



## Feed the Future Innovation Lab for Livestock Systems

### Cambodia: Livestock Disease Management and Food Safety

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## 1. Introduction

More than 70% of Cambodia's population is financially dependent on agriculture and livestock (Asian Development Bank [ADB], 2012). The vast majority of livestock operations are small scale and run by rural smallholder farmers. In general, livestock production is viewed as a secondary means of generating income, falling behind rice production in overall importance to livelihoods. The contribution of these operations to total agricultural production fluctuates annually. In 2015, the livestock sub-sector made up about 14% of the total agricultural product and 3.3% of the national GDP (Ministry of Agriculture, Forestry and Fisheries [MAFF], 2015). Most livestock production occurs in rural areas, as about 80% of the total population lives in a rural setting. Although the number is increasing, there are very few privately owned commercial livestock farms in Cambodia, most of them located outside of urban centers (Knips, 2004). Foreign investment in livestock and agriculture have increased since 2008, following the international food crisis. International investors seeking affordable, natural resources and a platform to expand industrial farming have gained access to unused Cambodian land through Economic Land Concessions (ELCs) granted by the government. Because of this trend, foreign investors dominate some aspects of the Cambodian livestock sector, including the feed market and dairy production. This has raised concerns about the impact of foreign direct investment on local communities' access to natural resources. Major players in the foreign investment trend include the US, Canada, Vietnam, China, Korea, Thailand, France, the UK, and India (Chan Hang *et al.*, 2012).

Poultry are the predominant livestock species in terms of total population, with the national flock estimated between 15-25 million birds. It is difficult to determine a precise population estimate for chickens in Cambodia because ownership is particularly high in rural and remote regions (10-24 birds/household). Duck eggs are preferred over chicken eggs and represent 60% of the laying flock, although ducks account for less than half of the national poultry flock (approximately 7 million birds). The national ruminant herd is estimated at 4 million head, approximately 3 million of which are cattle and 1 million buffalo. Cattle ownership is relatively high (1-5 cattle/household) considering the lack of commercial production. Pigs are the main livestock species in Cambodia with respect to tons of meat produced (93 million tons/year). There are approximately 2.8 million pigs nationwide, with about 5 pigs/household (Royal Government of Cambodia [RGC] and European Union [EU], 2007). Pigs are almost exclusively raised for meat production, in contrast to cattle and buffalo, which hold significant value as draft animals (Knips, 2004).

## 2. Major Animal Diseases

Animal diseases are recognized as one of the major bottlenecks of livestock productivity in Cambodia, posing significant threats to public and animal health as well as economic stability. Livestock mortality due to disease in Cambodia is extremely high: 10% of cattle and buffalo, 46% of pigs, and 60% mortality of poultry (Shankar *et al.*, 2012). Animal diseases are caused by a number of pathogens, including viruses, bacteria, protozoa, and parasites.

The following section provides an overview of the major diseases affecting the Cambodian livestock sector. Note that the following is not an exhaustive compilation, but rather an introduction to the key diseases that pose the greatest threat to livestock productivity and public health.

### **Foot-and-Mouth Disease (FMD)**

Foot and Mouth disease (FMD) is a severe, highly contagious disease that affects cloven-hooved animals (APHIS/USDA, 2013). It is caused by the FMD Virus (FMDV) in the genus Aphthovirus in the family Picornaviridae. There are seven serotypes of FMDV, but only three have been reported in Cambodia (Grubman and Braxt, 2004). Serotypes Asia 1 and A have been minimally reported in Cambodia, with the

majority of cases being serotype O (Tum et al., 2015). FMDV is identified by fever and blisters in and around the mouth, hooves, and mammary glands. Pain caused by the blisters often causes lameness and anorexia (APHIS/ USDA, 2013).

FMD is endemic in Cambodia and affects cattle, buffalo, and pigs (Shankar et al, 2012). Although mortality is relatively low for this disease, it causes significant losses in livestock productivity. Losses are most critical for meat production and draft power, as animals quickly lose body condition and become weak. In the case of lost draft power, this increases the labor load of smallholder farmers. Annual losses from FMD infection for a smallholder farmer are estimated between 4-11% of total annual income. Losses are incurred through loss of draft power, vaccination costs, treatment costs, and mortality. This estimate is conservative, however, considering it does not take into account chronic FMD infections (Young et al, 2014).

Vaccination coverage and adoption is low throughout Cambodia, resulting in inadequate herd immunity. Available vaccines include monovalent and trivalent varieties, which, according to recent studies, may have limited efficacy due to poor transportation and storage conditions, infrequent vaccination, and limited skill of administration (Tum et al, 2015).

Key country-specific risk factors for FMD include movement of live animals and communal pasturing (Young et al, 2014; Shankar et al, 2012). Transport of live animals throughout Cambodia is largely unmonitored, allowing for trade and purchase of sick animals and maintenance of FMD. In cases where animal health inspections are mandated at agricultural checkpoints, mild forms of FMD often go undetected or unreported (Young et al, 2014). Unofficial cross-border trade between Mekong River countries is a threat to international animal health and security, as it allows sick animals to bypass the already limited border checkpoints and quarantines. Communal grazing, pasturing, and watering is common in Cambodia because many farmers lack sufficient land for their livestock. This is particularly true for cattle. Since FMD is highly contagious, this is a key pathway for outbreaks (Shankar et al, 2012).

### **Hemorrhagic Septicemia (HS)**

HS is an acute, fatal disease that affects cattle, buffalo, and a small number of pigs in Cambodia. HS is caused by the virus *Pasteurella multocida* and the most common serotype in Cambodia is B:2, which serotype is also the most prominent throughout Asia. Death from HS can occur within 24 hours and without clinical signs. More commonly, however, fever, respiratory distress, and excess salivation persist for 2-3 days. The death rate is extremely high, with some studies reporting mortality rates near 100% in some parts of the country (Kawasaki et al., 2013; Shivachandra et al, 2011). HS is endemic in Cambodia and incidence of HS is usually higher among younger animals (between 6 and 12 months old) (Kawasaki et al., 2013). Buffalo are typically more susceptible to HS than cattle (De Alwis, 1999). Household level impact of HS is significant, particular to the smallholder farmer. Although severity of loss can depend on multiple factors (e.g., socioeconomic status, size and age range of herd, husbandry and management strategies, level of community support), up to 40% of farmers may lose more than their entire annual income due to HS infection. Only 18% of farmers will experience a net loss less than 10% after an HS outbreak. The average cost per large ruminant ranges US\$105-\$6201 (Kawasaki et al., 2013).

Vaccination coverage against HS is low at 41% in 2011 (Rast et al., 2013). In addition, Kawasaki et al. (2013) report that one or more large ruminants per household are often left unvaccinated, leaving the unprotected animals vulnerable to the disease. There is hesitation among farmers to adopt the vaccine for several reasons, including a perceived association with abortion in pregnant cows, limited access to vaccinations, and vaccine cost. Additional research is needed to determine the vaccine's effect on pregnant cows, as there is no conclusive evidence on the topic (De Alwis, 1999). Biannual vaccinations

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<sup>1</sup> Note that the wide range in cost per large ruminant case of HS is due to the inclusion of fatal and non-fatal cases; where fatal cases typically cause greater loss.

are shown to be most effective at preventing HS. This requires additional work and knowledge on the part of the farmer to administer a dose every six months. Many farmers in the Kawasaki study had limited avenues of vaccine delivery as an additional barrier. Vaccinations may be acquired through a government program for US\$0.15, or privately for US\$0.25. Even government-distributed vaccines, however, are considered expensive by smallholder farmers (Maclean, 2006).

Risk factors of HS pertinent to Cambodia include poor husbandry and management practices, hot/human climate, and a high buffalo population. Communal, free-range grazing allows HS to spread between herds. This also renders herd monitoring difficult, as some animals are inaccessible at the time of vaccination (De Alwis, 1999). HS is associated with seasonal outbreaks, especially in endemic areas. Incidence of disease often increases as temperature and humidity increases. Finally, a high buffalo population allows for more consistent maintenance of HS in Cambodia, since buffalo are most susceptible (Kawasaki et al., 2013).

### **Classical Swine Fever (CSF)**

CSF is a viral disease in the Flaviviridae family that affects domestic and wild pigs. The disease is endemic in Cambodia and poses a significant risk to small- and medium-scale swine operations (Chan, 2008). CSF can be difficult to diagnose because signs vary significantly by age and breed. Mortality of CSF can be as high as 90%; high mortality occurs more often in young pigs. Most animals develop fever within 10 days after infection. Petechial hemorrhages (i.e., small, red pinpoint marks that are usually associated with asphyxiation) of the skin and mucosa can be a clear sign of CSF, though they do not occur in all cases (Moennig, 2000).

CSF is a chronic issue in all provinces of Cambodia (Huynh, 2007). The most significant risk factor for CSF in Cambodia is transport of live animals (Moennig, 2000). Middlemen traders often travel from village to village, purchasing animals along the way and transporting them communally to a processing site. Although Cambodia's Department of Animal Health and Production (DAHP) recommends that traders purchase animals with complete vaccine records against major diseases, it is often impossible for traders to do so. This is predominantly because of low vaccination rates at the farm level (ACIAR, 2011). CSF has the potential to stall prospective formal international trade agreements, particularly with China, due to more stringent regulations on animal health in cross-border trade. Loss of the production value at the farm level is also significant as pig production is a common source of secondary income. Unlike cattle and buffalo, the role of pigs on the Cambodian farm is purely for meat production. Therefore, when pigs lose their value as meat producers, the farmer loses the entire investment (Moennig, 2000).

### **Porcine Reproductive and Respiratory Syndrome (PRRS)**

PRRS is a viral disease that affects domestic, feral, and wild pigs and other members of the Suidae family. There are two major strains of the PRRS virus, one that dominates Europe and a second that originated in North America. The North American genotype is the cause of severe PRRS in Cambodia and other countries in SEA (OIE, 2008). Symptoms of PRRS vary based on the age, immune status, and strain of the virus. Adult pigs display reduced appetite and fever, along with abortion and loss of balance. Mortality rate among sows is up to 10%. Stillborn piglets are associated with infected litters and weaned piglets may display discolored coats and skin, loss of appetite, or respiratory distress (OIE, 2008).

The first outbreak of PRRS hit Cambodia in 2010, most likely due to illegal import of infected pigs from Vietnam (Dietze et al., 2011). The outbreak severely affected pig production due to high morbidity and mortality among adult pigs. Mortality was highest among smallholder farmers (35-50% loss) due to lack of medical intervention (Tornimbene et al., 2014). PRRS outbreaks typically follow a similar pattern in Cambodia, with commercial farms affected first, eventually spilling over to affect smaller operations. (Dietze et al., 2011).

Prevention and control practices are still in development following the initial outbreak in 2010. While

vaccines do exist for PRRS, their efficacy is debated and they are not used in Cambodia. The Cambodian government has instead focused on mobilization of veterinarians, increasing the education of farmers, and improving biosecurity (Nguyen, 2013).

### **Newcastle Disease (NCD)**

NCD is an infection caused by Newcastle Disease Virus (NCDV) that affects domestic poultry and some wild bird species. NCDV is a member of the virus family Paramyxoviridae, genus Avulavirus (Ganar et al., 2014). Signs of disease vary by case and breed as the virus takes a variety of routes, sometimes affecting the respiratory system, sometimes the digestive and nervous systems. Young birds are especially susceptible to NCD and also experience higher mortality (Miller, 2014).

NCD is the single most important animal health challenge facing chicken production in SEA. A highly virulent strain of NCD, velogenic viscerotropic (vvNCD), is endemic in Cambodia and predicted to cause losses of up to 80% in backyard small-scale commercial flocks (Sen et al., 1998; FAO & UNDP, 1994).

Major risk factors associated with NCD outbreaks include contact of commercial flocks with backyard flocks, which serve as the reservoir for NCD in Cambodia. While most large commercial flocks are vaccinated, vaccination is incomplete among small-scale commercial and entrepreneurial chicken producers. This leaves smaller commercial producers highly vulnerable to infection by unvaccinated smallholder flocks (Sen et al., 1998).

The impact of NCD is experienced on commercial and smallholder farms. At the commercial level, small- and medium-sized operations experience the greatest loss due to incomplete vaccinations and typically more contact with backyard birds. When seasonal NCD outbreaks occur, which is common in Cambodia, revenues at large commercial operations increase at the expense of small farmers experiencing flock loss. Smallholder farmers lose broilers almost year-round because the birds are younger and more susceptible. Additionally, young broilers maintain NCD in the village stock as they come into contact with healthy chickens in the free-range system common in rural Cambodia. While there is income loss smallholder systems, it is not usually critical and impact is considered elastic in the short-term. However, human diet and nutrition may be weakened due to a decrease in per capita protein consumption (Sen et al., 1998).

Recommended control methods for NCD depend on a comprehensive system of improved biosecurity, vaccination, and Extension programs. Enhanced biosecurity measures focus on reducing contact between backyard birds and commercial operations. Vaccination is relatively affordable, but adoption at the smallholder level is limited leaving commercial farms vulnerable. Vaccination campaigns are therefore essential at the commercial level as enforced vaccination for smallholders by the DAHP within the current regulatory system is unlikely. Extension may be helpful in increasing adoption rates of vaccination at the village and smallholder level (Sen, 1998; FAO/UNDP, 1994).

## **3. Zoonotic Diseases**

### **Highly Pathogenic Avian Influenza (HPAI) H5N1**

HPAI H5N1 is an extremely virulent influenza A virus in the family Orthomyxoviridae that results in flock mortality up to 100%. Although subtypes H6 and H7 may also result in highly pathogenic avian influenza (AI), H5N1 is the cause of the unprecedented epizootic currently devastating SEA and other parts of the world. HPAI H5N1 affects a variety of bird species, domestic and wild (Alexander, 2006).

In Cambodia, first reported HPAI H5N1 case emerged from the Takmao Wildlife Rescue Center in 2003. A widespread outbreak hit shortly after in January of 2004, primarily affecting smallholder farmers raising backyard poultry (RGC, 2007). Other areas of the poultry sector were affected, including commercial duck operations, live bird markets, and fighting cocks, which have been considered significant in the rapid spread of H5N1 throughout SEA (Fournié et al., 2012). By 2005, 80% of Phnom Penh live-bird markets and 60% of provincial markets completely halted chicken sales (RGC, 2007). The

national-level impact of HPAI has been relatively low, especially when compared to neighboring countries. Cambodia has experienced national flock loss of 0.2%, compared to 25-30% loss in Vietnam and Thailand (Otte et al., 2008). At the household-level, the impact of HPAI is severe if the flock is infected. However, the likelihood of infection in Cambodia is low. Commercial farmers experience significantly greater losses than smallholders, but are also better positioned to cope with losses. Increasing the production diversity of smallholders is one proposed method of reducing shock to individual farmers (Otte et al., 2008).

The most recent outbreak in May 2016 involved community, backyard poultry in Kampot. The outbreak resulted in a 100% case fatality rate (affecting 155 out of 505 birds in the total flock); additionally there were 195 suspected cases, and these birds were euthanized. The outbreak was reported to the district veterinarian and cases were confirmed by the National Veterinary Research Institute (NAVRI) (Sovann, 2016). The recurrence of outbreaks since 2003 has led many to believe H5N1 is circulating undetected in Cambodian poultry (Fournié et al., 2012).

Currently there is no national campaign in place for HPAI H5N1 vaccination. This is in part because the RGC is not interested in offering compensation for the vaccine or production losses due to culling (Ear, 2009). Furthermore, the recurrences of disease in Cambodia are highly associated with improper handling of infected animals and lack of awareness at the community level. Current prevention strategies focus on communication of risk to rural populations, where human cases occur sporadically. Many of these cases have been connected to preparation of sick or dead chickens (Sims, 2013).

### **Tuberculosis**

Major livestock forms of TB include *Mycobacterium bovis* and *M. avis*. Human TB is most often caused by *M. tuberculosis* although zoonotic transmission from cattle to people is possible by *M. bovis*. *M. bovis* is transmitted to humans through contaminated unpasteurized milk or, less often, meat. Close contact with cattle also may increase the risk of transmission through inhalation of aerosolized bacteria (IMAT, 2014). Disease burden of zoonotic tuberculosis in Cambodia is largely unknown due to limited reporting, surveillance, and species-level laboratory diagnosis (WHO, 2012b). The impact of TB on the livestock sector is unclear, although decreased productivity would be expected in active bovine TB cases, more research is required to determine the extent of the loss.

## **4. Food-borne Diseases (FBDs)**

### **Burden of FBDs**

In the World Health Organization's (WHO) estimation of the global burden of food borne disease (FBD), Cambodia is included in Western Pacific Region B (WPRB) alongside China, Lao PDR, Malaysia, the Philippines, Korea, Viet Nam, and other nations in SEA. Overall, FBD burden was ranked as "intermediate" for this region. All countries in the WPRB had Disability Adjusted Life Years (DALYs) between 140 and 360 per 100,000 people. Diarrhea represented 14% of FBDs, with *Campylobacter* spp. ranked highest among diarrheal agents. FBD due to aflatoxin, a mold caused by poor storage of grain, was also a large contributor of FBD in this area (Havelaar et al., 2015). At the country level, WHO's estimates of FBD burden have a relatively high degree of uncertainty due to large data gaps (Devleesschauwer et al., 2015).

Of the Association of South East Asian Nations (ASEAN) countries, Cambodia has the highest rates of communicable and diarrheal diseases. DALYs for diarrheal disease and respiratory infections are especially high (Coker et al., 2011). With respect to foodborne illnesses, risk factors that contribute to Cambodia's high burden of disease include the following:

- Use of wastewater in agricultural production
- Sale of "hot" meat (unrefrigerated)

- Poor slaughterhouse hygiene
- Limited public knowledge and awareness of food borne illnesses
- High poverty
- Inadequate water, sanitation, and hygiene (WASH)
- Poor health and nutrition
- Vulnerability to climate change/severe weather events  
(Davies et al., 2013; Vuong et al., 2007; FAO/ WHO, 2004)

### **Distribution and Demographics of FBDs**

Rates of diarrhea are highest among young children (19-20% among children below one year of age) than older children (13% among children between 1 and 5 years of age). Surprisingly, prevalence of diarrhea is not heavily influenced by location: both rural or urban residents have the same rates. However, distribution of foodborne illness is influenced by province. Provinces with the highest rates of childhood diarrhea include Battambang/Pailin (21%), Preach Vihear/Stung Treng (19%), and Takeo Province (19%). Provinces with the lowest diarrheal prevalence are Kampot and Prey Veng, at 5% each. Poor children are more likely to have diarrhea than children in wealthier households. Rates of diarrhea are higher in areas where improved water, sanitation, and hygiene are limited (DHS Cambodia, 2015).

Health problems like chronic undernutrition increase susceptibility to diarrheal disease. About 32% of children in Cambodia are undernourished (FANTA, 2014). Among indigenous children, rates of malnutrition are even higher (70%), leading to increased susceptibility (Health Unlimited, 2002). Foodborne disease may also affect children's growth and development, potentially leading to permanent stunting or cognitive impairment in severe cases (Niehaus et al., 2002). Researchers have found that even asymptomatic infections with enteric pathogens may lead to malnutrition and stunting through environmental enteropathy (Mbuya & Humphrey, 2016). One study found that 12% tested positive for *Campylobacter* spp. by Polymerase Chain Reaction (PCR) with higher percentages for children under 16 years of age and 24% of children under two years of age excreted *Campylobacter* spp. in their feces (Obsjer et al., 2016).

### **Major Food Borne Diseases**

#### Salmonellosis

Salmonellosis is caused by *Salmonella* bacteria, a rod-shaped bacterium in the Enterobacteriaceae family. There are several serovars of *Salmonella*: *S. enterica* serovar Typhi and *S. enterica* serovar Paratyphi result in typhoid fever in humans. Other serotypes of *S. enterica* are often grouped together as nontyphoidal *Salmonella* (NTS) (Carrique-Mas et al, 2013). While most healthy adult animals can tolerate low levels of *Salmonella*, moderate to high levels of *Salmonella* in feed or water can substantially reduce productivity of livestock. The primary socioeconomic impacts from reduced animal health are seen on the side of draft power and income from pigs (International Federation for Animal Health [IFAH], 2012). Infection in cattle and buffalo, however, is far less common than porcine Salmonellosis (Devendra et al., 1997). Primary sources of *Salmonella* infection include contaminated water and food (Vlieghe et al., 2013).

The Southeast Asia subregion has the highest burden of salmonellosis in the world. The burden in this subregion is estimated at approximately 54 million human cases per year, 88,200 of which are terminal (Majowicz et al., 2010). Incidence is estimated at 3980 per 100,000 person-years. Burden of disease is estimated by region because there is no reliable data available for burden at the country level. This may be due to a variety of factors including likelihood of seeking medical care and lack of laboratory testing, leading to ambiguity with respect to the causative agent (Majowicz, 2010). Studies of *Salmonella* outbreaks show high rates of multidrug-resistant (MDR) *S. enterica*, and resistance to antibiotics has been identified in both typhoidal and NTS serotypes (Emary et al., 2012). As a result, Cambodia may have to



drastically alter its treatment methods of salmonellosis in the near future (Vlieghe et al., 2013; Akhtar et al., 2015).

### Brucellosis

Brucellosis is a rare disease among humans and animals in Cambodia and other tropical countries in SEA. Sothoeun, Young, and Windsor (2011) found that there were no reports of human brucellosis in Cambodia in the literature. Following the review, field testing at 120 sites in Cambodia found all specimens negative for brucellosis. While the ASEAN Secretariat places brucellosis among their priority zoonotic diseases, the prioritization is not country-specific and focuses on SEA countries in temperate climates (Bordier & Roger, 2013).

From 2008 to 2009, brucellosis was placed in the top 10 zoonotic diseases affecting Cambodian livestock according to the World Animal Health Organisation (OIE) report on the World Livestock Disease Atlas (OIE, 2011). It is possible that in areas where Malaria is endemic, fever from brucellosis is misdiagnosed. Furthermore, even if brucellosis is recognized, it is unlikely that the disease will be reported. These two factors may lead to underestimation of human disease burden (Bordier & Roger, 2013). While there are several subtypes of Brucella, *B. Melitensis* is the primary cause of brucellosis in Cambodia. *B. Melitensis* typically affects goats and sheep, but may also infect camelids, cattle, and buffalo to a lesser degree (OIE, 2011). Since the Brucella that is prevalent in Cambodia does not lead to severe disease in cattle and buffalo, the major livestock species in the country, the economic impact of the disease has been minimal. There is also the potential for Brucella to cause porcine respiratory coronavirus infection (PRCI), which can cause disease in humans. According to the OIE, however, there is no information available for PRCI in Cambodia. In surrounding countries, PRCI is either not reported or data is unavailable (OIE, 2011).

## **5. National “Action Plan” for Food Safety and Animal Health**

Cambodia’s Rectangular Strategy is the country’s primary action plan for national development. This strategy is broken down into four phases, with each phase containing four “sides.” Phase III is most focused on reaching food safety objectives. Side 1 of Phase III focuses on strengthening private sector livestock processing through improved technologies, education, and mechanization. Phase III side 2, focuses on food safety, reduction of morbidity and mortality from disease, and removal of development barriers to livestock and aquaculture subsectors (RGC, 2013).

The Agriculture Sector Strategic Development Plan (ASSDP) is included under Phase III of the Rectangular Strategy and is under the primary direction of Ministry of Agriculture, Forestry, and Fisheries (MAFF). Program II of the 2014-2018 ASDP seeks to increase production, diversification, and commercialization of livestock programs. Because the livestock sector is highly constrained by poor animal nutrition, high mortality and disease prevalence, as well as low and poorly enforced sanitary standards, the vast majority of the ASSDP focuses on animal health and food safety. Following is an outline of key objectives relating to animal health and food safety:

### Animal health targets

- Improved access to feed and forage
- Increased herd/flock vaccination coverage
- Improved prevention and control of zoonoses
- Increased number of livestock extension workers trained in animal health

### Food safety

- Improved prevention and control of food borne illnesses

- Modernization of slaughterhouses and processing facilities
- Implementation of incentives for privatized slaughter facilities
- Implementation and adoption of laws on sanitary standards and animal health
- Implementation of disease surveillance methods

(MAFF, 2015)

## **6. Achievements of the National “Action Plan”**

In 2015, the Law on Animal Health and Production was passed by the RGC’s National Assembly. The law is backed by the Rectangular Strategy’s Side II, Promotion of Livestock Farming and Aquaculture (RGC, 2013) and officially delegates animal health-related responsibilities to associated institutions within the government including the Department of Animal Health and Production (DAHP) and MAFF. The Law on Animal Health and Production consists of 22 chapters and 124 articles detailing institutional management of the livestock sector. Overall, the law seeks to strengthen the sector through clear dissemination of responsibilities to all livestock stakeholders (farmers/animal owners, veterinarians, policy makers, extension officers, traders, slaughter facilities, feed distributors and manufacturers, processors, and others) (RGC, 2015). The major objectives of the law include the following:

- Management of animal health and production practices
- Protection human, animal, and environmental health
- Control and prevention of major animal diseases
- Protection and maintenance national animal resources
- Maintenance of a sustainable and safe supply of animal products to domestic and international consumers

(RGC, 2015)

Another major milestone, the 2013 Census of Agriculture of the Kingdom of Cambodia (CAC) marked the first agricultural census in the history of the nation. Preliminary activities for the CAC began in 2013 and were supported by funding from the RGC, Food and Agriculture Organization of the United Nations (FAO) and Australian Agency for International Development (AusAID), USAID, and Sweden. Technical support was also offered through these and other channels including the National Institute of Statistics (NIS).

## **7. Constraints of the national framework**

Cambodia’s programmatic strategy for food safety and animal health is spread, mostly without coordination, between several institutions. Key institutions for food safety include MAFF, the Ministry of Commerce (MoC), and the Ministry of Health (MoH). MAFF is generally responsible for safety and quality control of raw agricultural products; MoC mainly regulates and inspects processed foods; and MoH regulates good management practices, setting industry standards for hygiene and sanitation, and implementing food labeling. There is considerable overlap between these institutions and no clear statement of specific, delegated responsibilities (Soeun, 2004).

While the ASDP recommends increased inspection and regulation of animals and animal products, Cambodia has inadequate human capital to carry out these actions. There are a limited number of inspectors employed for these activities (Soeun, 2004). Furthermore, many inspectors lack sufficient expertise because there are no stipulations for training of inspectors under Cambodian law. To account for these constraints, the FAO and WHO recommend prioritization of inspector training as well as food safety education at the producer, industry, and consumer level (FAO/ WHO, 2004).

## 8. External recommendations

Evaluation of the current VAHWs (Veterinary Animal Health Workers) program is seen as a primary target for future growth in animal health and veterinary services (Carvalho et al., 2004), particularly because VAHWs are the primary actors in disease surveillance in Cambodia (Calba et al., 2014; Stratton et al., 2015). The Cambodian government began training VAHWs in the 1990s to improve animal health and access to veterinary services for smallholder farmers. VAHWs are trained in the basics of veterinary medicine. During the first wave of training, this focused on livestock production; however, following the HPAI outbreak in 2004, a second wave of training increased focus on disease surveillance and treatment. Despite significant improvements in animal health (AH) since the induction of this program, several weaknesses in AH services should be addressed in order for the progress to continue. VAHWs are members of the community and are typically farmers. Although VAHWs are considered representatives of the DAHP, they are not compensated by the government. The only payment received by VAHWs is compensation from farmers who request their services. This has led to a decrease in participation by VAHWs; for instance, nearly 7.5% of activities were ceased in 2010 alone (Calba et al., 2014). In addition, activities and responsibilities of VAHWs have never been officially specified, which has led to significant heterogeneity between the activities of VAHWs. Stratton et al (2015) estimate that less than half of the VAHW obtain up to 40% of their household income from VAHW related activities. The study observes that this % could increase by targeted training for VAHWs as well as access to veterinary equipment, vaccines and drugs.

The Cambodian government has not conducted formal evaluations of VAHWs since the introduction of the program. External organizations like OIE utilize a top-down approach that assesses the competence and skill level of VAHWs. According to Calba et al. (2014), this approach may not be most effective in Cambodia because it does not take into consideration the expectations of the stakeholders or Cambodia's national AH objectives. This study recommends a more participatory approach to achieve the following goals:

1. Identify and formalize VAHW activities
2. Score the VAHW program with respect to sustainability, effective treatment and production, vaccination, and disease reporting

## 9. On-going food safety and disease control programs and their impact

### **Southeast Asian Foot and Mouth Disease Campaign (SEAFMD)**

The Southeast Asian Foot and Mouth Disease Campaign (SEAFMD) was started by OIE in conjunction with FAO in 1997 to address the growing food-and-mouth disease crisis in SEA. This program was divided into five phases, with the ultimate program goal of FMD eradication in the Southeast Asia region (SEAR) by 2020. Phase 1 established the Regional Coordination Unit in Bangkok, Thailand; evaluated the situation; identified key needs; and built links between beneficiary nations and donor agencies. The program targeted surveillance and public awareness during Phase 2. Phase 2 also divided SEA into zones of action; Cambodia is included in the Lower Mekong Zone (LMZ) along with Vietnam. Phase 3 emphasized risk analysis, surveillance, and vaccination against FMD. Animal movement and government regulation of transboundary trade are also key strategies. During Phase 3, SEAFMD added highly pathogenic avian influenza (HPAI) and classical swine fever (CSF) to the control program<sup>2</sup>. Phase 4 focuses on expanding the control and eradication zones established during Phase 3. Finally, Phase 5 depends on improved surveillance methods and vaccine delivery to control residual FMD infections. Communication between beneficiary countries is expected to be extremely important during the later stages of this phase. SEAFMD expects to complete activities by 2020 (OIE/SEAFMD, 2007). Every two years, SEAFMD meets to review the status of each SEAFMD member country according to findings from partner organizations (FAO, ASEAN, OIE, AusAID, and the European union). Areas of interim reporting

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<sup>2</sup> Funding for program expansion was provided by ADB.

include monitoring and evaluation of on-going phases, international coordination and support; program management and economic impact analysis; policy and legislation supporting disease control and prevention; public awareness and communication; and disease surveillance, diagnosis, reporting, and control (OIE/SEAFMD, 2010). As of February 2016, SEAFMD estimated 119 on-going FMD outbreaks; this is the highest rate of disease outbreak among all SEAFMD member countries (FAO, 2016).

### **Asian Development Bank's Transboundary Animal Disease Control Project**

The Transboundary Animal Disease Control for Poverty Reduction in the Greater Mekong Subregion (TAD/GMS) seeks to promote inclusive economic growth through improved government regulation and regional partnerships. This is predominantly a capacity building and technical assistance program in animal health, specifically focusing on TADs that pose major threats to livestock trade in the GMS. This concept is based on the socioeconomic effects of animal disease at the household level, where rural smallholder farmers are most vulnerable to negative impacts of livestock disease outbreaks. The greater outcomes of this project include reduced poverty and vulnerability of farmers, increased livestock productivity, and increased access to safe trade. The project activities on the ground were completed in 2015, and the program is now in the evaluation phase (ADB, 2016).

### **Village-based Biosecurity for Livestock Disease Risk Management**

This program is funded and implemented by the Australian Centre for International Agricultural Research (ACIAR) in collaboration with MAFF. The project started in 2011 and will end in 2018. The project focuses on increased knowledge of animal disease and transmission at the village level. Although livestock production in Cambodia is dependent on the smallholder farmer, knowledge of animal disease and health is most limited at this level of production. The village-based biosecurity project builds from previously implemented projects on best practices in animal health and husbandry to improve farmers' knowledge of disease control and prevention as well as trade management.

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