

A Study on the Service model of risk mitigation on livestock pandemic based on Networks

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Abstract— The service model for the risk mitigation based on networks described in this paper covers real time data acquisition, monitoring of risk events, and provision of mitigation services for the identified risks. It occurs regularly every year and the goal is to minimize the killing and loss of livestock by monitoring in advance for quarantine of African swine fever, avian influenza, foot-and-mouth disease and bovine spongiform encephalopathy to use the network and AI technologies. Animal epidemics, which occur regularly every year, are causing economic losses worldwide and a great crisis in securing food resources. For the prevention of such livestock infectious diseases, it is more problematic because it is handled manually and there is no standardization procedure until now.

A service model is required to derive necessary service features that support these missions. Therefore, the service model is proposed in this paper for the future standardization.

Keywords— Risk mitigation service, Livestock pandemic, Risk mitigation action, Risk monitoring function

I. INTRODUCTION

It is required to effectively prevent infectious diseases occurring in wild birds, wild animals and livestock by utilizing the modernized advance network, and to effectively treat the future, current and post situation. As the 5G and IoT network deployment, massive machine-type terminals especially in the verticals collect massive data which enables the digital transformation of vertical outside and inside, such as the agriculture, logistics, transportation, healthcare, environment, supply chain finance, etc. [1][2]

It is not only valuable directly for the service provider who collect, aggregate and analyse the data, but also for the upstream data consumers which reuse the data for derivative business, e.g. the environment data (e.g. temperature and wind speed) for agricultural insurance, the driving behavior data of vehicles for second-hand transaction, the transportation traffic data for AI algorithm training, etc. The importance of the data raises the concern to the data integrity and the trust anchor. Animal epidemics, which occur regularly every year, are needed standardization to prevent economic losses worldwide and a great crisis in securing food resources. [3]

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no standardization procedure until now. It is required to effectively prevent infectious diseases occurring in wild birds, wild animals and livestock by utilizing the modernized advance network, and to effectively treat the future, current and post situation. [4]

II. CONCEPT OF RISK MITIGATION SERVICE

Animal epidemics, which occur regularly every year, are causing economic losses worldwide and a great crisis in securing food resources. [4][5]

For the prevention of such livestock infectious diseases, it is more problematic because it is handled manually and there is no standardization procedure until now. It is required to effectively prevent infectious diseases occurring in wild birds, wild animals and livestock by utilizing the modernized advance network, and to effectively treat the future, current and post situation. [6]

Risk mitigation service refers to all aspects of the risk mitigation processes which are intended to reduce the impact of risks and develops mitigation processes, as part of the service, based on data. In the conceptual diagram shown in Figure 1, risk events are detected by analysing risk data obtained from service areas owned by farm owners or enterprises, i.e. risk sufferers via communication networks. Risk mitigation service providers then classify the risk types and assess the impacts due to the detected risks. The risk status will be delivered based on the risk types and impact levels to the relevant parties, i.e. risk mitigators that are responsible to cope with risks such as disaster prevention headquarters or local officers to prevent the dispersion of risks. The results after these risk mitigation actions have been performed will ultimately be delivered to the service users (risk mitigators and risk sufferers). A reference architecture based on this concept will be described in the next clause. [7][8]

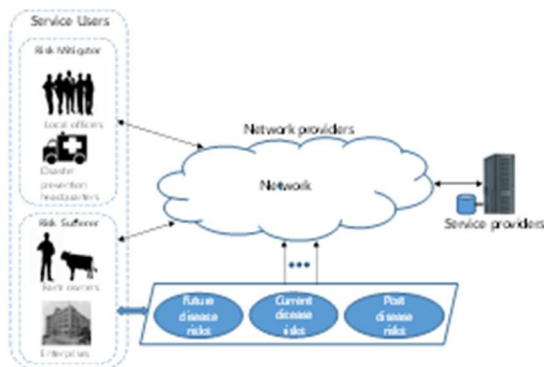


Figure 1. Conceptual diagram of risk mitigation service.

III. SERVICE REQUIREMENTS FOR RISK MITIGATION

Risk mitigation service should be effective to reduce risks in relation to rescue, evacuation, safety confirmation and life sustainability. There could be a consideration of risk types with associated levels of risk possibilities. Therefore, risk types need to be identified, and for each risk type several levels of risk possibilities may be required to be distinguished. Service providers should provide risk message boards, risk notices, risk mitigation guidance, and safety confirmation and message broadcast capabilities for risk indication to users. [9][10]

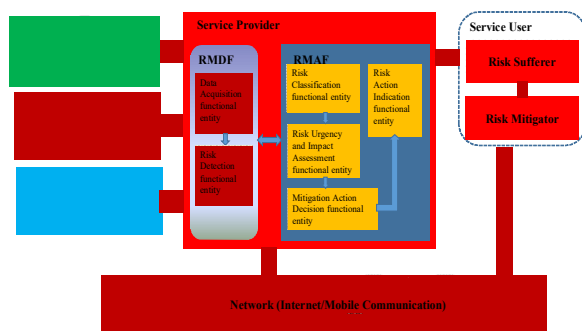


Figure 2. Service model of the risk mitigation

IV. RISK MITIGATION ACTION OF LIVESTOCK PANDEMIC

Livestock diseases can severely harm animal health as well as human health, and also have adverse economic impacts through their effects on producer incomes, markets, trade, and consumers.

Especially, foot and mouth disease is considered to be the most economically devastating livestock disease in the world, and represents a worst-case scenario for livestock diseases because of the variety of species involved, rapid spread, and difficulty in controlling outbreaks.

Immediate notification is necessary because of its rapid and substantial impact on the international trade of animals and animal products. [8][9]

Figure 3. shows the Risk mitigation function and Figure 4. shows the Risk classification function flow. [10]-[14]

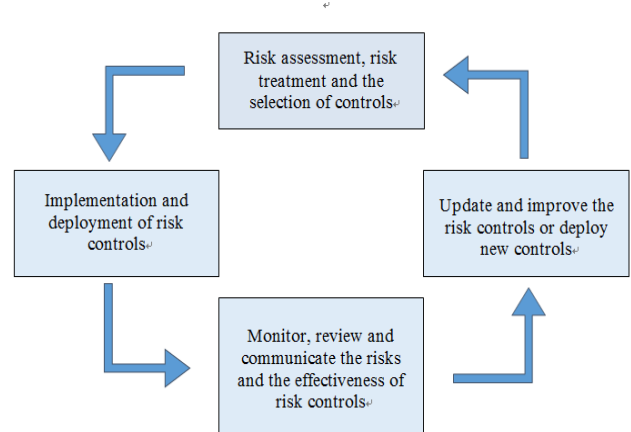


Figure 3. Risk mitigation action function

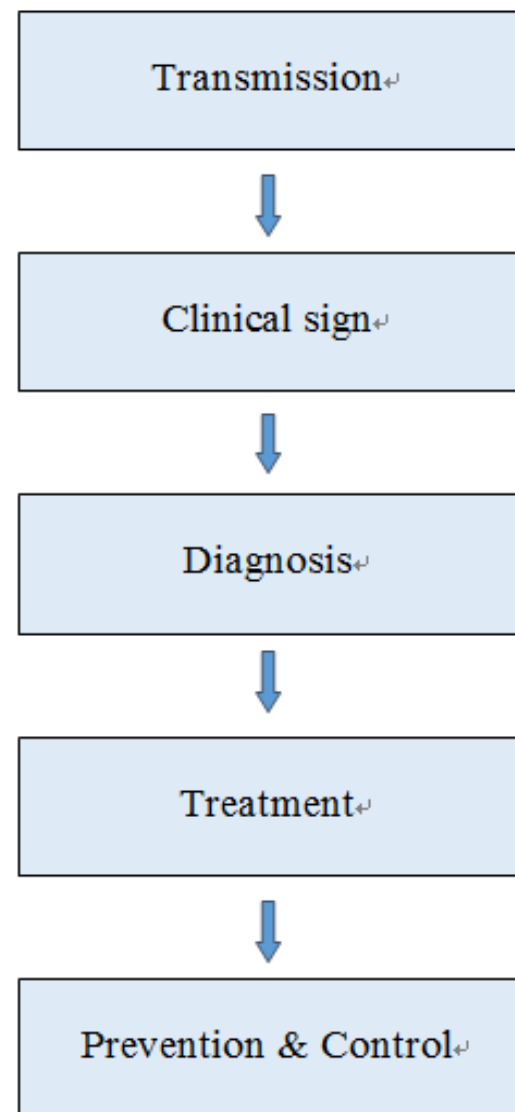


Figure 4. Risk Classification Function Flow

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- Transmission

Foot and mouth disease virus is spread via contact and fomites (including contaminated inanimate objects and people moving between infected and uninfected animals). Inhalation and ingestion are routes of infection. Outbreaks may originate in swine herds fed raw garbage containing infected meat, and are usually propagated by the transport of infected animals to markets or new locations. Introduction of an infected animal to a susceptible herd or insemination of a susceptible cow with infected semen may also initiate outbreaks. Airborne transmission has been reported, and cattle may be more susceptible to this route of infection. Dispersion of airborne viruses is influenced by weather conditions. The incubation period is usually two to five days, but may be longer in sheep and goats. The disease is highly contagious and infectious. Cattle may shed the virus for four or more days before clinical

- Clinical Signs

Affected animals develop vesicular lesions of the tongue, dental pad, gums, cheek, hard and soft palates, lips, nostrils, muzzle, interdental space (between the hooves), and on the coronary band. In affected ruminants, vesicular lesions may be observed on the udder and teats. Lesions may be observed on the snout of affected swine. Excessive salivation is often the first observed clinical sign; the saliva is sticky, foamy, and stringy in consistency. A transient, high fever may be observed. Over a period of seven to 14 days, the vesicles break, erode, ulcerate, then heal. Abortions may also occur. Marked loss of condition is often observed because of reduced feed consumption secondary to oral pain. Milk production may be markedly decreased. The malignant form may produce myocardial degeneration and death in calves. Lameness and reluctance to move may be observed. A carrier state is possible in recovered ruminants, but plays an unknown role in transmission of the virus. Clinical signs may be more subtle in sheep and goats, resulting in delayed recognition that may increase the risk of spread of the outbreak. Lameness is often the first observed clinical sign of FMD, and the vesicles may be more difficult to recognize. Up to 25% of affected sheep may not develop clinically apparent vesicles, and others may only develop a single lesion or develop vesicles that are visible for less than three days.

- Diagnosis

A tentative diagnosis of FMD is made based on clinical signs, but distinguishing FMD from VS is not possible based on clinical signs. Diagnosis can be confirmed by detection of the virus in samples from affected tissues or esophageal-pharyngeal fluid. Laboratory methods to confirm FMD include enzyme-linked immunosorbent assay (ELISA), complement fixation, virus isolation, virus neutralization, mouse inoculation, cell culture, and polymerase chain reaction (PCR).

- Treatment

Foot and mouth disease is a reportable disease. State or Federal animal health officials should be immediately notified when vesicular disease is observed. There is no treatment for FMD.

Strict quarantine and slaughter methods are employed to control outbreaks. Vaccination may also be used to control outbreaks. Infected, recovered, and FMD-susceptible contact animals are slaughtered, and carcasses, bedding, and all animal products in the affected area are destroyed. Vaccinated animals may be killed and destroyed, or slaughtered with salvage of the meat under supervised procedures. Recovery from uncomplicated FMD is relatively rapid, but the virus can persist in the pharyngeal tissues. Permanent reduction in productivity has been observed following recovery from acute FMD infection.

- Prevention and Control

A cell culture-origin vaccine is available, but must be matched to both the type and subtype of virus involved in the affected region. Vaccinated animals develop protection against clinical signs of FMD within seven to eight days. In the face of an outbreak, the use of interferon is being researched to bridge the gap in protection before vaccination is effective. Vaccination can be instituted to create a barrier of protected animals between infected and susceptible animals. Vaccination complicates diagnosis of FMD (although tests are being developed that differentiate vaccinated from infected animals), and may increase the risk of subclinical infection and subsequent outbreak but the level of risk is unknown. Rarely, vaccination may result in an outbreak if the vaccines are not properly manufactured. Prohibition of importation of live ruminants and swine and their products from FMD-affected countries is paramount to preventing outbreaks. Travelers returning from FMD-affected countries are advised to avoid contact with livestock, zoo animals, or wildlife for a minimum of five days

V. CONCLUSIONS

If A survey on the standardized points around service model for of risk mitigation on livestock pandemic based on networks is given in this paper. The standardization work for risk mitigation on livestock pandemic based on networks is just at the beginning stage in ITU-T meetings. More studies on each point are required to finish the works including amendments and enhancements such as service requirements and service scenarios need to be explored for this standardization. These standardization activities are expected to contribute to the global usages of risk mitigation on livestock pandemic situation.

These features enable service providers to provide information about various risk mitigation services needs from service users and provide advice on livestock pandemic situation such as risk mitigation monitoring, risk mitigation action, and all of information in response to requests for services from service users. More interests are expected to attain the successful results that ultimately contribute to innovate in lifestyle.

This service model is required to derive necessary service features that support these missions. Therefore, it is proposed in this paper for the future standardization.

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