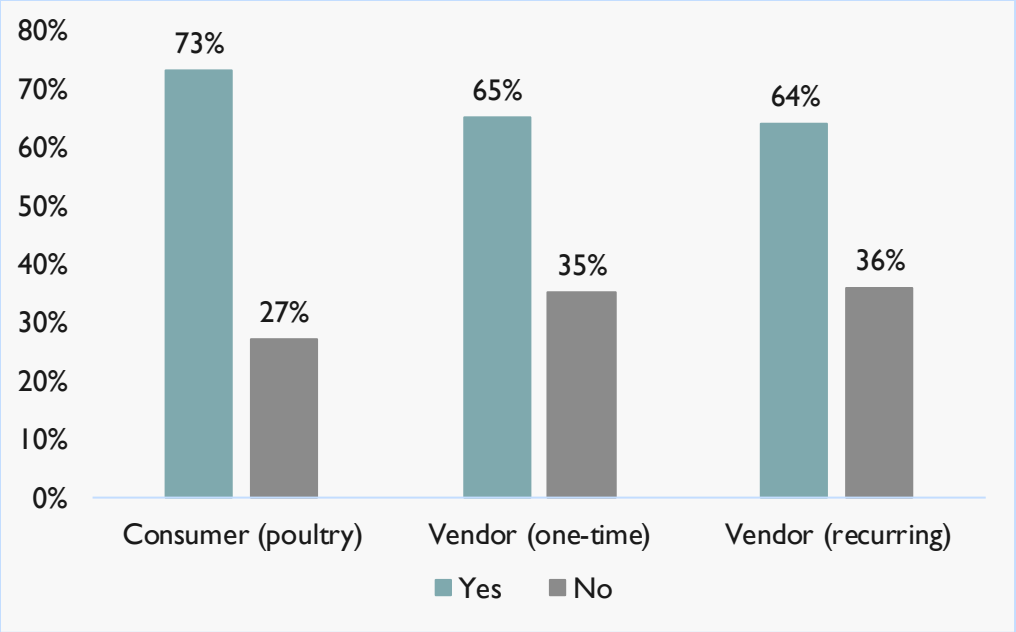

Figure 1: Percent of each group willing to pay more for an improved bio-secure market and safer product

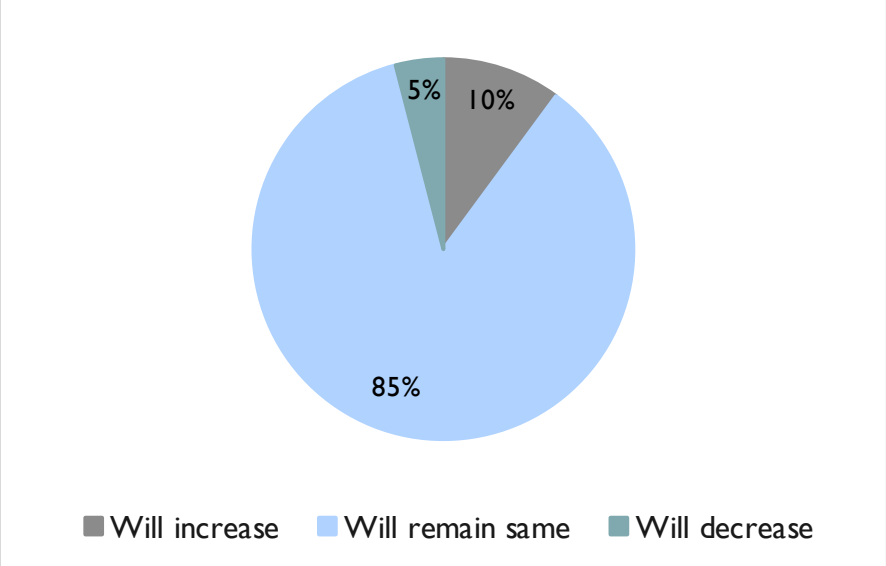

Figure 2: Change in consumers' chicken consumption due to purchasing from improved LBM with their stated WTP

Consumers' WTP and vendors' expectation for per unit of chicken had differences. In comparison with the consumers' WTP, vendors' expectation of prices in an improved bio-secure market was BDT 12 vs BDT 14 (USD 0.11 vs USD 0.13) for broiler per kg, BDT 14 vs BDT 16 (USD 0.13 vs

USD 0.15) for *Sonali* per kg, BDT 17 vs 21 (USD 0.16 vs USD 0.19) for *Deshi* per kg (Tables 10 and 11). Vendors were willing to pay BDT 40,510 (USD 373.36) on average [median BDT 20,000 (USD 184.33), minimum BDT 500 (USD 4.61), and maximum BDT 300,000 (USD 2764.98)] as a one-time investment. They also reported that they would pay BDT 7,586 (USD 69.92) (15%) more on average for monthly recurring costs, while their calculated WTP was BDT 8,523 (USD 78.55) (20%) more on average.

Table 10: Willingness to pay from the consumers for chickens in an improved bio-secure LBM

Type of chicken	Present price		WTP with present price		Mean WTP (in %)
	Mean	Median	Mean	Median	
Broiler (BDT/kg)		n= 594		n= 404	
	178	180	190	190	12 (7)
Sonali (BDT/kg)		n= 561		n= 380	
	277	280	291	290	14 (5)
Sonali (BDT/bird)		n= 18		n= 18	
	265	250	290	290	25 (9)
Deshi (BDT/kg)		n= 346		n= 187	
	618	600	635	610	17 (3)
Deshi (BDT/bird)		n= 38		n= 38	
	533	550	552	565	19 (4)

Table 11: Expectation of the vendors for chickens in an improved bio-secure LBM

Type of chicken	Present price		Expected price		Difference of mean (%)
	Mean	Median	Mean	Median	
Broiler (BDT/kg)		n= 159		n= 159	
	177	180	191	190	14 (8)
Sonali (BDT/kg)		n= 171		n= 171	
	275	280	291	290	16 (6)
Sonali (BDT/bird)		n= 6		n= 6	
	284	253	301	287	17 (6)
Deshi (BDT/kg)		n= 72		n= 72	
	611	600	632	620	21 (3)
Deshi (BDT/bird)		n= 18		n= 18	
	573	600	606	650	33 (6)

Consumers' higher WTP decision for chicken was significantly associated with education ($p<0.003$), occupation ($p<0.028$), and income level ($p<0.000$) (Table 12). Similarly, the vendors' decision was significantly associated with education ($p<0.039$), income level ($p<0.021$), and city corporation type for both one-time payment ($p<0.027$) and recurring costs ($p<0.035$).

Table 12: Bivariate analysis of willingness to pay decision with socioeconomic variables

Variables	Consumer		Vendor (one-time)		Vendor (recurring)	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Age						
18-30	113 (74)	40 (26)	39 (67)	19 (33)	40 (69)	18 (31)
31-45	191 (72)	75 (28)	65 (71)	27 (29)	60 (65)	32 (35)
46-60	104 (74)	37 (26)	26 (57)	20 (43)	27 (59)	19 (41)
60+	31 (77)	9 (23)	2 (29)	5 (71)	3 (43)	4 (57)
P-value		***0.874***		***0.073***		***0.457***
Gender						
Male	280 (76)	90 (24)	131 (65)	71 (35)	130 (64)	72 (36)
Female	159 (69)	71 (31)	1 (100)	0 (0)	0 (0)	1 (100)
Others	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
P-value		***0.079***		***0.462***		***0.181***
Education						
Uneducated	14 (64)	8 (36)	5 (50)	5 (50)	5 (50)	5 (50)
Able to sign	20 (61)	13 (39)	11 (55)	9 (45)	8 (40)	12 (60)
Primary (1-5)	66 (71)	27 (29)	34 (55)	28 (45)	39 (63)	23 (37)
Secondary (6-9)	53 (60)	35 (40)	44 (80)	11 (20)	40 (73)	15 (27)
SSC	56 (73)	21 (27)	23 (79)	6 (21)	22 (76)	7 (24)
HSC	76 (75)	25 (25)	10 (56)	8 (44)	9 (50)	9 (50)
Honours	70 (79)	19 (21)	4 (50)	4 (50)	6 (75)	2 (25)
Masters and above	84 (87)	13 (13)	1 (100)	0 (0)	1 (100)	0 (0)
P-value		***0.003****		***0.039****		***0.101***
Occupation						
Government service	32(84)	6(16)				
Private service	125(74)	44(26)				
Businessman	96(76)	31(24)				
Daily wager	15(54)	13(46)				
Homemaker	120(67)	58(33)				
Shopkeeper	9(90)	1(10)				
Student	28(85)	5(15)				
No employment	14(82)	3(18)				
P-value		***0.028****				
Marital Status						
Married	382 (72)	148 (28)				
Unmarried	49 (86)	8 (14)				
Widowed	6 (60)	4 (40)				
Divorced	2 (67)	1 (33)				
P-value		***0.110***				
Religion						
Islam	414 (73)	157 (27)	131 (65)	71 (35)	130 (64)	72 (36)
Hindu	23 (85)	4 (15)	1 (100)	0 (0)	0 (0)	1 (100)
Buddhist	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Christian	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Variables	Consumer		Vendor (one-time)		Vendor (recurring)	
	Yes	No	Yes	No	Yes	No
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
P-value		***0.241***		***0.462***		***0.181***
Income						
Did not mention	10 (63)	6 (37)	0 (0)	3 (100)	2 (67)	1 (33)
≤ 20,000	104 (62)	65 (38)	51 (58)	37 (42)	48 (55)	40 (45)
20100 – 40000	167 (70)	71 (30)	50 (67)	25 (33)	50 (67)	25 (33)
40100 – 60000	86 (86)	14 (14)	21 (84)	4 (16)	20 (80)	5 (20)
60100 – 80000	24 (92)	2 (8)	5 (100)	0 (0)	5 (100)	0 (0)
80100 – 100000	28 (90)	3 (10)	1 (50)	1 (50)	1 (50)	1 (50)
> 100000	20 (100)	0 (0)	4 (80)	1 (20)	4 (80)	1 (20)
P-value		***0.00****		***0.021****		***0.126***
Ownership of the shop						
Self-ownership			7 (47)	8 (53)	7 (47)	8 (53)
City corporation (lease)			25 (63)	15 (37)	24 (60)	16 (40)
Rent			100 (68)	48 (32)	99 (67)	49 (33)
P-value				***0.252***		***0.250***
City corporation type						
DNCC	174 (70)	76 (30)	56 (75)	19 (25)	55 (73)	20 (27)
DSCC	265 (76)	85 (24)	76 (59)	52 (41)	75 (59)	53 (41)
P-value		***0.096***		***0.027****		***0.035****
Market type						
City corporation	85 (71)	35 (29)	48 (69)	22 (31)	47 (67)	23 (33)
Private	354 (74)	126 (26)	84 (63)	49 (37)	83 (62)	50 (38)
P-value		***0.519***		***0.442***		***0.504***
Market size						
Small (≤ 10 vendors)	269 (75)	91 (25)	49 (65)	26 (35)	46 (61)	29 (39)
Medium (11-20 vendors)	114 (71)	46 (29)	39 (62)	24 (38)	40 (63)	23 (37)
Large (>20 vendors)	56 (70)	24 (30)	44 (68)	21 (32)	44 (68)	21 (32)
P-value		***0.562***		***0.788***		***0.732***
Day type						
Weekdays	192 (70)	82 (30)	69 (64)	38 (36)	67 (63)	40 (37)
Weekend	247 (76)	79 (24)	63 (66)	33 (34)	63 (66)	33 (34)
P-value		***0.117***		***0.865***		***0.656***

Significance level: p< 0.05*, p< 0.001**

Reasons behind consumers' willingness and unwillingness to pay

The cleanliness of markets and shops (94%) was one of the primary reasons behind the consumers' WTP more for chicken in an improved bio-secure market (Table 13). The majority of the consumers (63%), who were not willing to pay more, thought the current prices were already high, while half of them (52%) mentioned that the price would not be affordable (Table 13).

Table 13: Consumers' reasons behind willingness and unwillingness to pay

	n	(%)
Consumers' reasons behind willingness to pay	**n = 439**	
Cleanliness of market and shop	412	(94)
For quality (healthy and clean chicken) product	195	(44)
Aesthetics	185	(42)
Fear of disease from chicken	167	(38)
Helps removing odor	155	(35)
Comfort and convenience	141	(32)
Slaughtering and processing will be visble to consumers	46	(10)
Ensures conforming to religious norms	43	(10)
Consumers' reasons behind unwillingness to pay	**n = 161**	
The current price is already high	102	(63)
Not affordable	83	(52)
It is government's responsibilty to pay additional money for the improved market	43	(27)
It is the vendors' responsibilty to pay additional money for the improved market	21	(13)
The intention of this intervention is just to increase price	19	(12)
Not sure about the sustainabilty of the bio-secure market and its practice	9	(6)
Indefferent about purchasing chicken from an existing LBM vs an improved LBM	5	(3)
Not concerned about disease	9	(6)
The concept of improved LBM is not meaningful to me	6	(4)
Lack of skilled human resource to make this structure working	3	(2)
Avian influenza is not visible	2	(1)

Reasons behind vendors' willingness and unwillingness to pay

The majority of the vendors reported that better shop settings compared to the present average LBM setting was the reason for vendors' WTP for one-time investments (70%) and for monthly recurring costs (75%) (Table 14). More than half of the vendors (58%) found one-time investments too expensive (Table 14). Vendors were also concerned that they could not afford that amount of money for a one-time investment (51%) and the monthly recurring cost on a regular basis (68%). Three percent of the vendors (2 out of 71 vendors) who were unwilling to pay onetime investment were willing to pay installments over time.

Table 14: Vendors' reasons behind willingness and unwillingness to pay (one-time and recurring)

	Vendor (one-time)		Vendor (recurring)	
	n	(%)	n	(%)
Vendors' reasons behind willingness to pay	**n= 132**		**n= 130**	
Better shop setting compared to present situation	92	(70)	97	(75)
Increased number of sales	80	(61)	89	(68)
Ability to provide better service to the consumers	60	(45)	72	(55)
Better and more organized cleaning practices	49	(37)	50	(38)
Disciplined working environment	41	(31)	45	(35)
Better chicken health compared to present situation	41	(31)	35	(27)

	Vendor (one-time)		Vendor (recurring)	
	n	(%)	n	(%)
Attract more consumers	30	(23)	31	(24)
Better slaughtering and processing practices	28	(21)	24	(18)
Better quality (clean and healthy) chicken	26	(20)	30	(23)
Vendors' reasons behind unwillingness to pay	**n=71**		**n= 73**	
This investment can be too much expensive	41	(58)		
Cannot afford that amount of money at once	36	(51)		
Cannot afford that amount of money on a regular basis			50	(68)
Regular cost to maintain new changes will be expensive	23	(32)	43	(59)
Fear of loss in business	21	(30)	32	(44)
If price increases, sale of chicken may decrease	11	(15)	20	(27)
The intervention will not be sustainable	7	(10)	10	(14)
The concept of improved market is not meaningful	6	(8)	6	(8)
Uncertain about the support from market or local authority/ government	5	(7)	2	(3)
New settings and practices might be difficult to adapt considering the rush and busiest selling hours	3	(4)	5	(7)
Extra effort on maintenance	3	(4)	3	(4)
Fear of monitoring committee increasing price	2	(3)	2	(3)

CONCLUSIONS

Our study found that both consumers and vendors are willing to provide extra money to contribute to the funding mechanism to build and maintain improved bio-secure LBMs in Dhaka city. A considerable percentage of consumers (73%) expressed willingness to pay premium prices, from current average of BDT 12 to 17 (USD 0.11 to 0.16) (3-7% above the current price) per kg and BDT 19 to 25 (USD 0.18 to 0.23) (4-9% above the current price) per bird for various types of chickens, assuming improved LBM conditions. Cleanliness was one of the important motivating factors for the consumers' willingness to pay. The majority of the consumers who wanted to pay for fear of disease (91%) and for healthy and clean poultry (94%) also wanted cleanliness of the market environment in trade of extra amount they were willing to pay. But cleanliness was not always about health perspective as 9% of the consumers who wanted to pay for fear of diseases and 6% of the consumers who wanted healthy and clean poultry were not concerned about cleanliness. Consumers commonly consumed broiler and *Sonali* chicken. Vendors showed a great willingness to invest, with a significant increase of 20% over their current operating costs for improved LBMs. Increasing sales in an improved shop was one of the prime motivating factors for vendors' willingness to pay. Vendors expected to receive an increased price from the consumers for an improved market and safer product – from the current average of BDT 14 to 21 (USD 0.13 to 0.19) per kg for various types of chickens. There is a small gap between the consumers' WTP and vendors' expectation; we can inform that to policymakers and find out a solution which would bring the other relevant stakeholders such as government, poultry associations and business entities as possible contributors to cover the cost.

For improved market structures, washable walkways, regular water supply and drainage systems scored high, suggesting consumers' preference for an improved market. Consumers also emphasized separating sick chicken from healthy chicken, a separate disposal system for dead chicken, and regular cleaning and disinfection. Most consumers rated all the 17 attributes as 'important' reflecting consumers' awareness about the potential infrastructural, biosecurity and institutional changes for an improved market.

Income was one of the influencing factors for WTP of the consumers and vendors, as the higher income groups had a significantly greater readiness to pay for an improved bio-secure LBM. The economic rationale behind this positive relationship is that higher-income individuals typically have more disposable income, allowing them to allocate a larger portion of their budget towards purchasing premium goods and services, such as improved market facilities for poultry products. Similar to income, higher-educated individuals were more willing to pay to contribute to the funding mechanism for improved LBMs.

Although the majority of the consumers (73%) and vendors (around 65%) were willing to pay more for an improved market, the remaining of the consumers and vendors had different opinions and reasons behind their unwillingness to pay more. The existing market price seemed very high and not affordable to most consumers who were not willing to pay a higher price for purchasing chicken from an improved LBM. Unwilling consumers also thought the government had to play the leading actor role in building improved market structures. Vendors' unwillingness to pay were linked to their concerns about unaffordability of higher amount money for a one-time investment or for regular maintenance cost, and fear of loss in business.

Our study generated evidence on the willingness to pay of consumers and vendors to understand the future for improved and bio-secure LBMs in Dhaka city. These findings are useful for future research and interventions to adopt such designs that consider perspectives from diversified stakeholders, including consumers, vendors, and public and private authorities, to improve the LBMs. Previously, WTP studies were used for pricing reforms to improve community-based facilities [45, 46]. This study could inform government decision-making about reforming chicken pricing and utilizing the findings to design the modern infrastructure of bio-secure LBMs and increase public investment to develop improved bio-secure LBMs.

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ANNEXES

ANNEX 1. PARTICIPANTS IN THE EXPERT CONSULTATION MEETING AT PHASE 2

Venue: icddr,b

List of Participants

Name	Area of expertise	Designation
Md. Akhtaruzzaman Khan	Economics and financing	Professor, Department of Agricultural Finance, Bangladesh Agricultural University
Md. Salauddin Palash	Economics, agricultural business model and marketing	Professor (Agricultural Market Systems), Department of Agribusiness and Marketing, Bangladesh Agricultural University
Emdadul Haque Chowdhury	Poultry biosecurity, pathogenesis	Professor, Department of Pathology, Bangladesh Agricultural University
Rebeca Sultana	Public health, anthropology, and health economics	Associate Scientist, Emerging Infections, Infectious Diseases Division, icddr,b
Ireen Sultana	Public health, biosecurity, and veterinary science	Assistant Scientist, Emerging Infections, Infectious Diseases Division, icddr,b
Md Mustafizur Rahman	Public health, and medical science	Research Investigator, Emerging Infections, Infectious Diseases Division, icddr,b
Md. Habibullah Fahad	Public health, and anthropology	Field Research Manager, Emerging Infections, Infectious Diseases Division, icddr,b
Md. Jawwad Kamran	Health Economics	Research Assistant, Emerging Infections, Infectious Diseases Division, icddr,b
Nadia Ali Rimi	Public health, anthropology, avian influenza and LBM biosecurity	Associate Scientist, Emerging Infections, Infectious Diseases Division, icddr,b

Note-taking (icddr,b): Hridita Safiq; Md. Jawwad Kamran

ANNEX 2. FEATURES OF EXISTING LBMS AND AN IMPROVED BIO-SECURE LBM SHOWED IN THE VIDEO CLIP

Features of existing LBM	Features of improved bio-secure LBM
▪ Congested space for consumers, vendors and poultry cages and processing equipement. ▪ Unclean metal cages; absence of trays under the layers of the cages to collect poultry feces ▪ Waste and blood are scattered on the grounds ▪ Vendors are performing skinning, and processing on the lid of the slaughetring barrel ▪ Unclean hot water used for scalding	▪ Arranged, clean and open space inside the shop ▪ The metal cage is clean. Under every layer, there are trays to collect feces ▪ The shop is washable ▪ Poultrys are slaughtered in clean equipment and processed on a clean surface ▪ Poultrys are dipped into temperature-controlled scalding machine ▪ Dressing machine is covered so that particles cannot spill outside ▪ Vendors are eviscerating on a clean wasahble surface; wastage cannot be seen ▪ Carcasses are washed with clean water ▪ To ensure that the consumers get their chosen birds, tags are used to identify those easily while packaging

ANNEX 3. LIST OF POSSIBLE ONE-TIME CAPITAL COST AND RECURRING COST FOR AN IMPROVED LBM

One-time capital costs	Monthly recurring costs
1. Tiling the floor 2. Improving drainage system 3. Purchasing improved equipment 4. Improving ventilation and lighting 5. Ensuring running water supply 6. Establishing a central slaughterhouse	1. Rent for the shop 2. Soap, detergent and disinfectant for cleaning and disinfecting shop and tools 3. Electricity bill 4. Running water bill 5. Wages of staff of the shop 6. Repairing and purchasing tools/equipment 7. Plumbing 8. Packaging

ANNEX 4. FREQUENCY OF ATTRIBUTES AT ATTRIBUTE ELICITATION OF THE CHICKEN CONSUMERS AT PHASE I

Sl. No.	Attributes	n
	Infrastructure	
1.	Wide and spacious market alley and sufficient space in front of each shop	23
2.	Higher market surface compared to surrounding roads and same floor height for all poultry shops	17
3.	Separate waste disposal point/bin for poultry market	3
4.	Separating each poultry shop with brick walls and renovating the shops at the same time	4
5.	Number of shops should be according to market space	4
6.	**The walkway inside the market (alley) will be easily washable**	**15**
7.	**All the poultry shops are separated in a corner of the market**	**6**
8.	**A designated poultry slaughtering and processing (removing skin and offal and cutting meat) table**	**10**
9.	**There is a common slaughtering place for slaughtering and processing poultry from all poultry shops in the market**	**3**
10.	Selling area and processing area will be separated inside a shop	15
11.	**Easy washable surfaces and implements**	**15**
12.	**Regular (starting from opening of shop until closing) water supply for each shop**	**27**
13.	Availability of water taps inside the market and recycling of water	14
14.	**Improved (wide drains connected with central drainage network) and concealed drainage system in every shop**	**16**
	Hardware and tools	
15.	**Improved ventilation, lighting and fan in the shop**	**6**
16.	Large metal cages with trays and the cages should be kept side by side instead of one above another	12
17.	Glass chambers for keeping poultry	3
18.	**Workers using masks and gloves**	**13**
19.	Dressing machine for broiler and layer shop	3
20.	Basin for handwashing in each shop	3
	Recommended practices: Cleaning and disinfections	
21.	**Regular (daily) cleaning and disinfection of poultry cages, slaughtering and processing areas, and drains**	**39**
22.	Quick disposal of waste from slaughtering and processing zones	12
23.	Appointing cleaners specific to poultry market	7
24.	**All waste is disposed of in designated waste bins; no visible waste in the shop**	**36**
25.	Using trolley for waste disposal	2
26.	Recycling poultry waste and water/Engaging fertilizer companies to recycle waste	1
	Recommend practices: Slaughtering and processing poultry	
27.	**Performing slaughtering and processing in front of consumers**	**6**
28.	Following religious slaughter practices	12
29.	**Washing hands with soap after poultry slaughtering and processing (of each batch)**	**16**
30.	Using fresh water instead of filthy water to wash/soak poultry	13
31.	Height of the processing table should be a minimum 4-5 feet	1
	Recommended practices: Poultry keeping	

Sl. No.	Attributes	n
32.	**Keeping distance (one meter) between poultry cages/slaughtering place and consumers to prevent splattering of poultry body parts and blood**	**10**
33.	Using wood husk on the floor of poultry-keeping places	1
34.	**Separating sick poultry from healthy ones and separate arrangements for dead poultry disposal**	**2**
35.	Ensuring safe food for poultry	4
36.	Not selling sick/dead poultry	3
37.	Accurate weight and price	8
	Support and monitoring	
38.	Training for poultry shop owners, workers and cleaners on cleanliness, disinfectant use and hygiene practice	4
39.	Rules formulation and implementation by market authority	12
40.	**Using signboards inside and outside the market to display rules and awareness messages for raising consumer awareness of cleanliness and hygiene**	**2**
41.	Raising consumer awareness of cleanliness and hygiene	4
42.	Providing disinfectants (spray and bleaching powder) to shop owners	9
43.	**Regular monitoring by market authority and city corporation**	**12**
44.	Financial support from government intervention implementers for shop owners to maintain cleanliness and hygiene	2

*Blue colored attributes were selected during phase 2 at expert consultation meeting for the consumer survey at phase 3.