



# SMS GATEWAY: IMPROVING ANIMAL HEALTH THROUGH INFORMATION AND COMMUNICATION TECHNOLOGIES

## Objective

This case study sets out to show how an SMS Gateway system developed by FAO has been used to improve rural communication, support animal disease crisis management and contribute to livelihood resilience for small-scale farmers. Focusing on the case study of avian influenza in Bangladesh, the case study explores how the SMS alert system has bolstered disease prevention, surveillance and reporting among poultry farmers.

This resilience case study is designed for practitioners who are interested in using an SMS Gateway system, or other cellular or web-based technologies, to improve reporting of animal disease outbreaks and exchange other types of information. It is expected to be of particular interest to farmers and producers' organizations, animal health workers, government ministry officials and institutions involved in carrying out or supporting development projects.



## Geographical coverage



The project ran from 2010 to 2013 in Bangladesh. By the end of the first phase, the SMS Gateway project profiled in this case study had expanded to include 306 Upazilas (districts).

## Introduction

In Bangladesh, commercial and backyard poultry farms provide important sources of food and income. Backyard poultry production, which is primarily managed by women, accounts for half the 300 million heads of poultry raised nationwide. In rural areas, nearly 90 percent of households keep chickens and/or ducks in their yards. The prevention of, and rapid response to livestock disease is crucial for the protection of animal and human health, as well as livelihoods.

H5N1 Highly Pathogenic Avian Influenza (HPAI) first infected humans in 1997 during a poultry outbreak in Hong Kong SAR, China. Following its widespread re-emergence in 2003 and 2004, this avian virus spread from Asia to Europe and Africa and has become a major problem in some countries, resulting in millions of poultry infections, several hundred human cases and many deaths. Bangladesh is one of the countries that have been severely affected. Outbreaks in poultry have significantly affected livelihoods, economies and international trade.

Rapid disease detection and response are critical in halting the spread of avian influenza. To speed up this process, authorities sought ways to improve the exchange of animal health and disease information with both commercial and backyard farmers.



SMS Gateway, a project operated by the Food and Agriculture Organization of the United Nations (FAO) with the support of the United States Agency for International Development (USAID), was launched in 2010 in Bangladesh to support timely and effective responses to outbreaks of H5N1 Highly Pathogenic Avian Influenza (HPAI)

The SMS Gateway system uses a network of community animal health workers (CAHW) and a system of code numbers to relay text messages sent by mobile phone through a web-based server based at FAO. The server automatically alerts the country's animal health authorities in the event of suspected cases of the disease.

The rapid communication of information from local communities has fostered timely investigation of suspected cases and faster, more effective responses, including culling, if needed. The system has been credited with improving disease reporting and response and helping to prevent or slow the spread of potentially devastating disease, thereby contributing to risk reduction and building the resilience of livelihoods amid crisis situations. Its success has inspired proposals for subsequent phases and has led other countries to consider applying similar concepts to protect animal health and boost rural communication services.

## Methodological approach

The launch and implementation of SMS Gateway involved:

- selecting and training personnel;
- identification or addition of mobile and web-based infrastructure;
- exchange of knowledge and information with farmers;
- coordination with governmental and organizational partners.

### **Personnel**

Community Animal Health Workers (CAHW) provided the first point of contact between farmers and the broader disease surveillance system.

Candidates for the positions of Community Animal Health Worker and Additional Veterinary Surgeon (AVS) were nominated in each Upazila Livestock Office (sub-district level). Both men and women CAHWs, who were based in the local community, were chosen with the following criteria:

- Experience in avian influenza surveillance activities;
- Possession of a mobile phone;
- Willingness to work at field level;
- Willingness to work with local Department of Livestock Services personnel;
- Minimum educational level of Junior School Certificate;
- Female candidates encouraged

Men or women Additional Veterinary Surgeons were selected from candidates with valid veterinary certificates and motorcycle driver's licenses, through a written examination.

By the end of the first phase of the project in 2013, 1,006 Community Animal Health Workers were involved in the SMS Gateway initiative in Bangladesh, of whom 10 percent were women. There were 103 Additional Veterinary Surgeons, 30 percent of whom were women.

### **Capacity Development**

All Community Animal Health Workers underwent initial training in case definition and identification of highly pathogenic avian influenza. They also received refresher training in biosecurity and good practices in poultry production, to allow them to raise awareness among farmers.

Training was also provided for commercial poultry farmers (mostly men) and backyard poultry farmers (mostly women), in order to raise awareness of the project, as well as animal health issues, disease prevention and disease reporting.

### **Infrastructure**

Key elements in the system included mobile phones used by the Community Animal Health Workers, a web-based server hosted at FAO and animal health, veterinary and laboratory contacts at sub-district, district and national levels. The software used in the system was developed by a team of FAO's computer technologists with inputs from epidemiologists and veterinarians from the FAO Technical Unit for the Avian Influenza Programme. The SMS Gateway software was tailored to suit the existing administrative infrastructure in the country and the project was developed in line with existing telecommunications technology and human resources. For detailed information on infrastructure and other considerations, see Box: Setting up an SMS Gateway system.



## Reporting

Community Animal Health Workers were requested to send one SMS message daily after door-to-door visits and in the case of unusual events, Additional Veterinary Surgeons were instructed to visit the farms for spot investigations and sample collection. The number of households visited by each CAHW was recorded and compliance with animal health regulations was monitored

**Disease action plan** After carrying out a routine visit, the Community Animal Health Worker uses a mobile phone to send a text message, indicating the state of health of the farmer's flock. The coded message is received by a server hosted at FAO. If the code indicates suspected disease, an automatic SMS from the server alerts the district-level Upazila Livestock Officer (ULO) and the Additional Veterinary Surgeon, who arranges for an investigation. If the threat is considered real, a sample carcass is sent to a Field Disease Investigation Laboratory or the Central Disease Investigation Laboratory in Dhaka. In the case of H5N1 Highly Pathogenic Avian Influenza confirmation, the flock is culled within hours. If birds are culled, the farmer must observe a three-month quarantine period, but can also expect to receive monetary compensation for the temporary loss of livelihood.

## SMS Gateway – How it works

In general, an SMS Gateway allows computers to send and/or receive information and urgent updates through Short Message Service (SMS) technology used by mobile phones. SMS Gateway systems have now been widely adopted for commercial use and many IT companies have developed different software solutions which, using web-based technology, allow users to send and receive a high volume of SMS texts for different purposes, such as for marketing services and products.

The FAO SMS Gateway reroutes coded messages from field workers by way of a simple mobile phone to a server placed in the FAO office in Dhaka. Using specially designed software, the server processes the coded messages sent by Community Animal Health Workers and, in the event of a suspected H5N1 Highly Pathogenic Avian Influenza outbreak, it sends out an automatic alert by SMS to the relevant Upazilla Livestock Officer.

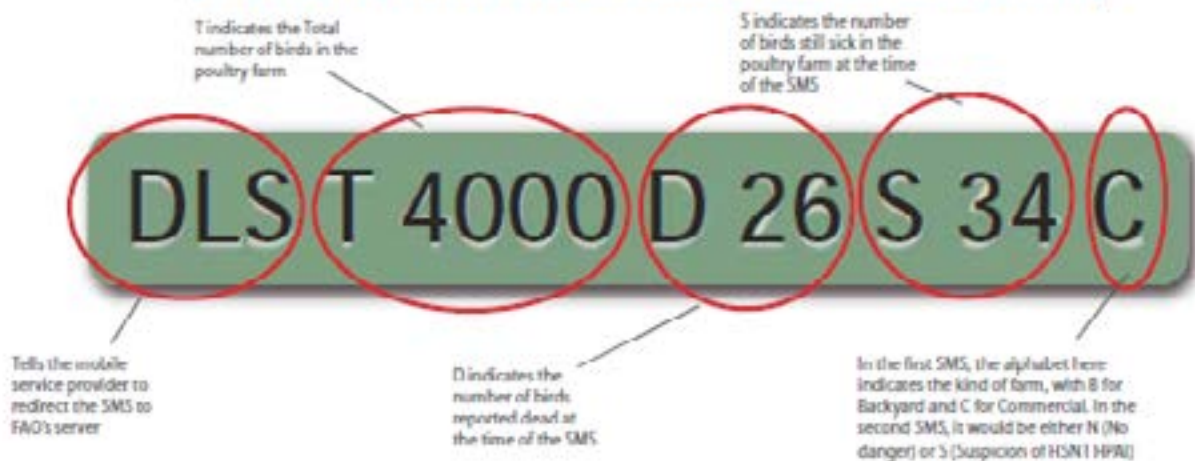
In order to be read by the FAO SMS Gateway system, the SMS must contain a specific code representing key information, keyed in by the Community Animal Health Worker.

The code is: DLS T xxxx D xx S xx C/B.

- The first three letters, DLS, allow the mobile service provider to filter the SMS and reroute it to the server at the FAO office.
- The letter T, followed by a number, indicates the total number of birds present at the farm.
- The letter D, followed by a number, indicates the number of dead birds reported by the farmer.
- The letter S, followed by a number, indicates the number of birds suspected of being ill.
- The final letter, which may be B or C, tells the server if the outbreak is happening in a backyard or a commercial farm.

For example, if a Community Animal Health Worker sends out the following SMS: DLS T 2000 D 2 S 32 B, the message will be interpreted as: Total number of birds: 2,000. Number of dead birds: 2. Number of sick birds: 32. Outbreak happening at a backyard farm

## CRACKING THE CODE *The secret language of reporting outbreaks*



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### Summary of system components/requirements

Key components of the system included:

- Community Animal Health Workers (CAHW) with mobile phones.
- District-level Upazila Livestock Officer and Additional Veterinary Surgeons (AVS) to investigate suspected outbreaks.
- Web server (hosted at FAO) to route confirmed reports to national authorities.
- Field and central laboratories.
- Chief Veterinary Officer to evaluate laboratory report and authorize culling, if needed.
- Field team to conduct culling.
- Mandatory 3-month quarantine of properties where diseased birds were found.
- Procedures for compensating farmer for lost flocks, in the event of culling.

## Validation

Since the SMS Gateway used a web-based server, this facilitated monitoring, assessment and data gathering for the project.

### Response time

Following implementation of the SMS Gateway system, the response time for H5N1 Highly Pathogenic Avian Influenza outbreaks was drastically reduced: in 2007, the range of activities from detection to disinfection used to take about 4.8 days, while in 2011, after the introduction of the SMS Gateway system, response time was reduced to 1.43 days. In one well documented case, a farmer reported bird deaths to a Community Animal Health Worker, who then sent a text message to alert authorities. Within 24 hours, on-site and laboratory checks led to confirmation of the H5N1 Highly Pathogenic Avian Influenza virus. The rapid response by authorities and subsequent culling of the farmer's entire flock kept the disease from spreading to adjacent farms.

## Number of detections

In 2010, almost 70 percent of Bangladesh's 31 outbreaks of H5N1 Highly Pathogenic Avian Influenza were reported through the SMS Gateway. In 2011, the performance was even better: Some 87 percent of the 61 outbreaks were reported using this technology.

## Impact

Before SMS Gateway was set in place in Bangladesh, consistency and timeliness of disease detection and response were major challenges. Farmers were also concerned about the potential impact on their livelihoods of reporting suspected disease occurrences. Following its implementation, SMS Gateway had the following impacts:

- Significant improvement in detection of H5N1 HPAI outbreaks
- Significant improvement in quality and efficiency of outbreak reporting
- Improved field level capacity to survey, assess and detect outbreaks.
- Capacity development of Community Animal Health Workers, giving them a new set of skills in animal disease detection and improving their social role within their community.
- Significant improvement in Bangladesh's rapid response capacity to H5N1 HPAI.
- Proven ability to halt the spread of disease to adjacent farms.
- Improvement in resilience of both men and women poultry farmers to shocks due to animal diseases.
- Increase in farmer awareness of good practices in animal health and disease reporting.
- Increase in farmer awareness of support provided in the event of loss of flocks.
- Increase in trust, as seen in farmers' willingness to report disease outbreaks to local authorities.
- New roles for people in the community.
- New layers of social and professional contact/communication.
- Strengthening of country's rural communication services.
- Influence on other countries, which have considered adopting similar approaches to animal disease prevention/ reporting and communication

By lunchtime on the day of the outbreak, a courier sets out carrying the chicken carcasses preserved in ice, headed for the Central Disease Investigation Laboratory in Dhaka.



**Rapid response prevents spread of deadly disease** Bangladeshi poultry farmer Ghiasuddin was alarmed to see his chickens dropping dead one morning and promptly reported the occurrence to the community animal health worker (CAHW). The animal health worker used SMS Gateway to relay the message through the server based at the FAO office in Dhaka. The resulting investigation confirmed the presence of H5N1 Highly Pathogenic Avian Influenza, and within 24 hours, the remains of the farmer's entire flock had been culled. The speed of this response prevented two adjacent farms from being affected by the disease.

"We had all been worried," said Masud, owner of a neighbouring farm. "But nothing happened to my birds." Ghiasuddin had to wait for a mandatory quarantine period of three months before restocking his farm, but in the meantime, the Upazila Livestock Officer provided financial compensation to help him restart his livelihood. The building of trust among farmers and animal health workers, as well as the systematic training and sharing of information, was fundamental to the positive impact of the project.

## Success factors

While the SMS Gateway took an innovative approach to disease surveillance and reporting, its success was partly due to a decision to make use of, or adapt, existing or easily accessible technologies and institutional and social systems. Two key examples are the mobile phones already in possession of the Community Animal Health Workers and the country's animal health/veterinary administrative structure. The use of animal health workers from local communities also helped to build a sense of trust among farmers in the new system.

Information sharing and training allowed actors at every level to become familiar with SMS Gateway, learn how to use it and understand their own roles in the system. The training and outreach process involved women, who are largely responsible for backyard poultry production.

The project's effectiveness was first established through a pilot project, allowing sufficient time to demonstrate that it could work, while the web-based system made it easier to monitor cases and gather data on its impact and viability.

The system was backed by the commitment of the Government and bolstered by collaboration between the public and private sectors, international partners and donors, and community-based organizations.

## Constraints

There were few, if any, technological constraints, since farmers were not expected to adopt new communication technologies. The Community Animal Health Workers were required to have mobile phones, but most of them already owned one. The greatest constraint was the cost of salaries for the Community Animal Health Workers and Additional Veterinary Surgeons. Addressing this issue has become a top priority as the country seeks to build on this successful model.

Building and maintaining trust was crucial for SMS Gateway, since reporting a suspected disease outbreak could lead farmers to lose their flock through culling. The project succeeded in allaying farmers' fears and building trust, partly through a compensation scheme.

## Lessons learned

Research and project reports indicate that farmers are ready to pay small fees for services that they find useful for their livelihoods. As they planned their next steps, project managers considered ways to design and implement a system whereby Community Animal Health Workers could sustain their livelihoods by providing primary animal health care services on a fee-paying basis to farmers, such as vaccinations and deworming.

FAO's Emergency Centre for Transboundary Animal Diseases in Bangladesh also took into account the following proposals for revision of the original project:

- Foster a more active role for farmers and encourage them to report outbreaks of animal diseases on their farms.
- Expand the range of animal diseases monitored with the SMS Gateway system by Community Animal Health Workers and train them to notice and report the early signs of various livestock conditions.
- Take advantage of the two-way option of SMS Gateway (an SMS can be sent from mobile phones to the server, and vice-versa) and use this to deliver useful and timely animal health information to farmers.

It is important to forge partnerships with existing rural communication services that are already self-sustaining, to ensure that animal health is kept under control and that disease outbreaks are reported to authorities in a timely manner.

It is critical for farmers to cooperate with Community Animal Health Workers and provide them with reliable information about their animals. In order to build trust in this relationship, Community Animal Health Workers must be members of the local community in which they operate. In addition, differences in the experiences of men and women must be taken into account. For example, in Bangladesh, backyard poultry operations are operated primarily by women. The project recruited both men and women for the Community Animal Health Worker and Additional Veterinary Surgeon roles, who served as the primary points of contact with producers. The service provided through the SMS Gateway system must be of good quality and useful for farmers. And crucially, in order to promote farmers' cooperation, a system for compensating them for their financial losses must be put in place.

## Sustainability

The SMS Gateway System was initially developed by FAO under a project funded by the USAID. The World Bank later on took over the system with an objective to gradually hand over the system to DLS along with man power. Although in terms of technology, the outlay is minimal, since once the SMS Gateway system is implemented the running costs are very low, the project turned out to be heavily dependent on external funding due to the workers' salary costs. In February 2013, when the first phase of the project ended, the salary costs for Community Animal Health Workers (8 000 Taka per month/US\$103 for 1 006 staff) and Additional Veterinary Surgeons (35 000 Taka per month/US\$448 for 103 staff) were prohibitively high for the Government of Bangladesh to absorb on its own. Unfortunately it was not possible to transfer the system to the Department of Livestock Services because of lack of financial resources to support the workers. This was identified as a key challenge to address in the planning and design of future phases.

Using an SMS notification system for Animal Disease incident reporting proved to be a fast method of receiving status updates in different geographic locations. However, the SMS system is too expensive due to the SMS based cost compared to a toll-free number. If a toll-free number can be used for this purpose, it would become more viable. In order to make it more sustainable, one solution could be to incorporate the usage of the SMS Gateway System with the regular activities of Department of Livestock Services with the existing manpower.

## Replicability and scaling up

With its straightforward and efficient structure, the SMS Gateway can be easily adapted to other situations. Various diseases can be monitored by local authorities. Farmers will eventually accept having to pay a fee to Community Animal Health Workers if they can benefit from a wider range of services, including primary animal health care.

Any replication or scaling up of the programme will need to address the issue of establishing funding systems that are self-sustaining and make a careful analysis of the financial, human resources and equipment required for a successful outcome.

It is important to embed a gender sensitive approach in any scheme based on this model, and advisable to include sex disaggregated data in monitoring and evaluation of its impact.



**More countries turn to mobile technology for better agriculture** In Indonesia, the government is using an SMS alert system to help control influenza. The initiative, part of the National Animal Health Information System (iSIKHNAS), allows field staff (paravets and vets), village reporters and other personnel to send coded SMS messages to the animal health agency about suspected or confirmed cases of H5N1 Highly Pathogenic Avian Influenza. The system is also being used to monitor other livestock diseases. Registered users can access a wide variety of information from the system through their phone, via SMS or instant messaging (IM). Computer users with internet access can access data through the iSIKHNAS website: [www.isikhnas.com](http://www.isikhnas.com)

## Setting up an SMS Gateway system

### **Short Message Service (SMS)**

Short Message Service (SMS) is a mechanism that allows short text messages to be sent and received by mobile devices. A simple short message is created in the sender's mobile device and then forwarded to an SMS centre, which sends a positive or negative response specifying whether the short message was correctly sent or not. The SMS Centre receives messages from senders and sends them on to their intended recipients. The system also determines whether a given recipient is available on the network. If so, the message is sent. Otherwise, it is stored until the intended recipient becomes available. Network carriers use SMS Centres and Gateways to facilitate and streamline text messaging processes.

Text messaging has become a global communication medium, which allows a large community of users to share or propagate information. But even though SMS or text messaging is simple to use and a well-known communication process, the technology behind providing the service is not simple. Implementing an SMS gateway will require some important considerations.

### **Service infrastructure**

Implementing or deploying an SMS Gateway will require components that need to be carefully chosen to ensure administrators and end-users are able to manage the system effectively and with minimum complexity.

### **Network carrier**

If the SMS service is designed for rural areas, selecting the right mobile serviced provider is critical. The carrier should provide strong signal strength to ensure good coverage in the required areas and 99 percent of service availability. It should also provide SMS operations services, which include: storing, routing and forwarding inbound short messages to the designated endpoints.

### **Server and data network**

Since each SMS Gateway application will have different requirements for capacity, performance and availability, it is essential to define the scope of the project to achieve optimal performance and correctly allocate the resources available.

### **Server**

Independently of the operating system used, resource needs for an SMS gateway deployment are defined in terms of Central Processing Unit (CPU), memory and disk capacity. It is therefore essential to ensure that the computer to be used has adequate CPU, memory and disk space so as to provide an optimal service.

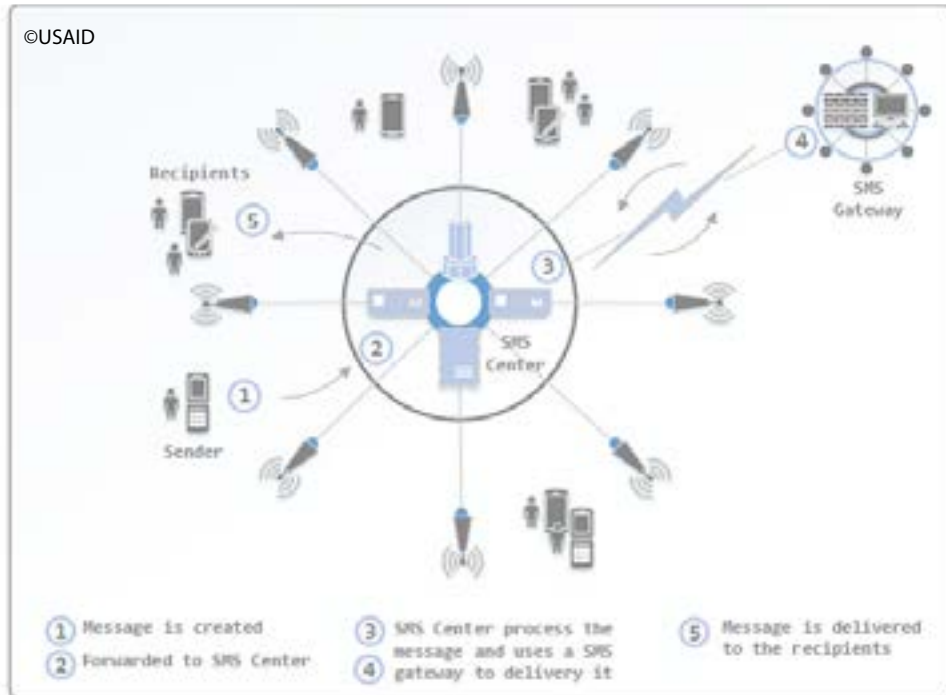
### **Security**

Since SMS services are frequently used by commercial organizations, a security breach in the system could have a serious financial impact. It is therefore essential to protect the services against threats, such as computer worms, viruses, SMS spam or any unauthorized access to the system. As a defensive method, it is advisable to use: Firewalls, SMS spam filtering and keep the SMS Gateway application properly updated.

### **Documentation**

Creating detailed documentation, such as a standard device configuration, graphical logical schemes, network maps and traffic statistics, will help to operate a healthy service. Detailed documentation will enable administrators to troubleshoot and optimize the performance and stability of the service with greater ease.

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## Conclusion

The SMS Gateway system has produced significant results in monitoring H5N1 Highly Pathogenic Avian Influenza outbreaks in a reliable and efficient manner, and appears to be an effective method of connecting farmers with authorities. Given the widespread diffusion of mobile phones in the developing world and the very low cost of sending SMS, farmers themselves can also monitor and report directly to authorities, sending information on the status of their animals.

The proposal of using an SMS Gateway system may come from farmers, producers' organizations, veterinary/animal health workers or government ministry representatives. Ultimately, setting up and using such a system requires discussion and taking stock of community needs. Other key considerations include the technology already at the disposal of farmers, or other actors such as animal health workers, the potential for gaining access to further technology (such as a web-based server) and financial resources (through direct charges/fees, grants or other funding), as well as support available from organizations such as FAO.

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## Authors

Isabella Rodriguez y Baena - Clare Pedrick - Sophie Treinen - Charmaine Wilkerson

## + For more information...

On the good practices team: [good-practices@fao.org](mailto:good-practices@fao.org)