Chapter 7

Case study in livestock disease management: Korea

This case study begins with a contextual overview of the livestock sector and animal health situation in Korea, and then focuses on the following aspects: government awareness of producer behaviour in livestock disease management; information, education and training for producers; and producer compensation policy in Chile. The final section presents the conclusions and policy recommendations.

7.1. Overview of the livestock sector and animal health situation

Structural characteristics and economic importance of livestock production

Korea is a land-scarce country with the highest population density and the lowest availability of arable land per capita among OECD countries (0.029 hectare in 2013) (World Bank, 2016). The rapid industrialisation and urbanisation of the past decades has increased incomes (the GDP per capita has almost trebled since the mid-1990s) and shifted food consumption pattern towards livestock products. Domestic demand drew growth of domestic livestock production whose share in total agricultural output rose from only 23% in 1995 to 42 % in 2014 (OECD, 2016a), but Korea remains a net importer of livestock products, particularly beef and dairy. In 2014, domestic production covered 48% of national beef consumption, 55% of dairy products, 75% of pig meat, and 79% of chicken meat (MAFRA, 2016a). Domestic production is dependent on imported animal feed, with feed maize constituting country's top agricultural import (FAO, 2016).

Land scarcity is a significant factor leading to the overall small-scale farm structure in Korea. In 2015, a total of 1 089 thousand agricultural holdings operated in Korea (KOSTAT, 2016a) with the average farm size of only 1.5 hectares, although this represents an increase by almost 64% since 1975 (MAFRA, 2016a). Over 68% of farms have less than 1 hectare and only 8% have more than 3 hectares (KOSTAT, 2016a).

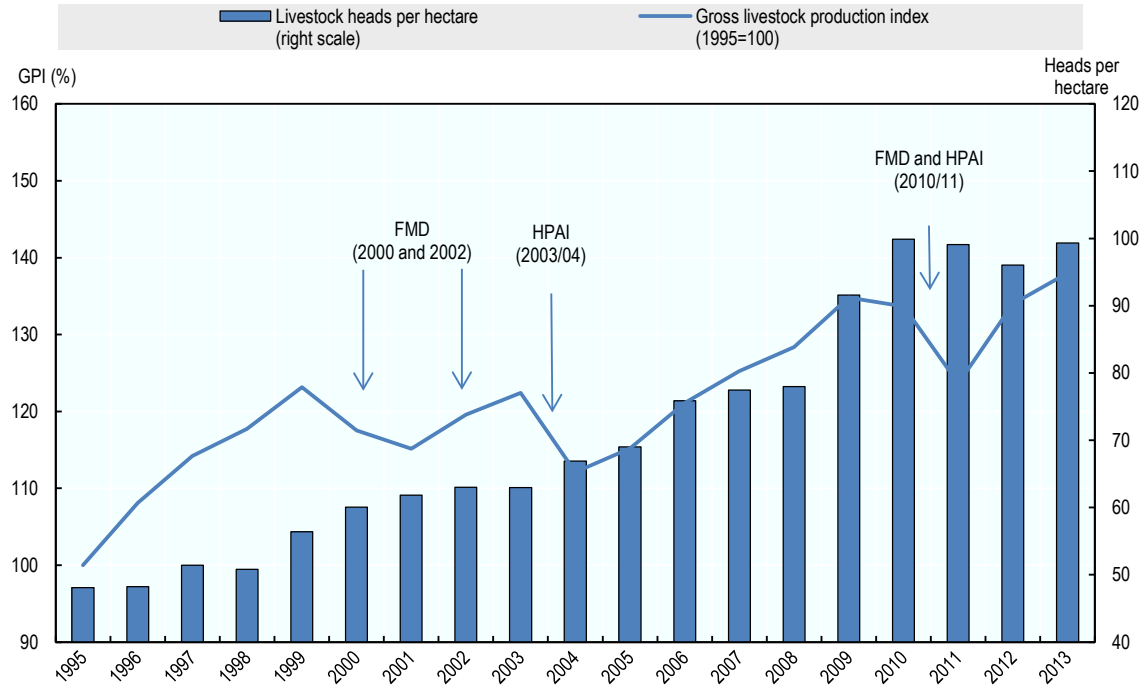
Cattle, pigs and chickens are the principal animals, with sheep representing insignificant numbers. A relatively small proportion of farm households are engaged in livestock production. Among more than one million farm households only somewhat over 53 000 keep livestock. Beef cattle are found on 7% of farms, 0.4% of farms keep dairy cattle, 0.4% pigs, and 3% chickens (KOSTAT, 2016a). Establishments with livestock derive on average 88% of their gross farm receipts from livestock activity (KOSTAT, 2016b), but many of them rely also on off-farm earnings. In 2015, the share of farm households with off-farm earnings was on average 43% across different livestock specialisations, with the lowest one (29%) observed in pig farming (KOSTAT, 2016c).

With limited land the growth in livestock output has been supported by strong increases in stocking densities (Figure 7.1). Between 1995 and 2015 beef cattle per holding increased from 5 to 30 heads, pigs from 136 to 1 679, and chickens from 928 to 5 369 (KOSTAT, 2016a). The livestock farm structure has also changed since 1995, with a shift of production towards larger farm sizes (Annex 7.A1). This process went particularly fast in the poultry sector which has become the most concentrated livestock sector and has also seen rapid development of vertical integration. In 2015, over 90% of meat chickens and meat ducks were raised within vertically integrated operations (Korean Government, 2016). Despite this apparent structural change, relatively small operations dominate in numbers across all types of livestock activities and in the beef, dairy and poultry sectors they also retain significant production shares (Figure 7.2).

Due to economic development and rural-urban migration which drew mainly on younger people, agriculture has experienced significant ageing and labour shortages (OECD, 2008). Somewhat less than three-quarters of livestock farmers in Korea are above 55 years of age, among whom those over 65 years constitute a large part (Figure 7.3). The aged structure of agricultural labour is not only the result of outflow of younger generations from rural areas. For the older-age rural population agricultural activity is also a form of a social safety net as they are not sufficiently covered by the existing pension systems. Many aged in rural areas stay economically active which contributes to the continuation of the small farming system in Korea (Annex 7.A2).

The structural characteristics discussed above indicate that farmers engaged in livestock production constitute a small part of Korean agriculture. These farmers are predominantly small-scale and in high age brackets and for many being active in agriculture is a way of social security. While livestock farmers derive most of their agricultural receipts from livestock, many of them also rely on off-farm earnings.

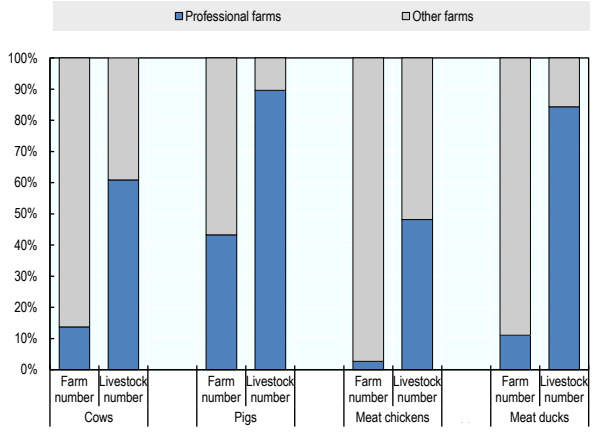
Figure 7.1. Changes in total livestock output and livestock densities in Korea between 1995 and 2013



FMD – foot-and-mouth disease, HPAI – highly pathogenic avian influenza;
Note: The values of livestock densities are based on the total number for the main species (cattle, pigs, sheep, goats and poultry) divided by agricultural area.

Source: FAO (2016).

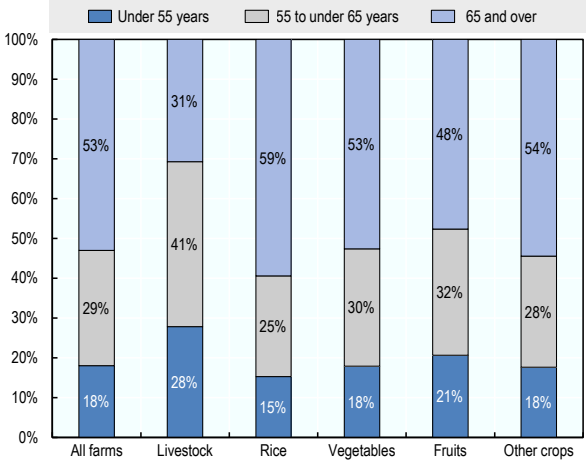
Figure 7.2. Distribution of farm numbers and livestock inventories between large and small farming segments in Korea, August 2016



Note: The benchmark separating large and small farms is: 50 cows, 1 000 pigs, 30 000 meat chickens, and 10 000 meat ducks. The establishments with livestock above these numbers are classified as large ("professional") farms, and those below are classified as small farms.

Source: MAFRA (2016b).

Figure 7.3. Age structure of livestock farmers in Korea, 2015



Source: KOSTAT (2016a).

Overall situation related to livestock and animal disease risk

Since the mid-2000s, Korea has experienced serious reoccurrences of highly infectious diseases, such as avian influenza, foot-and-mouth disease, brucellosis, bovine tuberculosis and classical swine fever (Table 7.1). Highly pathogenic avian influenza (HPAI) has been stubborn, with states of clinical disease notified to the OIE in 2003, 2006, 2008, 2010, and 2014. New HPAI occurrences were notified also in 2015, with 11 million birds destroyed. Low pathogenic avian influenza in sub-clinical form was detected every year between 2007 and 2010, and most recently, in 2015 and 2016. Korea had been FMD-free since the 1934 epidemic, but suffered an outbreak in 2000 (Yoon et al., 2012). This disease causes considerable financial damage. For example, in 2010-11, 153 outbreaks during 145 days prompted the destruction of 3.3 million pigs and 150 000 cattle. The estimated impact on the national budget was KRW 2.7 trillion (USD 2.5 billion), which included the cost of compensation for destroyed animals, cost of vaccination and disease control measures. This unprecedented epidemic led the government to adopt in 2011 a policy of nationwide vaccination for all cloven-hoofed animals. Still, the FMD re-occurred every year since 2014, with the most recent outbreak in early 2017.

Table 7.1. The number of major recent infectious disease outbreaks in Korea

Disease	2010	2011	2012	2013	2014
FMD	17	153 (2010-11)	-	-	188 (2014-15)
HPAI	-	53 (2010-11)	-	-	391 (2014-15)
Brucellosis	-	490	273	118	84
Bovine tuberculosis	-	257	290	321	438

Source: Adapted from Oh (2015).

Concerning diseases not subject to OIE notification and taking the most recent period only, Korea suffered large outbreaks of seven diseases in 2015 and eight in the first half of 2016. This concerns diseases such as porcine epidemic diarrhoea (PED) and chronic wasting disease (CWD). According to the Korean government, although disease occurrence has been on the decline since 2014, the subsequent deaths of piglets caused serious damage to farms. Easing of movement restrictions, the provision of livestock insurance, and other means are being applied to induce owners to voluntarily report disease. CWD broke out for the first time in six years since 2010 and requires special attention in terms of control and prevention as the data is not sufficient to prove the possibility of the disease transmitting from animals to humans. The Animal and Plant Quarantine Agency (Foreign Animal Disease Division) is in charge of monitoring the disease via research projects (Korean Government, 2016).

The reoccurrence of FMD and HPAI in 2010 have led the government to overhaul the national livestock disease prevention and control system with the focus on changing it from a reactive to pre-emptive system. A long-term goal has been set to become a disease free country. According to the Korean government, this involves strengthening of disease surveillance, improved disease outbreak control and post-outbreak management, and making farmers more responsible and autonomous. Annex 7.A3 exemplifies the changes foreseen in the system in application to prevention and control of FMD. The major "Livestock Industry Act" and "Act on Prevention of Contagious Animal Diseases" were also amended to strengthen animal disease regulation; these acts introduced a range of underlying measures discussed below.

Key institutions involved in livestock disease issues

The Ministry of Agriculture, Food, and Rural Affairs (MAFRA) is responsible for the delivery of animal health services on behalf of the Korean Government with the mandate for legislative initiative (Annex 7.A4). The Central Animal Disease Control Council is a non-permanent body deliberating on major policies related to animal disease control.

The Animal and Plant Quarantine Agency (QIA) is an executive veterinary agency implementing disease control policies and has the responsibility of veterinary research. Livestock Health Control Association (LHCA) is a public veterinary institution, performing duties of clinical examination, testing, sanitary inspections of livestock products, disinfection, and education and public relations for the prevention of livestock diseases. Central Animal Disease Surveillance Council operates as QIA's consultative platform.

Each provincial government has a veterinary service responsible for the control and eradication of diseases within the province. These veterinary services include veterinary laboratories, which carry out veterinary diagnosis, surveillance activities, and inspections of livestock products.

Livestock producer associations – the National Agricultural Cooperatives Federation (NACF), the Korean Swine Association, the Korean Poultry Association and the Korean Cattle Association – have established Joint Disease Control Units in each region, which conduct autonomous disease control activities, such as cleansing and disinfection.

7.2. Government's activity to increase awareness about farmer behaviour

Private operators are the ultimate decision makers of farm enterprises. Evidence about farmer behaviour and their response to policy is thus a necessary input into policy making, including in the area of animal disease.

Availability of information about farmers undertaking livestock activity

As a starting point, governments require sufficient information about the number, structural and social characteristics of the farming community they engage with. This information should have adequate national coverage and consistency.

Statistics Korea (KOSTAT) is the central institution producing the body of national statistics. Every five years KOSTAT conducts the Census of Agriculture, Forestry and Fisheries. It generates information on the number of farm households by type of agricultural activity, age and educational attainments of managers. It also observes the farms in terms of the value of agricultural sales, the size of livestock herds, and areas planted and harvested to different crops. Quarterly Livestock Statistics Surveys use the populations of the Agricultural Census for a more frequent monitoring of "livestock farms", defined as households which derive the largest part of agricultural receipts from livestock production. These Surveys report the number of such holdings and animals by species, and socio-economic characteristics of farms, such as gender and age of farm operators, amount of sales per holding, or farm size. The extent to which this information is used for livestock policy development requires further investigation.

There is an obvious lack of information about the households with agricultural activity but which do not fall under the official definition of agricultural holding and thus are not statistically observed. In Korea, this includes establishments with less than 0.1 hectares of land or with sales of agricultural products per year or the value of agricultural animals below KRW 1.2 million (USD 1 090). These establishments also represent certain biosecurity risks.

The re-occurrence of FMD in 2000 exposed the insufficiencies of information about the number of holdings keeping animals, their location and the numbers of animals in holdings. This prompted the government to introduce in 2003 a mandatory registration system. The establishments with cattle, swine and poultry with inventories above a certain threshold were obliged to register with local administrations and report the number of animals, the existing livestock facilities and equipment. Along with livestock farmers, livestock traders and owners or drivers of vehicles for transportation of livestock are also subject to the mandatory registration. The owners of livestock vehicles should also install a GPS device that wirelessly recognises the vehicle. The regulation has been further strengthened after the epidemics of FMD and avian influenza in 2010-11. In 2013, obligatory sanitary standards and location criteria for livestock establishments were introduced. These apply to larger farms which should receive approval by local authorities based on compliance with these standards (Annex 7.A5). Failure to comply with facility approval requirement entails a

penalty of KRW 30 million (USD 27 000) and may be punished by imprisonment, while a failure to comply with the registration requirement leads to a penalty of KRW 5 million (USD 4 400).

The information from the mandatory registration and approval system is aggregated into the Korean Animal Health Integrated System (KAHIS), which is used to support disease prevention, biosecurity and control activities. For example, the creation of the KAHIS has substantially facilitated the epidemiologic investigations by enabling the analysis of big data as opposed to previous reliance on interviews.

Funded research into farmer behaviour

A preliminary examination indicates that economic research into animal disease in Korea focussed on issues of livestock insurance, in particular, the aspects of adverse selection and moral hazard (Jeong and Huh, 1998; Kim et al., 2008a). Other studies measured the economic impacts of livestock diseases and estimated direct economic losses and the associated welfare losses (Huh et al., 2001; Jung et al., 2001; Choi et al., 2002; Song et al., 2006; Woo et al., 2008; and Jeong et al., 2011). A broader behavioural research into issues of animal disease management, such as farmer risk perceptions, farmer awareness of risks and their potential effects, awareness about specific disease risk management practices, attitudes towards these practices, or attitudes towards specific (compensation) policy measures, seems to be lacking, although a further literature search is required to firmly support this conclusion. Environmentally friendly agriculture (Jung, 2008; Choi et al., 2009; Cho, 2004) and risk attitudes of rice farmers (Kim et al., 2008b) have been the main issues of interest in farmer behavioural research in Korea. Overall, livestock disease thematic seems to remain primarily a veterinary field (Annex 7A6).

Awareness through interaction with industry organisations and veterinarians

Several councils are organised in Korea for the exchange between the government and non-government stakeholders. The interaction through the channels described below is primarily focussed on veterinary and sanitary aspects of livestock epidemics.

The Central Animal Disease Control Council was created in 2002, initially to act as an advisory body to the Minister of Agriculture, Food and Rural Affairs and was also later given the task of preparing proposals for disease control policy (Box 7.1). The Council joins government officials, livestock industry representatives, experts in livestock husbandry, veterinary, medicine and environment. The creation of this body was a step towards increasing traditionally limited involvement of farm industry and other stakeholders in Korea in livestock policy development. The Council is focussed mainly on issues of disease epidemics and is accordingly structured. Five sub-councils are organised on FMD, BSE, bovine diseases, swine diseases, and poultry diseases. They review response measures to epidemics, such as the scope of movement restrictions and depopulation, whether to conduct immunisation in the case of major livestock disease outbreaks, change of vaccines, etc. Beyond the Central Council, councils associated with local governments with similar functions operate at regional level.

The Central Animal Disease Surveillance Council is the advisory platform of the Animal and Plant Quarantine Agency; while the Surveillance Councils for Animal Disease Affected Areas are held by the municipal or provincial animal disease control institutions. These councils consider operational and local issues, such as the establishment of animal disease surveillance plans, collection and analysis of information on disease epidemic, early detection of diseases, development of preventive measures, and animal disease outbreak warnings. They engage various representatives, such as the central and regional biosecurity institutions, the Livestock Health Control Association, the National Agricultural Cooperatives Federation, the Korean Veterinary Medical Association, and producer associations.

According to the Korean government it also holds consultations with veterinarian associations (Korean Pig Veterinary Society, Korean Veterinary Medical Association), veterinary universities and clinical veterinarians as part of the process for determination of disease prevention policies.

Box 7.1. Central and regional Animal Disease Control Councils in Korea

The Central Animal Disease Control Council ("Council") is a non-permanent body which deliberates on major policies that concern animal disease control, as stipulated in the Act on the Prevention of Contagious Animal Disease ("the Act"). In addition to government officials, the Council includes experts in relevant fields, such as the veterinary, livestock husbandry, medicine, and environment. The functions of the Council include:

- Formulation and implementation of measures for the management of contagious animal diseases.
- Investigation and research concerning contagious animal diseases.
- Establishment and implementation of emergency control measures for each contagious animal disease.
- Co-operation with related agencies for animal disease control.
- Formulation of quarantine measures for animals exported or imported and the products thereof and the improvement in the quarantine system.
- Other matters deemed necessary for the management and control of contagious animal disease and referred to the Council by the Minister of MAFRA or the chairperson of the Council.

The Council is currently composed of 73 members: 8 representing the government, 21 academia, 13 the livestock associations, and 31 the private sector, including veterinarians and consumer groups. Academia members represent the following fields: 14 veterinary professors, 4 medical professors and 3 are professors of economics, or agricultural economics. Members from the private sector are mostly veterinary clinicians and some are experts in law and environment, or represent consumer groups.

Source: Korean Government (2016).

7.3. Communication, information and training for farmers

Information and education influence all aspects of farmers' decision making. Appropriate communication and information about disease existence, identification, consequences, costs and benefits of control and prevention programmes, responsibilities and policies, enables farmers to make well-informed decisions and ensure the diseases are managed effectively.

Communication and information

MAFRA and the Animal Plant and Quarantine Agency (QIA) have a legal duty to notify disease outbreaks and disseminate information on the status of notifiable disease outbreaks. Information about 11 diseases, such as the date of outbreak, the kind of disease and affected farms, and the type and number of affected livestock is available in real time on the websites of the MAFRA, local governments and QIA. MAFRA maintains a website dedicated to FMD and AI. The government also collects monthly data on FMD status of pig farms according to the FMD serum surveillance plan. MAFRA and QIA are also tasked to provide detailed information about the occurrence of contagious animal disease abroad. Biosecurity information may also be disseminated through livestock industry newspapers and magazines. For direct communication, which is particularly important for small farms and aged persons in rural areas, a call centre with 188 service providers is operated by the Livestock Health Control Association, a public institution for disease prevention.[1]

Besides the information on disease outbreaks, the information on livestock disease control measures is shared with farmers and livestock stakeholders. They can obtain it directly from the websites of veterinary authorities or local governments. The government develops annual livestock health and disease control plans and manuals and provides this information to relevant public officials and people in the livestock industry. Occasionally, the government produces leaflets and producer organisations deliver to farmers and the industry. Beyond that, producer organisations publish biosecurity information on their home webpages.

There are thus various channels for communication on the epidemiological and sanitary aspects of livestock disease with farmers, directly or through their associations. However, the communication about economic aspects of disease management seems to be lacking. Economic considerations play a very important role in farmers' decisions to adopt certain behaviour. The economic information to support farmers' decisions

should help them understand the cost and benefits of various disease management practices, it should provide information about economic impacts of animal disease on the farm enterprise (on profits and wealth), as well as about broader effects of potential disease outbreaks on the livestock sector as a whole, upstream and downstream industries, consumers and their local communities. Such communication could draw on a body of available research and implies the need for various studies into the economics of farm biosecurity practices and economic impact analysis of FMD and avian influenza. A number of Korean studies (cited above) measured economic impacts of livestock. Research carried out elsewhere but of relevance in the Korean context could also be mobilised to open communication with producers in the economic dimension of disease management.

For the moment, no focused surveys or studies have been undertaken into livestock farmers' information needs, the degree to which they make recourse to external information, most used and trusted sources, and the extent to which they use information from government. Another important aspect is the identification of the most effective channels and the forms of communication. Famers may not consider generic information useful and there is a need to tailor the communication according to farms of different business profiles ("professional" versus "non-professional"), specialisation, and exposure to disease risks. The predominance of "non-professional" and older age groups amongst Korean livestock farmers involves additional specifics, e.g. on-line communication may be less effective and more personalised and varied direct ways of communication may be required. Co-operation with producer associations could facilitate the identification of areas for the improvement of biosecurity communication, as well as implementation and funding of this work.

Education and training

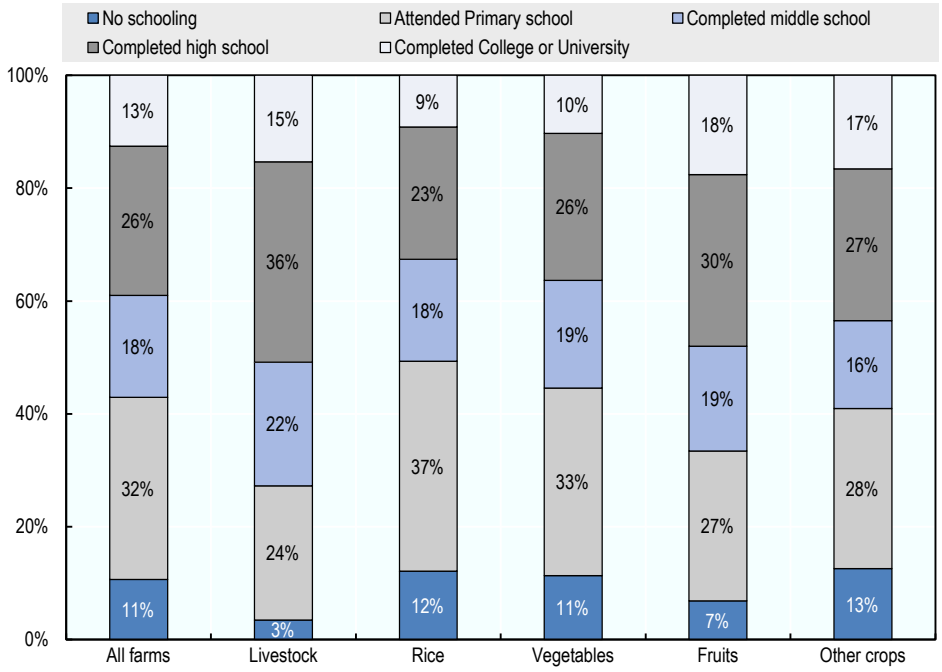
Approximately 15% of livestock farmers in Korea have college or higher education (Figure 7.4). The dominant majority of livestock producers (82%) have only completed either middle or high school, while 3% have received no schooling. These education attainments are rather low, but compare more favourably with those in some crop farming activities (for example, rice and vegetable growing).

Recently, the government has taken an essential step to increase farmer awareness about major infectious diseases, reporting requirements, and preventive measures. In 2013, a mandatory training was introduced for farms (owners and hired farm managers) included in the livestock farming registration system. This mandatory training also covers livestock traders and owners or drivers of vehicles for transportation of livestock (Annex 7.A5).

The training themes include livestock laws and regulations, disease control and management, animal welfare, hazard analysis critical of control points (HACCP), and other optional topics. The programme includes on-site training. Livestock traders and owners or drivers of vehicles for livestock transportation additionally receive the course on livestock vehicle registration system. For the farmers, the amount of training is up-scaled depending on the size of their enterprise: smaller farmers (who only have to register their operations) undergo shorter training, while those with larger operations (who have to register their operations and receive the approval of facilities) take a more extensive training (Table 7.2). Upon completion of the mandatory programme, farmers should take a supplementary training (every two years for larger farms and every four years for small farms). A special site was created in 2015 so that farmers can take the supplementary training on-line (www.farmedu.kr).

The cost of the mandatory training is shared between the government and trainees – farmers, traders, and transporters of livestock. The government covers 70% of the training fees, with trainees contributing the remaining 30%. The government also bears the programme administration expenditures.

Figure 7.4. Education attainments of livestock farmers in comparison with other farmer groups in Korea



Note: livestock farms are the establishments with receipts from livestock products comprising the largest share of total agricultural receipts.

Source: KOSTAT (2016a).

Table 7.2. Mandatory training programme in animal disease prevention and control in Korea

		Mandatory training	Supplementary training
Livestock farmers	Large farms (subject to registration operations and approval of facilities)	24 hours	6 hours every 2 years
	Small farms (subject to registration of operations only)	6 hours	6 hours every 4 years
Livestock traders		- "-	4 hours every 4 years
Owners or drivers of vehicles for transportation of livestock		- "-	- " -

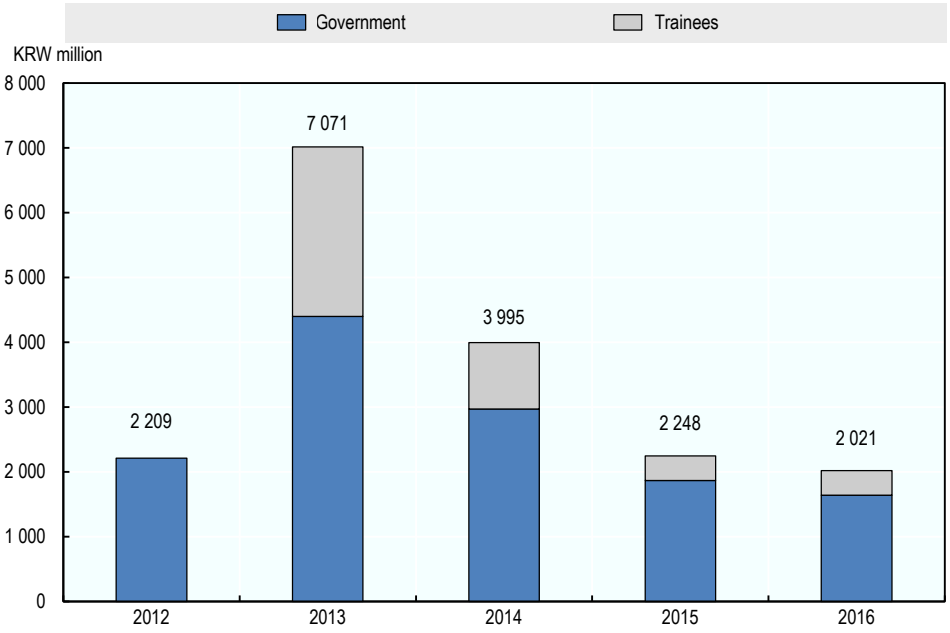
Source: Korean Government (2016).

Mandatory training does not concern livestock keepers who are not required to register (i.e. keepers with very small livestock numbers), poultry keepers with production facilities below the minimum size threshold (10 m^2) and also the owners of animals that are not susceptible to FMD or avian influenza. The exemption of the smallest animal keepers is driven by obviously high administration costs to engage with this group. The inclusion in the mandatory training of these micro-farmers would also involve an additional high financial burden for the government, while the willingness of these producers to voluntarily contribute to the cost of training is not clear. The exemption of the smallest livestock keepers from the obligatory training is thus an expected choice. This, however, leaves considerable risk given the assumingly large numbers of such livestock holders and the frequent re-occurrence of serious disease in recent years, such as avian influenza. It may be warranted considering alternative ways to involve this group in biosecurity training by exploring the potential for local action with engagement of local communities.

Beyond the mandatory training the government funds several voluntary training programmes. One is targeted to farms that keep cloven-hoofed livestock and thus represent a potential FMD risk. Two courses are

available within this programme: a Group Training Programme on Prevention and Control Measures for Contract-Based Pig Farm Managers (about three hours) and a Tour Training Programme by region for Artiodactyla Farms (about one hour). Another voluntary training programme is aimed at prevention and control of avian influenza, and also includes several courses: "On-site Training for HPAI-affected Farms or Poultry Farms in AI-concentration Regions" and "Training for Poorly Performing Farms" based on the review and assessment results of prevention and control status of poultry operations.

Figure 7.5. Public spending on training in disease prevention and control in Korea, 2012-16



Note: the spending amounts include mandatory training only and cover all beneficiary groups, i.e. farmers, livestock traders and transporters.

Source: Korean Government (2016).

The government began the funded training programmes in 2012. The amount of spending more than tripled in 2013 with the introduction of the mandatory programme, but has been diminishing since then, reflecting the passing of the phasing-in peak (Figure 7.5). The total government spending amounted to KRW 2.6 billion (USD 2.3 million) per year in 2012-16, and varied during this period between 4% and 17% of total allocations for agricultural education and extension (as they are estimated in the OECD agricultural support database for Korea – OECD, 2016a).

The training programmes include pre-set topics. Farmer and industry opinions about their training needs have not yet been collected. Farmer and trainers' opinions about the training provided and the effectiveness of government spending have not been yet evaluated.

7.4. Current experience with farmer compensation policy

Compensation is the principal economic instrument of livestock policy with a direct impact on producer incentives and actions to manage disease risk. Compensation is understood in this case study to be any payment or reimbursement provided to farmers within the framework of disease control and prevention programmes. This includes: (i) indemnity for direct disease losses, such as dead or destroyed animals; (ii) compensation for consequential losses, such as those from business interruption; and (iii) payments for farmer *ex ante* actions, such as subsidising biosecurity investments and operations. This part examines the degree to which Korea's compensation policy stimulates or discourages producers to make adequate efforts to prevent disease and report it in a timely fashion when it occurs.

Disaster assistance for nationally notifiable diseases

Compensation policy related to infectious livestock diseases is part of the national livestock disease prevention and control policy. A range of assistance is currently in place to compensate for direct and consequential losses of livestock producers (Table 7.3). There is an explicit delineation between disaster assistance and insurable risk in Korea which is based on the categorisation of diseases into nationally notifiable and those that are not included in this list. Sixty-five livestock diseases are listed as the national notifiable infectious diseases under the "Act on Prevention of Contagious Animal Diseases". These diseases are further classified into three categories according to the degree of contagiousness and the scale of potential socio-economic losses. For each class, a specific set of outbreak control measures is established, which effectively determines the scope of potential compensation in each disease case (Annex 7.A7).

Table 7.3. Korea's support measures related to livestock epidemics

		National notifiable diseases					Non-notifiable diseases: Insurance
		Livestock compensation scheme	Livelihoods Stabilisation Assistance	Income Stabilisation Fund	Operations Stabilisation Fund	Fund for Stabilisation of Agro-industry	
Coverage		14 diseases in Class 1 and Class 2[1]	FMD, HPAI, CSF, ASF, CBPP, Rinderpest	FMD, HPAI	FMD, HPAI	FMD, HPAI	16 types of livestock
Financing arrangements		Costs shared between central and local governments			Financed by central government		Insurance premium co-financed by central and local governments
		80% - central government; 20% - local governments	70% - central government, 30% - local governments	70% - central government, 30% - local governments	Concessional loans	Concessional loans	
Direct losses	Culled animals	X	-	-	-	-	X
	Lost product	-	-	-	-	-	-
	Lost property	X	-	-	-	-	X
	Movement restrictions	-	-	X[2]	-	-	-
Consequential losses	Re-stocking	-	-	-	X[3]	-	-
	Partial loss of animal value	-	-	-	-	-	-
	Business interruption	-	-	-	-	X[5]	X
Household income support		-	X[4]	-	-	-	-

FMD: foot-and-mouth disease; HPAI: highly pathogenic avian influenza; CSF: classical swine fever; ASF: African swine fever; CBPP: contagious bovine pleuropneumonia.

1. Class 1: FMD, HPAI, CSF, ASF, rinderpest, CBPP; Class 2: brucellosis, tuberculosis, bovine spongiform encephalopathy, swine Aujeszky's disease, *swine influenza,* scrapie, rabies, and mule deer chronic wasting disease.
2. Losses from movement restrictions include losses from delays in livestock shipping and stocking or advanced shipping.
3. Reduced-interest loans to producers for the re-stocking following outbreaks.
4. Assistance is provided to the owners of animals slaughtered by stamping-out order.
5. Assistance is provided to agribusinesses such as hatcheries, slaughterhouses or feed companies.

Source: Korean Government (2016).

In the event of notifiable disease outbreaks, central and local governments provide various types of support to producers, and in certain cases also, to upstream and downstream businesses. This support concerns both direct losses resulting from outbreak control measures, as well as consequential losses.

The livestock compensation scheme operates for livestock keepers whose animals were ordered for destruction (Annex 7.A7). This support is provided for diseases in Class 1 and Class 2 for which culling is

part of the outbreak response measures. Only 14 diseases are distinguished in these two classes that command compensation. The base indemnity rate corresponds to the market price of animals on the day it is stamped out. However, the effective indemnity rate is flexible due to the possibility of varied discounts to the base rate depending on the risk status of farm, type of disease, and compliance with prevention and outbreak control requirements (Table 7.4).

The condemned animals, whether healthy or sick, command a 100% indemnity. However, for those tested positively for FMD, AI, swine fever or brucellosis, the indemnity is discounted by 20% of the market price. This discount is meant to incentivise livestock farmers to prevent these diseases in particular. A further incentive for prevention of disease is included in the differentiation of indemnity depending on a farm's disease history: those with recurrent outbreaks in the past two years will incur a 20% and up to 80% reduction depending on the number of outbreaks. A reduction in indemnity rates is also foreseen in the event of violation of rules for preventive vaccination or failure to comply with disease outbreak control orders. Another set of discounts is intended to incentivise the early reporting of disease – delays in reporting result in reductions of indemnity rate by 20% to 40%. In the case of a failure to report the indemnity is reduced by 60%. Early reporting is also stimulated by the provision of no indemnity for dead animals. Finally, since 2015, there is a system of rewards to third parties who report the presence of suspected animals on other farms, or report other farmers violating orders on preventive measures.

Table 7.4. Compensation discounts for destroyed livestock

Discount criteria		Reduction to the base compensation rate, %
Infection with FMD, AI, swine fever, and brucellosis		20%
Unregistered, unauthorised farms		10%
Non-compliance with the recommended stocking densities of livestock		No compensation for the livestock in excess of the recommended number
Failure by contractor to ensure training in farms raising animals under contracts		5%
Risk profile of farm	2 outbreaks within 2 years	20%
	3 outbreaks within 2 years	50%
	4 outbreaks within 2 years	80%
Disease reporting	Delay in reporting from 1 to 4 days	20%
	Delay in reporting of 5 days and over	40%
	Failure to report	60%
	Early reporting (on the day of outbreak or before the appearance of symptoms)	A decrease of rates by 10% of other penalties if they apply
Prevention during "peace time"	Failure to comply with orders such as inspection, administration of medicine or injection	5%
	Failure to vaccinate for FMD	40%
	Rejection, interruption, evasion of epidemiological study	5%
Compliance with control measures	Failure to disinfect	5%
	Failure to comply with movement restrictions	5%
	Violation of temporary movement restrictions	5%
	Failure to carry out culling	5%
	Failure to carry out orders, such as burial or disinfection	5%
	Failure to carry out orders, such as movement restrictions of infected object, restriction of washing	5%

Source: MAFRA (2016d).

This current scheme has been applied since December 2015 and replaced the previous mechanism which was considered ineffective following the outbreaks of FMD and HPAI in 2014. More time is required to observe and evaluate the performance of this new scheme. However, several tentative comments about the incentive structure of the current scheme can be made.

The scheme uses around 20 different criteria that can trigger a reduction in indemnity. Farmers thus face a long list of potential penalties and may be induced to trade across different infringements. Second, a

question can be raised on whether a 5% indemnity discount for the failure to comply with outbreak control or surveillance orders acts as a sufficient disincentive to such serious infringements. Third, the system with multiple penalties related to different aspects of producer behaviour may be too complex to administer. The establishment of the presence (or absence) of specific infringements takes time and may delay the payment of compensation putting farmers at a disadvantage. Alternatively, if the compliance of all the beneficiaries with all the requirements is not appropriately verified, there is a risk of unequal treatment and moral hazard. Finally, some of the penalties – compliance with registration and with livestock density regulations – are not related to particular emergency event. Although it may be operationally easier to identify and penalise the violators using the circumstance of indemnification, these infringements would be more adequately addressed through strengthening the general system of regulatory control and enforcement.

As highlighted above, the Korean livestock compensation scheme incorporates mechanisms to induce early disclosure of disease. First, farmers do not receive compensation for dead animals. Second, several brackets – "1 to 4 days", "5 days and over" and "failure to report" – are applied to upscale the penalties for late reporting. However, the use of multiple brackets may encourage a wait-and-see attitude among farmers. In particular, because a failure to report under the current scheme does not eliminate the eligibility for indemnity – other things constant, farmers would still recover from 20% of the market value of lost animals in the case of FMD, AI, swine fever and brucellosis, to 40% in all other cases. A single term for reporting disease and a denial of indemnity if it is not reported may be more effective to incentivise early disclosure. A more stringent reporting rule though requires a good level of farmer awareness about clinical signs of disease – a task which is currently being effectively addressed through the mandatory training.

Another aspect is that compensation provisions in the case of a failure to report seem to be considerably misaligned with other regulations. As already mentioned, a non-reporting farmer would be able to partly recover the cost of destroyed animals, but at the same time the "Act on Prevention of Contagious Animal Diseases" stipulates that any owner of livestock or any veterinarian who violates the obligation to report suspicious animals shall be punished by imprisonment for up to three years or incur a fine up to KRW 30 million (USD 27 000).[2] A similar misalignment concerns the non-compliance of farmers with the registration requirement: in the compensation scheme this infringement results in a 10% reduction of indemnity only, but other regulations subject it to the same criminal and financial penalty as in the case of the failure to report.

The compensation policy in Korea extends beyond losses from the compulsory culling of animals. In certain cases, consequential losses from disease outbreaks are compensated. Consequential losses can result from business interruption (e.g. buildings must be dedicated to stamping-out efforts); movement restrictions, i.e. animals cannot be moved from the property – sometimes in these cases a "welfare" slaughter is carried out; re-stocking costs; partial loss of animal value due to vaccination; or general price declines (OECD, 2012).

Several types of assistance related to consequential losses have been provided on the basis of *ad hoc* government decisions related to FMD and HPAI outbreaks:

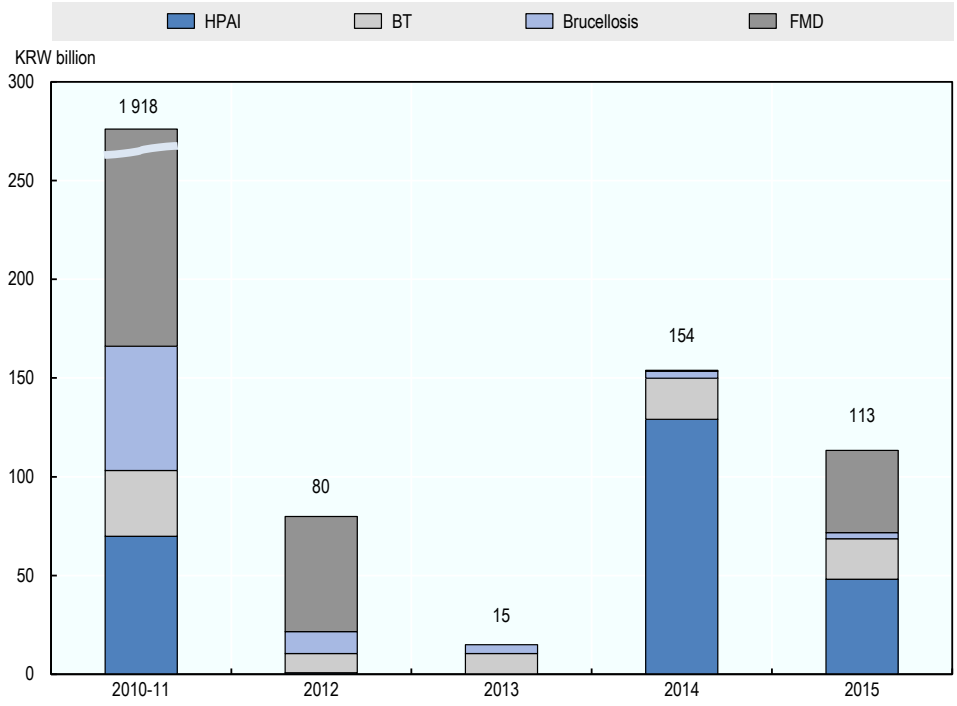
- Income Stabilisation Fund compensated farms subjected to livestock movement restrictions for losses from shipping delay or restocking delay that lead to a fall in animal market value, or additional rearing cost.
- Operations Stabilisation Fund provided loans for restocking of farms where animal culling was implemented.
- Stabilisation Fund for Agro-Industry provides business interruption assistance to downstream operators, such as slaughterhouses, hatcheries, or feed companies at low interest rates.

Finally, consequential epidemic assistance has an equity argument in Korea: as agriculture is dominated by small farms, their business interruption could threaten the livelihood itself of livestock farmers. The Livelihoods Stabilisation Assistance can be considered as a form of social safety net in the event of several highly contagious diseases epidemics – FMD, AI, CSF, ASF, CBPP, and Rinderpest. It consists of a direct

income transfer to affected households up to the amount of the average national 6-months household expenditures.

The information available since 2010 shows that the government has incurred considerable expenditures to cover losses in livestock epidemics (Figure 7.6 and Annex 7.A9). They reached an exceptional level in 2010-11 when a serious FMD outbreak occurred. The overwhelming part of compensation outlays was spent to offset direct losses of farmers from control measures. The share directed to the consequential loss assistance appears to be relatively small – it reached 2% of total compensation outlays in 2010-11 and 1% both in 2014 and 2015, with no such assistance provided in 2012 and 2013.

Figure 7.6. Loss compensation expenditures related to livestock epidemics in Korea, 2010-15



FMD: foot-and-mouth disease; BT: bovine tuberculosis; HPAI: highly pathogenic avian influenza; CSF: classical swine fever; ASF: African swine fever; CBPP: contagious bovine pleuropneumonia.

Source: Korean Government (2016).

Livestock insurance

Livestock insurance dates to the late 1990s. At the time, livestock cooperatives acted as insurers and offered government-subsidised insurance premiums. Since 2007, the government has sought to attract private companies in this activity so as to increase the quality of service. At present, several private companies – NongHyup, KB and Hanwha – offer livestock insurance and sixteen types of animals are insured.[3] The central and local governments co-finance premiums subsidies at 70-80%. Livestock diseases are among the insurable risks, but only those that are outside the list of nationally notifiable diseases. The cover includes dead animals and animals slaughtered in emergencies, as well as damage to the facilities accommodating diseased livestock and related buildings (peripherals).

The highly concessional terms led to considerable expansion of livestock insurance. Between 2011 and 2015, it increased from 55% to 91% of total livestock numbers (of 16 types covered by insurance). Over the same period, the claims-to-premiums ratio rose from 60% to 98%. The majority of claims concerned animals

lost to disease and emergency slaughter; these claims amounted to 90% of the total value of claims made in 2012 and 86% in 2015.

Other assistance related to animal disease

Farmers receive subsidies for some vaccines, veterinary services, and the modernisation of livestock facilities which covers improved biosecurity. This assistance is largely focussed on prevention of FMD and avian influenza. The amounts allocated for the vaccination have increased from KRW 14 536 million (USD 12 million) in 2005 to KRW 84 801 million (USD 74 million) in 2015. Government covers all vaccination costs except in the case of FMD and circovirus.[4] The aid for veterinary services began in 2008, but has been small in terms of the number of beneficiary farms and spending amounts. The Fund for Support of the Implementation of Free Trade Agreement created in 2004, finances investments in enterprise modernisation to increase competitiveness of farmers and fishermen. The financed projects, among other components, include the overhaul and construction of new facilities to improve sanitary conditions on farms. Central and local governments and individual farmers co-finance these investment projects.

7.5. Conclusions

Korea's rising population and incomes drove domestic demand for livestock products and induced growth in domestic livestock production. Due to scarcity of agricultural land this growth was supported by a substantial increase in livestock densities. The rapid intensification of livestock production has likely played an important role in the reoccurrences of highly infectious diseases in recent periods. In certain years, livestock epidemics brought about considerable disruptions to the industry and a loss of growth.

The government responded with strong measures to address the deteriorated animal disease situation. The regulation has been significantly tightened for livestock operations, with stringent criteria introduced for production facilities, their location and livestock densities. Legal responsibility of farmers for disease reporting was increased with non-compliance leading to large financial penalties and up to criminal responsibility. Another principal step was the introduction of the mandatory training for persons involved in breeding and handling livestock, with the largest part of training costs covered by the government.

The reoccurrences of serious livestock epidemics also necessitated a revision of the previous livestock indemnity scheme, broadening of the scope of financial assistance and of the range of instruments to compensate livestock producers for direct and consequential losses.

The boundaries between different types of assistance are delineated explicitly. This is based on the classification of diseases according to the degree of contagiousness and the scale of potential socio-economic losses. Disaster assistance is provided for the nationally notifiable diseases which require destruction of livestock. The subsidised insurance addresses diseases outside the notifiable disease list. An explicit delineation between the two groups of disease risks creates clear signals to farmers about the scope of potential assistance and ensures no overlap between different types of assistance.

As in many countries, indemnification for destroyed livestock is the main compensation policy in Korea whose principal rationale is to incentivise disclosure of disease. A distinct feature of the current Korean scheme is that it foresees discounts to indemnities to discourage producer misbehaviour. This principle has an obvious logic: unless farmers face some uncompensated losses, it cannot be expected that they will change their behaviour. In this respect, the Korean compensation scheme employs a good principle to align farmer incentives to act in a socially desirable way. This also moves the compensation mechanism away from a one-size-fits-all principle to the one of adapting compensation according to individual (mis)behaviours. Nevertheless, a number of issues related to the penalty structure applied in the current scheme deserve further consideration. Overall, this comes to a possible need of simplifying and tightening the penalties so that farmers receive clearer signals about the desired behaviour and that the administration of the programme is facilitated. Also, the infringements not related to specific livestock epidemics may be more effectively addressed by strengthening control and enforcement of regulation in general, rather than by reducing compensation following the epidemic.

Other types of support related to animal disease – consequential assistance and insurance – require an in-depth analysis beyond the framework of this case study. However, several initial observations can be made. Consequential loss assistance has so far been provided discretionally and only in the cases of large epidemics of FMD and AI. Leaving aside the issue about the rationale for such assistance, a general recommendation from the OECD work on risk management is to move away from *ad hoc* assistance to the extent possible towards more explicit *ex ante* policy frameworks. The purpose here is to reduce uncertainty for both business and government. Such frameworks delimit in advance government and private responsibilities in coping with particular risks, and define criteria that trigger the assistance and its scope. The existence of explicit *ex ante* rules may stimulate businesses to develop their own crisis management strategies with an understanding of the scope and conditions for potential public assistance. *Ex ante* frameworks also allow governments to avoid budgetary decisions under political pressure at the time of crisis and allocate more spending to prevention of livestock epidemics rather than incur high costs to cope with its consequences.

Livestock insurance is a risk management instrument complementing disaster assistance in Korea, and actively promoted by the government in recent years. The effort has been on engaging large private insurers in the provision of this insurance. Substantial premium subsidies are granted to farmers to increase the uptake of insurance with the result that it covers today nearly all insurable agricultural livestock. The claims-to-premium ratio in livestock insurance has substantially increased since 2011, with the majority of claims made in respect of animal disease. This suggests that the longer-term sustainability of this rapidly expanded insurance system warrants an assessment. OECD's conceptual and empirical work on agricultural risk has shown that subsidised insurance encourages excessive risk-taking by farmers, which in the long-run may cause deficits in the insurance system and undermines its financial soundness (OECD, 2011).

Disaster assistance in Korea has so far been fully based on public funding with some parts of it co-financed by central and local governments and others fully covered by the central government. The experts (Jeong et al., 2011) proposed the organisation of biosecurity funds in Korea co-financed by livestock farms, farmers associations, and central and local governments – but this had no further developments. It may be worthwhile considering the possibility of integrating livestock producers into the cost-sharing for livestock epidemics. Several important institutional elements for a cost-sharing approach are already in place in Korea. Livestock producers are institutionalised into the commodity associations, such as the Korea Pork Producers Association and the Korea Beef Cattle Association. The Korean Animal Health Integrated System (KAHIS) contains varied information about livestock keepers and could constitute the basis for the establishment of producer contributions towards the cost-shared system.

The advantages of the public-private cost-sharing were discussed in detail in the synthesis report and the Australia case study. The key advantage of public-private cost-sharing is that it helps to optimise compensation policy by reducing moral hazard and information asymmetries within the "biosecurity contract" between private producers and government. Furthermore, cost-sharing by definition requires an explicit delineation of financial responsibilities between private and public parties, while written protocols and procedures reduce uncertainties for all stakeholders. Producer resistance to the sharing of financial burden of livestock epidemics is very likely, but there are examples of long-standing schemes with high levels of stakeholder acceptance. The country experiences show that the arrangements can vary greatly – from *ex ante* producer fees to *ex post* collections, or combining both; from flat fees to fees differentiated based on specific producer profiles (e.g. farm disease history, livestock inventories); the shared costs may cover different types of losses and involve a different distribution of financial burden between stakeholders. Thus, there is a large room of flexibility in designing cost-sharing arrangements, which allows the adaption to specific country contexts and constraints.

The current livestock disease policy seems to be driven mainly by veterinary and sanitary rationale. Whether the future policy development choice would be to fine-tune the existing instruments or to initiate new cost-sharing approaches, the Korean government should increase its engagement with producers and their organisations. The government needs to obtain better understanding of farmer behaviour if it desires to rely more on farmers' voluntary actions rather than coercion and penalties. The government may consider investing more in farmer surveys, conventional economic research and behavioural research. The scope of issues that could inform future livestock policy in Korea is broad: farmer awareness of biosecurity; how

farmers make decisions about the adoption of certain practices and what the major drivers of these decisions are; how cost and investment profitability considerations affect farmer biosecurity decisions; what the financial constraints of livestock farms are and how these constraints differ across farm sizes; how farmers obtain biosecurity information and which sources they consider trustworthy; how farmers perceive their responsibility in disease management and the extent to which they are willing to act collectively in prevention and control of disease.

Gaining evidence about farmer behaviour is important not only for improving the economic instruments of policy, but also for a sustained change in individual attitudes and enhancement of social drivers towards positive behaviour. One related consideration is that the broad scope of penalties in the current livestock compensation scheme suggests that for good or bad reasons some farmers simply neglect the regulations. The government has recently introduced rewards to third parties for reporting the presence of suspected animals on other farms. This, however, poses a question about the extent to which this measure can be effective with respect to its objective and about the effects it may have in terms of trust and connectedness within the local communities. Both trust and connectedness are parts of social capital which is essential to strengthen social norms. These norms are important drivers of producer behaviour, as well as purely economic factors. Although the establishment of strong social norms for "good" behaviour takes time, it needs to be pursued and there is a role for policy through communication and "naming and shaming". To have broader responses in the Korean farming community where small "non-professional" producers represent a large constituency this communication should engage levers in different dimensions – psychological, social, as well as economic ones.

Finally, the policy problem of animal disease risk management in Korea extends far beyond the issues related to disease management as such. It fundamentally concerns the improvement of the farm structure and human capital employed in the industry. Current structural features of livestock farming in Korea present distinct challenges from the perspective of animal disease management. The rapid intensification of production over the past two decades has substantially increased the risks of occurrence and spread of disease. Although there has been an apparent structural adjustment with a concentration of production in larger units, the sector continues to be dominated by small-scale and often, non-professional, farmers. Substantial farming segments in the livestock sector may be facing constraints to undertake adequate investments in biosecurity and in better production technologies to reduce disease risks. The situation is complicated by the demographic and human capital factors when the dominant majority of producers are people of older age groups with relatively low levels of education. These groups are less likely to plan longer-term enterprise development, including investing in biosecurity.

The improvement of the livestock disease situation in Korea is therefore also a matter of structural policy to facilitate the establishment of enterprise with adequate investment-generating capacity and higher human capital. This is a long-term policy problem including several corollary dimensions. One is that current policy of high support to producers most likely has an effect of limiting structural adjustment. Another dimension is strengthening the social security for older farming generations so that the re-allocation of production factors to other operators is facilitated and occurs without adversely affecting the well-being of those who are compelled to leave agriculture. Finally, there is a challenge to ensure that the consolidation of the livestock farm structure develops sustainably and without negative effects on the environment. All these fundamental policy issues open a large research agenda on the linkages between animal disease and farm structure, social policy and sustainability and require sufficient analytical evidence for development of best policies to tackle animal disease from that perspective.

Notes

1. In 2016, 25 specialists, such as veterinarians and rearing management experts are additionally stationed at the call centre to provide consultation across wide areas including animal diseases. The number of these experts is to be increased to 40 in 2017.

2. For comparison, according to 2015 Census of Agriculture, 50% of livestock farms in Korea that had receipts from sales of livestock products had annual receipts below that amount (KOSTAT, 2016a).

3. Cattle, horses, pigs, eight kinds of poultry (chickens, ducks, pheasants, quails, turkeys, ostriches, goose, and aquarium birds), and five other types of animals (dear, sheep, bees, rabbits and badgers)

4. For FMD vaccination, large farms (with more than 50 heads of cattle and more than 1 000 heads of pigs) cover 50% of the vaccination costs, with the rest shared between the central government (35%) and local government (15%). In the case of circovirus vaccination, farms of all sizes cover 40% of costs, with the central government and local governments covering the rest in equal shares (30%-30%).

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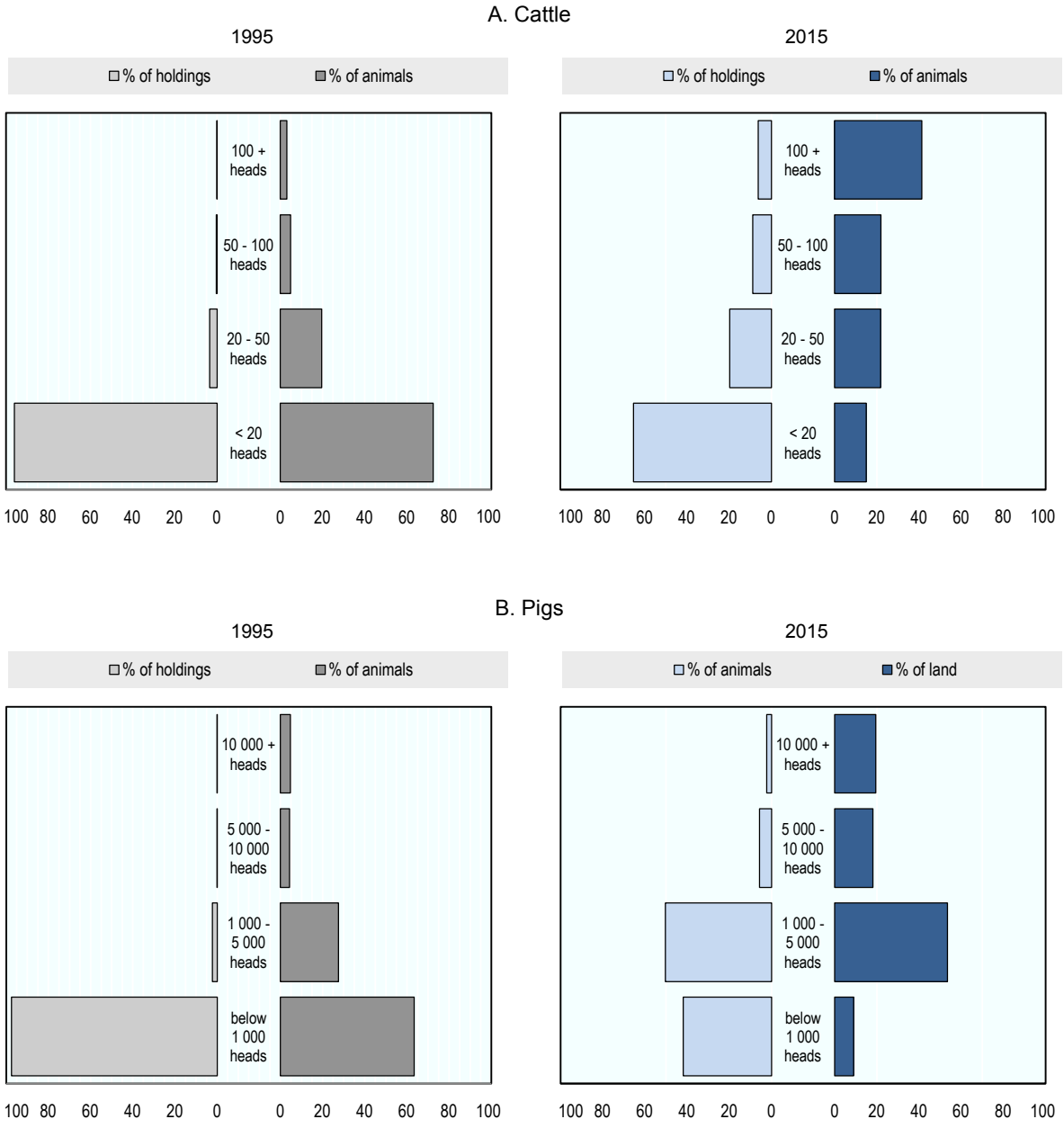
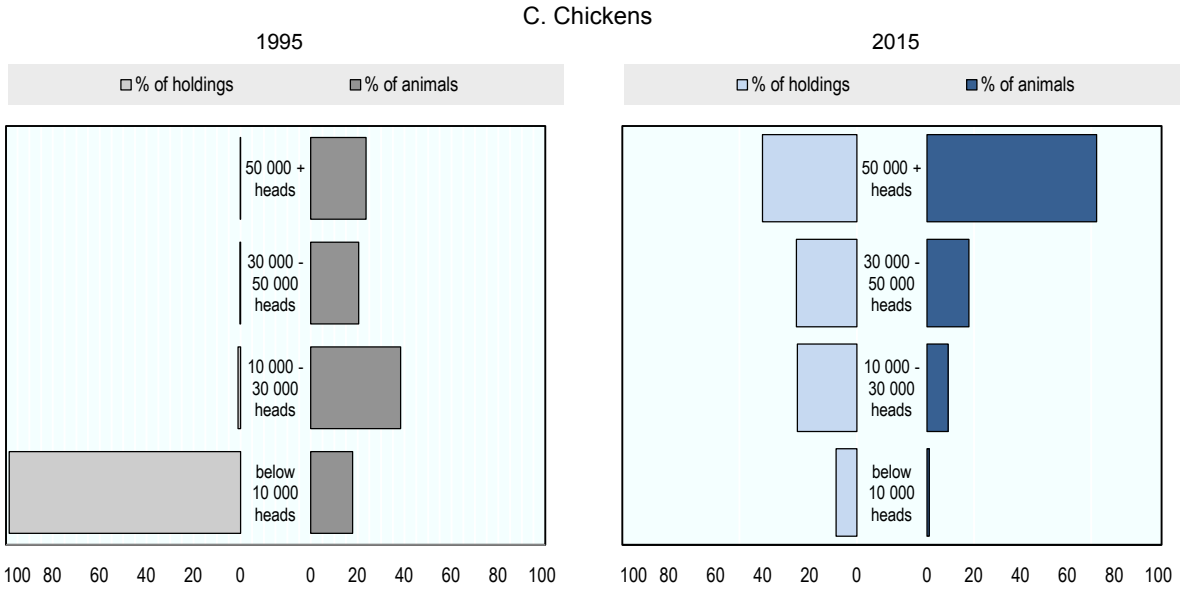
Annex 7.A1

Distribution of farm and animal numbers in Korea by farm herd size, 1995 and 2015





Source: KOSTAT (2016c).

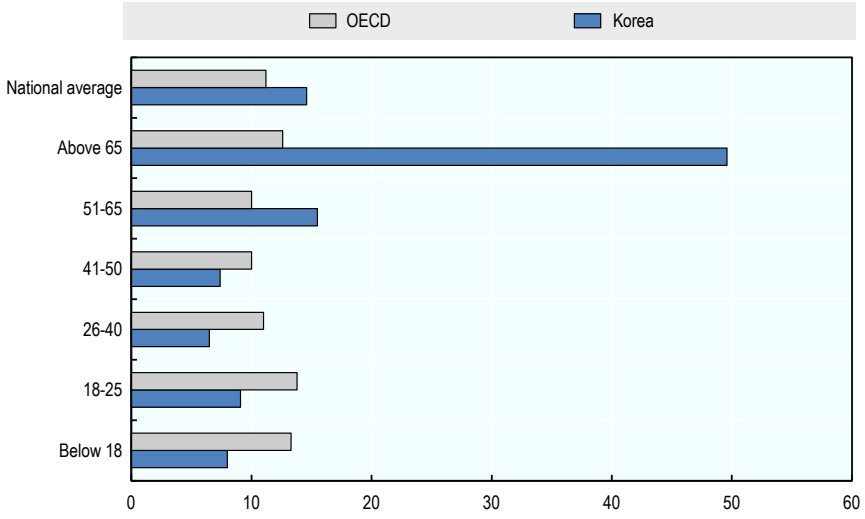
Annex 7.A2

Public pension system in Korea

The relative poverty rate of the over-65 age group of Korea was 49.6% in 2013, which is almost four times higher than the OECD average of 12.6%. Their absolute poverty rate – defined as the share of persons with an income below the minimum cost of living – was 30% in 2014. The high elderly poverty rate reflects both the decline in family support and the weakness of other private and public sources of old-age income support (OECD, 2016b).

Figure 7.A2.1. Relative poverty rates in Korea and OECD average, 2013

Percentage of persons with income below 50% of the national median



Note: relative poverty is measured by reference to median income, not taking into account household assets and liabilities.
Source: OECD (2016c).

The Korean public pension scheme was introduced relatively recently. There are two main pension schemes for the elderly: the National Pension and the Basic Pension. The National Pension Scheme (NPS), covering workers in establishments with ten or more employees, was implemented in 1988. In 1992, the compulsory coverage was expanded to firms with five and more employees. It was expanded further in 1995 to farmers and fishermen (Moon, 2002). The pension age is currently 61 with at least ten years of contributions. From 2014, the poorest 70% of those aged 65 and over can receive the Basic Pension – a non-contributory safety-net for the elderly – that pays a monthly allowance ranging from KRW 100 000 to KRW 200 000 depending on income level.

The NPS provided old-age pension benefits to 32.1% of the elderly in 2015, with pension benefits at 23.5% of the average wage.

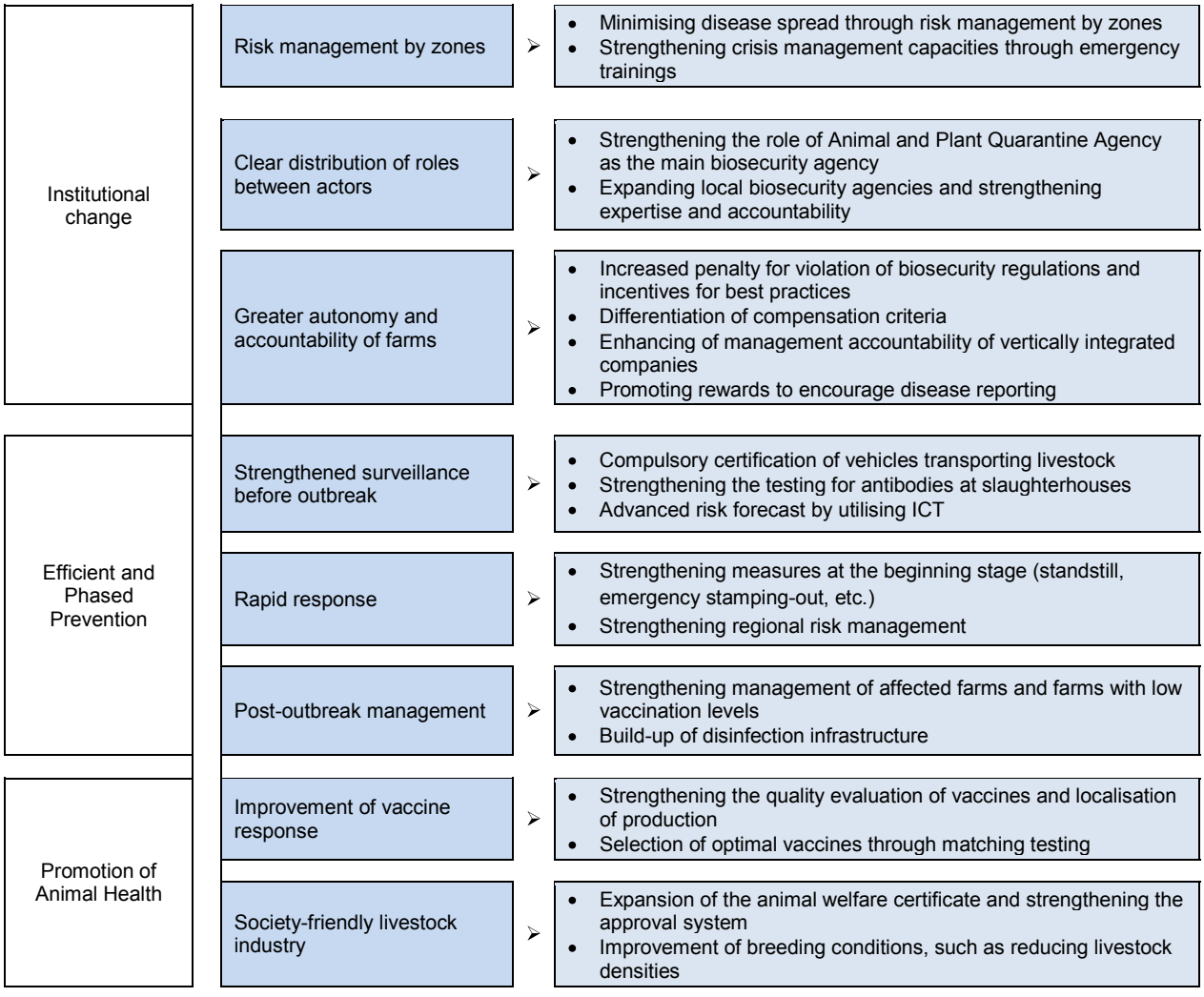
The Basic Pension spreads resources very thinly over a large segment of the older population. The maximum benefit is equal to KRW 200 000 (USD 176) which accounted for 6.2% of the average wage in 2014. Seniors receiving no income or less than KRW 300 000 per month from their National Pension also receive an additional KRW 200 000 per month (OECD, 2015).

Annex 7.A3

New animal disease prevention and control system for FMD in Korea

Changes in the system of FMD prevention and control foresee the transition:

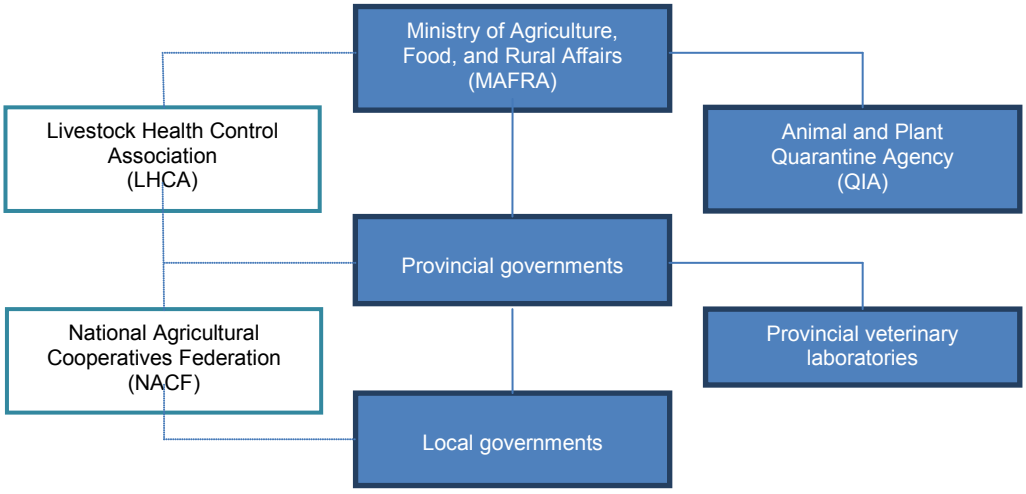
- From reactive to pre-emptive measures (e.g. strengthened surveillance and disinfection).
- From the veterinary-centred to a multidisciplinary approach based on cost-minimisation and utilisation of ICT.
- From measures led by the central government to cooperative activity with shared responsibility of agencies and private farmers.



Source: Korean Government (2016).

Annex 7.A4

Key institutions involved in livestock disease issues in Korea



Institution	Functions
MAFRA	• Planning and coordination of vaccination and surveys for infectious animal diseases • Planning and coordination of production and quality control of veterinary biologicals • Planning and coordination of the quarantine regulations for imported or exported animals and animal products • Supervision on activities of Veterinary Medical Associations and veterinary hospital
QIA	• Prevention and control of the major animal diseases • Surveillance of animal diseases • Operation of animal diseases emergency control centre • Operation of animal diseases Surveillance Committee • Technical support with diagnostic materials providing and standardization of diagnostic methods • Educational & training programme for provincial animal health authorities
Provincial governments	• Implementation of animal disease control measures in the region
Provincial Veterinary Laboratories	• Veterinary diagnostics and disease surveillance within region • Diagnosis and Monitoring detection test of animal diseases
LHCA	• Vaccination, clinical examinations of livestock, and collection of test specimens • Sanitary inspection of livestock products • Disinfection • Education and public relations
Producers	• Livestock producer associations, such as the National Agricultural Co-operatives Federation, the Korean Swine Association, the Korean Poultry Association and the Korean Cattle Association established Joint Disease Control Units in each region, which conduct autonomous disease control activities, such as cleansing and disinfection.

Source: Based QIA (2016) and Ozawa et al. (2003).

Annex 7.A5

Approval and registration of livestock activity in Korea

Eligibility to registration and approval procedures for the establishments keeping livestock

Type of enterprise	Registration of operations required	Approval of production facilities required
Establishments with cattle and pigs:		
Farm facilities with total surface of 50 m^2 and more	Yes	Yes
Farm facilities with total a surface below 50 m^2	Yes	No
Establishments with poultry (chickens and ducks):		
Farm facilities with total surface of 50 m^2 and more	Yes	Yes
Farm facilities with total surface below 50 m^2 and up to 10 m^2	Yes	No
Farm facilities with total a surface of less than 10 m^2	No	No
All establishments with sheep and deer	Yes	No
Establishments with animals not susceptible to FMD or avian influenza (rabbits, dogs and horses)	No	No

Criteria for registration and approval of establishments with livestock: example of poultry farms

Category/ type		Establishments eligible for registration only	Establishments eligible for approval of facilities
Facility/ Equipment requirements	Livestock raising facility	Structure with easy flow of wind and ventilation	- Special livestock raising facility existing - Ventilation n system
	Egg storage facility (laying hens)	None	- Egg storage facility - Insect-, heat-resistance facility, ventilation - Temperature adjustable facility (air conditioner) for eggs
	Sterilisation facility	None	- Disinfection facility for automobile - Gate bar at the entrance - Walk-in disinfectant spray for clothes - Log for automobile and visitors - Disinfectant mat at the entrance of livestock farms
	Disease control	None	- "Authorized personnel only" sign at the entrance - Hedge or fence to control the entrance of visitors, automobiles - Storage for medicines, sterilized equipment and others
Recommended unit area for breeding		- Laying hens (cage·floor): 0.05・0.11 m^2/per hen(*) - Meat poultry (windowless poultry house): chicken: 39 kg/m^2; ducks: 0.246㎡/a duck	
Location requirement		None	Reject approval within 30m from roads and within 500m from slaughter house or feed factory
Training requirement		Initial minimum training: 6 hours Addition training: 6 hours (every 4 years)	Initial minimum training: 24 hours Addition training: 6hours (every 2 years)

(*) For establishments eligible for registration only: 0.042㎡ for laying hens (cage).

Source: Korean Government (2016).

Annex 7.A6

Economic studies related to livestock disease in Korea and other behavioural research

	Livestock disease studies	
1.	Study title	Jeong, M. and Huh, D. (1998) "Analysis of risk attitudes of livestock farmers and moral hazard in livestock insurance", *Journal of Rural Development*, Vol. 21, N 4. pp. 39-50 (in Korean language).
	Summary	Livestock farmers' attitudes to risks of animal loss and moral hazard in the livestock insurance scheme are studied based on a survey data.
2.	Study title	Kim, T., Song, J., Cho, J. and Jeong, K. (2008) "Empirical analysis of adverse selection in livestock insurance", *Korean Journal of Agricultural Economics*, Vol. 49, N 1, pp. 1-19 (in Korean language).
	Summary	Adverse selection that may exist in livestock insurance programmes in Korea is analysed empirically with a pig producer's preference model and survey data. The results indicate that there exists adverse selection in the disease insurance contract. Some approaches to address adverse selection are presented such as introduction of compulsory insurance or differentiated insurance premium reflecting risk levels of individual farms.
3.	Study title	Huh, D., Jeong M., Kwon, O., Yoon, C. and Choi, J. (2001) *Measures to Strengthen the Animal Disease Control System in Korea*, Korean Rural Economic Institute, Naju-si, Korea (in Korean language).
	Summary	Economic costs of animal disease are estimated using the data between 1980 and 2000. The economic costs of diseases are estimated to vary for the cattle sector between KRW 824 billion and KRW 2 750 billion, for the swine sector between KRW 688 billion and KRW 1 095 billion, and for the chicken sector between KRW 154 billion and KRW 855 billion. Measures to strengthen the animal disease control system are proposed, such as reorganisation of control institutions; strengthening the role of the private sector; enhancement of the efficiency of quarantine system; development of a standard disease control procedure; establishment of an information system for contagious diseases; and pooling of veterinarians and livestock-related experts.
4.	Study title	Jung, C., Ryu, Y., Jung, H., Kang, J., Kim J. and Jung, H. (2001) *An Economic Analysis of Losses by Swine and Poultry Industries from Livestock Diseases,* KonKuk University (in Korean language).
	Summary	This study estimates economic costs of governments and producers related to livestock diseases, including government expenditures for compensation scheme, decrease in production value due to reduced farm gate prices and loss of export revenue. To reduce these, the authors propose an improvement of disease monitoring system to strengthen disease prevention.
5.	Study title	Choi, J., Jeong, M., Jeon, S., Sung, D. and Huh, D. (2002) *Analysis of the FMD Impact in 2002*, Korean Rural Economic Institute, Naju-si, Korea (in Korean language).
	Summary	The study analyses the economic impact of 2002 FMD epidemic in terms of its effects on supply and demand of livestock products and consumers reaction. A cost-benefit analysis of vaccination and stamping out decisions is made.
6.	Study title	Song, J., Woo, B., Huh, D. and Park, S. (2006) *An Economic Analysis of Livestock Diseases*, Korea Rural Economic Institute, Naju-si, Korea (in Korean language).
	Summary	The study employed an economic analysis model and livestock statistical data to measure the economic impact of livestock diseases per year. It found that losses of cattle farms can vary between KRW 500 million to KRW 67 billion. The losses of pigs and poultry farms are estimated KRW 5.3 billion and KRW 800 million, respectively. The losses of the livestock sector from PMWS (Post-Weaning Multisystemic Wasting Syndrome) and calf diarrhoea are estimated at KRW 18 million and KRW 28 million, respectively.

7.	Study title	Woo, B., Lee, H., Hwang, Y., Lee, J. and Kim, J. (2008) *An Economic Impact and Countermeasure Policies of Highly Pathogenic Avian Influenza*, Korean Rural Economic Institute, Naju-si, Korea (in Korean language).
	Summary	An economic impact of HPAI of 2008 is estimated covering the upstream, farm production and downstream stages. The study finds that economic loss from the outbreak of HPAI exceeded KRW 630 billion. The authors also reviewed the current animal disease surveillance system of Korea. Introducing an early warning system for HPAI is important to reduce a potential loss. To establish an early warning system, several systemic changes are recommended, such as maintaining breeding record and strengthening incentives for early reporting.
8.	Study title	Jeong, M., Huh, D., Kim, H. and Lee, H. (2011) *Measures to Improve Animal Disease Control*, Korea Rural Economic Institute, Naju-si, Korea (in Korean language).
	Summary	The study analysed the economic impact of FMD and HPAI, and suggested a variety of policy measures to improve the animal disease control system. The suggestions include increasing the number of staff and expending the quarantine facilities in ports and airports; improving the ability of regional biosecurity agencies; installing farm border fences and vehicle disinfection facilities; creation of bio-security funds by all stakeholders; and introduction of livestock permit system.
	Other studies related to farmer behaviour	
9.	Study title	Jung, Jin-hwa (2008) "Farmer education, technology adoption and Income: a case of eco-friendly farming in Korean farm households", *Korean Journal of Agricultural Economics*, Vol. 49, N 3, pp. 71-94
	Summary	The effect of farmer educational attainment on agricultural income, focusing on the allocative effect of education in association with technology adoption is analysed with the agricultural census data. The results indicate that education of both farm manager and family member raises the probability of technology adoption and farm managers' education attainment raises agricultural income by reinforcing the income effect of technology adoption. The author concludes that promoting farmer education is a good policy that can lead to technology adoption and speed up the diffusion of new technologies.
10.	Study title	Choi, Y., Kim, G., Lee, J., Kang, K., and Yun, S. (2009) "Analysis of the purchase and use fertiliser by farmers", *Journal of Agricultural Extension and Community Development*, Vol. 16, N 4, pp. 687-711 (in Korean language).
	Summary	This study was conducted to examine and compare farmers' purchase and use of fertilisers. Data were gathered from a total of 326 farmers across the country. The findings include: first, 70.6% of greenhouse horticulture farmers, 89% of upland-cultivating farmers, 76.3% of fruit-growing farmers purchased fertiliser in Nong-hyup (a farmer cooperative organisation); second, only 54.2% of the greenhouse horticulture farmers, 60.2% of the upland cultivating farmers and 70.4% of the fruit-growing farmers recognized optimum levels of fertiliser application. However, about half of farmers do not comply with optimum level of fertiliser, which means that there exist a significant gap between their behaviour and belief.
11.	Study title	Cho, Wan-Hyung (2004) "Analysing producer behaviour and characteristics of environmentally friendly agricultural products", *Korean Journal of Organic Agriculture*, Vol. 12, N 1, pp. 45-66 (in Korean language).
	Summary	Farmer social and economic behaviours and the characteristics of environmentally friendly agricultural products are examined based on the surveys on 341 farmers producing quality-certified environmentally friendly agricultural products. The author suggests policy implications, such as diversifying sales channels and strengthening farmer education and communication.
12.	Study title	Kim, S., Lee, S. and Lee, Y. (2008) "Evaluation on risk attitude of rice farmers", *Journal of Rural Development*, Vol. 31, N 1, pp. 57-75 (in Korean language).
	Summary	The study examines risk attitudes of Korean rice farmers based on responses about risk sources using an attitudinal scale approach. Economic, social, personal, and environmental sources of risk are considered in the measurement of risk attitudes. The results show that rice farmers are more likely to manage risks associated with the timing of farming practices, the amount of fertiliser, drainage management and flooding controls and pest and weed controls. Rice farmers who are younger and more educated, and who have more income and larger size of farming land are more aggressive in managing their exposure to risk.

Annex 7.A7

National notifiable diseases in Korea and response measures

Disease class	Disease	Control measures
Class 1	Cattle plaque, contagious bovine pleuropneumonia, FMD, plaque of small ruminants, blue tongue, rift valley fever, lumpy skin disease, sheep pox, vesicular stomatitis, African horse sickness, African swine fever, swine fever, swine vesicular disease, Newcastle disease, HPAI and others that are equivalent to the aforementioned	• Quarantine/detection of suspicious animal/stuff • Movement restriction of contaminated farm owner/family/workers • Access control to contaminated area of people/animal/vehicle • Access control to livestock facilities of people/animal/vehicle • Prohibition on taking out of animal/stuff from contaminated area • Restriction on pasturing animals • Order to close livestock facilities • Order to suspend business to livestock related business • Stamping out (6 diseases)
Class 2	Anthrax, blackleg, brucellosis, tuberculosis, Johne's disease, BSE, Q fever, swine Aujeszky's disease, Japanese encephalitis, Teschen disease, scrapie, glanders, equine infectious anaemia, equine viral arteritis, canine infectious disease, equine infectious uteritis, Eastern and Western equine encephalitis, Venezuelan equine encephalitis, pullorum, fowl typhoid, fowl cholera, rabies, mule deer chronic wasting disease and others that are equivalent to the aforementioned	• Quarantine/detection of suspicious animal/stuff • Access control to contaminated area of people/animal/vehicle • Prohibition on taking out of animal/stuff from contaminated area • Restriction on pasturing animals • Order to close livestock facilities • Order to suspend business to livestock related business • Stamping out (8 diseases)
Class 3	Bovine ephemeral fever, bovine akabane diseases, chicken mycoplasma disease, LPAI, foul brood and others that are equivalent to the aforementioned	• Quarantine/detection of suspicious animal/stuff • Prohibition on taking out of animal/stuff from contaminated area • Restriction on pasturing animals • Order to close livestock facilities • Order to suspend business to livestock related business

Source: MOLEG (2016).

Annex 7.A8

Livestock compensation scheme in the Korean Act on Prevention of Contagious Animal Diseases

Incentive aspects	Modalities
Scope of compensation	Compensation to livestock holders is payable for livestock slaughtered by the stamping-out order. Animals that died before the order are not compensated. Objects incinerated or buried in complying with the veterinary authority's order in the suspicion to be contaminated with pathogens of animal diseases are reimbursed.
Consequential losses	In the case of FMD or AI, concessional loans may be provided for re-stocking to farms (Operations Stabilisation Fund) and for business interruption to agricultural businesses (Fund for Stabilisation of Agro-industry companies).
Cost-sharing	The compensation is fully borne by the central, regional, and local governments. The central government covers 80% of the compensation and the regional and local government cover the remaining 10%.
Rules for valuation	For incinerated or buried objects, the value is assessed on the basis of the market price at the time of disposal. For livestock, market price of animal slaughtered is based on the farm gate price or wholesale price monitored by producer associations or NACF (National Agricultural Co-operatives Federation) on the day of stamping-out. If not available, the value is based on the price immediately prior to the implementation of measure.
Assessment of compensation payment	The amount of payment is established by a payment assessment team, created by local administration. The team comprises five members, including a local government official, a member of producer organisation, a member of Provincial Veterinary Laboratory and a veterinarian. The amount of payment is assessed by all the team members considering farm gate price and wholesale price and the average value of estimations of all team members is applied to the final assessment.
Discounts and penalties	In the case of FMD, AI, brucellosis, and CSF the indemnity is reduced by 20%. Reductions to compensation are applied in the case of reporting delay, non-compliance with rules for preventive measures, farm disease history and other criteria (see Table 7.4).
Timeframe for compensation	After a livestock holder requests compensation claim to the local administration, the latter should submit it to the regional administration within 2 days. Following a 15-day review of the claim, the regional administration will notify the decision. Local administration will then pay out the compensation to livestock holder.

Source: MOLEG (2016).

Annex 7.A9

Government expenditures on emergency animal disease events in Korea, 2010-15

Year	Disease	Species	Total expenditure		Of which			
					Direct loss of culled animals	Operational support	Price support	Consumption measures
			USD million (1)	KRW billion	KRW billion			
2010-11	Brucellosis	Bovine	55.6	62.9	62.9	0	0	0
	Tuberculosis	Bovine / Deer	29.4	33.3	33.3	0	0	0
	FMD	Artiodactyla	1 548.6	1 751.5	1 725.6	25.9	0	0
	HPAI	Birds	61.8	69.9	66.4	3.5	0	0
2012	Brucellosis	Bovine	9.8	11.1	11.1	0	0	0
	Tuberculosis	Bovine / Deer	8.6	9.7	9.7	0	0	0
	FMD	Artiodactyla	51.5	58.3	58.3	0	0	0
	HPAI	Birds	0.7	0.8	0.8	0	0	0
2013	Brucellosis	Bovine	3.9	4.4	4.4	0	0	0
	Tuberculosis	Bovine / Deer	9.3	10.5	10.5	0	0	0
2014	Brucellosis	Bovine	3.1	3.5	3.5	0	0	0
	Tuberculosis	Bovine / Deer	18.4	20.8	20.8	0	0	0
	FMD	Artiodactyla	0.4	0.5	0.5	0	0	0
	HPAI	Birds	114.1	129.1	127.2	1.9	0	0
2015	Brucellosis	Bovine	2.7	3.0	3.0	0	0	0
	Tuberculosis	Bovine / Deer	18.2	20.6	20.6	0	0	0
	FMD	Artiodactyla	36.8	41.6	41.1	0.5	0	0
	HPAI	Birds	42.5	48.1	47.5	0.6	0	0
Total expenditures								
2010-11	-	-	1 695.5	1 917.6	1 888.2	29.4	0	0
2012	-	-	70.6	79.9	79.9	0	0	0
2013	-	-	13.2	14.9	14.9	0	0	0
2014	-	-	136.1	153.9	152.0	1.9	0	0
2015	-	-	100.2	113.3	112.2	1.1	0	0

(*) For all years, the exchange rate for 2015 is applied (USD 1 = KRW 1 131).

Source: Korean Government (2016).