Country Report: Lao PDR

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Introduction

The Lao PDR has a land area of 236,800 square kilometres and a human population of 6,201,000 giving it the lowest population density in East Asia. A landlocked country, Lao PDR is bordered by Vietnam (2,069 Km in the east), Cambodia (435 Km in the south), China (505 Km in the north), Myanmar (236 Km north-west) and Thailand (1,835 Km in the west) with the Mekong River serving as much of the border with Thailand. About two-thirds of the country is mountainous which creates transportation difficulties while at the same time producing many rivers and vast hydropower potential. Lao PDR is a tropical country, whose climate is affected by monsoon rains from May to September alternating with a dry season from October to April.

The Lao PDR is a predominantly rural society with 85% of the population depending on agriculture for their livelihood with most of the rural households producing food mainly for their own consumption. Agriculture accounts for 52% of GDP with livestock and fisheries contributing 18%. Culturally, the Lao PDR is immensely diverse with more than 46 officially recognized ethnic groups. Broadly, the country can be divided into lowland and upland (or sloping lands) zones, and these provide different challenges and opportunities for development. Lowland areas are planted to paddy rice and are the most important rice cropping areas in the Lao PDR. They occur mainly along the Mekong and its tributaries, and this area is referred to as the Mekong Corridor. Agriculture in these areas is becoming more and more market-oriented with market forces driving the process of agricultural intensification and diversification. Upland villages in the sloping lands zone are more remote, have poorer road and market access and villagers rely predominantly on subsistence farming. While poverty has been reduced considerably in the Mekong Corridor, people in the sloping lands zone have been by-passed by economic growth and many are still living in poverty.

The Lao government wants to increase livestock production to reduce poverty and increase protein consumption from 22 to 50 kg per person in rural areas and from 33 to 70 kg per person in urban areas. The National Growth and Poverty Eradication Strategy identifies targets of an average meat supply of 70 kg/capita/year and increased exports to the value of US$50 million by 2020.

Given that 95% of livestock are local breeds produced by smallholders under low input/low output systems for domestic use and local trade, questions remain about the potential for producers to:

(1) lift productivity to reduce their poverty levels;
(2) increase production to meet growing domestic demand; and
(3) contribute to export markets.

The demand for meat in the Lao PDR and other Southeast Asian countries has grown consistently over the last decade and is likely to continue to do so for the foreseeable future. About 75% of cattle and buffalo produced are consumed domestically and the remaining 25% are exported. Thailand is a major market for live cattle and buffalo with the Lao PDR supplying approximately 20% of the demand, accounting for approximately 100,000 animals per year. Other major suppliers are Myanmar and Cambodia. Pigs and poultry are produced mainly for home consumption and local markets. There is strong demand pull for meat which will increase in future.

In 2011-2012, there were approximately 1,363,972 buffalo and 1,904,177 cattle, 3,464,187 pigs, 894,255 goats and 40,110,232 poultry. Density of cattle and buffalo is lower in the northern region than in the central and southern regions. Per capita pig density is higher in the lowland and highland areas than in uplands. Livestock are raised in extensive, low input systems that take advantage of naturally occurring feed resources. All livestock types are native breeds well adapted to the extensive production systems in which they are raised.

Livestock production is clearly in the hands of smallholder farmers with about 95% of all animals being reared by these producers. Smallholder farmers operate mixed farming systems, growing both crops and rearing animals. Ways of feeding and managing animals have evolved in response to the predominant cropping system and the available feed resources. These include fallow cropland, communal areas along roads, rivers, areas around fields and villages, dedicated grazing land, secondary forests and other non-cropped communal land. Additionally, crop by-products such as rice straw are also fed to ruminants. Commercial livestock production has developed only around major population centers such as Vientiane, supplying meat, eggs and milk to the urban population.

Legal and regulatory framework

Livestock regulations

Regulation No.0036/DLF dated January 2000 of the Department of Livestock and Fisheries is a comprehensive set of rules governing most aspects of animal raising and management in the Lao PDR. The regulation provides for the marking and registration of livestock, the movement of animals and their products and veterinary supplies in and out of and internally within the Lao PDR, and contains conditions relating to animal disease prevention and vaccination, the slaughter of animals and meat inspection, and the conservation of breeding stocks. Of particular relevance are the following points:

➪ The legal requirements to import livestock, feed and veterinary supplies are onerous: an official application has to be made 15 days before importation and should be accompanied by another form to the DLF (different forms for different products) also accompanied by a certification / license from the exporting country including, in the case of veterinary drugs, samples of the drugs. The imported goods have to be checked at border checkpoints. The regulations of the Ministry of Trade and Ministry of Finance also have to be followed.

➪ The legal requirements for export of animals or their products require, in addition to the equivalent requirements for importation, another set of forms and requirements for movement within the Lao PDR to the border. Thai Government regulations also have to be followed.

➪ Within the Lao PDR, irrespective of whether for export or not, all cattle and buffalo have to be vaccinated against HS and, in some areas, additionally for Anthrax and Black Quarter.

➪ Pigs must be vaccinated against CSF, chickens against NCD and Fowl Cholera, and ducks against Fowl Cholera and Duck Plague.

➪ There are comprehensive conditions relating to reporting of disease epidemics and the subsequent control of the epidemics including restriction on animal movements in declared epidemic zones. There are particular conditions relating to Anthrax, Black Quarter, CSF and FMD. These are all notifiable diseases. For all of these notifiable diseases, rules are given for destruction of infected animals, for disinfecting the area and vaccination of unaffected animals within the five km radius Epidemic Zone. Repeated vaccinations are not specified. Of particular interest is the restriction of movement of livestock in declared Anthrax and FMD epidemic zones which is 14 days after the day on which the last animal with symptoms is observed for Anthrax and 21 days for FMD.

In addition to the specific requirements of the Regulation 0036/DLF, provinces impose special directives on the livestock industries in their areas of control. Provincial directives are not consistent among provinces. In some provinces, directives regulate the importation of production animals through a restricted number of approved traders, taxes are imposed on the importation of feed and animals, and vaccine importation from Thailand is banned.

The conditions of Regulation No.0036/DLF are generally not enforced. However, provincial directives appear to be more consistently enforced. The livestock industry in the lowland areas adjacent to Thailand appears to be operating profitably under somewhat free enterprise conditions in the absence of appreciable enforcement of legal regulations.

Strict enforcement of existing regulations would hamper the export of livestock and would hamper the production of industrial animals for local consumption.

➪ The Law on Livestock Production and Veterinary Matters No 110/OP, 18 August 2008: The objectives of the LVL are to regulate the organization, management and inspection of livestock production and veterinary services; regulate the management and control of animal diseases; provide consumer protection from animal diseases transmissible to humans; protect national livestock resources and increase supply of quality livestock to the domestic and export markets; and ensure sustainable environmental protection.

➪ Decree on Livestock Management in Lao PDR No. 85/PMO dated 31 May 1993.

- Regulation on Livestock Management in Lao PDR No. 0004/MAF and Instruction on Livestock management in Lao PDR No. 0005/MAF dated 02 January 1997;
- Technical Norm/Guideline on Livestock and Livestock Products Management in Lao PDR No. 0036/MAF dated 24 January 2000;
- Different Orders, Announcements, and Instructions have been issued by MAF and DLF.

➪ The mentioned decree, regulation and technical norm provide for: Ear tagging and registration of livestock; movement of animals, their products, within the country, import and export, transit through the country; the regulation also regulates the supply of veterinary drugs and equipment; the conditions relating to animal disease prevention, control and vaccination; slaughterhouses and meat inspection and the conservation of breeding stocks.

Foreseen legislation activities

Draft specific legislation to be implemented the LVL such as:

- Regulation on slaughterhouse and meat inspection;
- Regulation on animal disease prevention and control;
- Regulation on animal and animal product movement management

These three documents have been submitted to the National Science and Technology organization.

Continued dissemination of the LVL by organizing the workshop with different sectors in each province throughout country;

- Draft the regulation on veterinary association;
- Draft the regulation on livestock production association;
- Draft the regulation on veterinary services such as: Veterinary clinics; vaccine and medicine production; animal vaccines, veterinary drug and veterinary equipment shops; establishment of veterinary professional schools.

The extent of antimicrobial use in livestock production

Lao PDR is a developing country and the majority of the antibiotics used in livestock and fisheries is as therapeutic agents to treat infections of bacterial diseases in intensive and extensive farming systems. They may also be used as prophylactic agents. Antibiotics are also used to counteract the adverse consequences of stress responses. They may also be used as prophylactic agents in the water of healthy birds and as growth promoters at sub-therapeutic concentrations in feed. Bacitracin, Bio-tetra, Bio-tylo, Chlortetracycline, Tylosine, Neomycin, Oxytetracycline, and others are used for these purposes.

Sub-therapeutic dosing in feed increases the rate of weight gain and improves the efficiency of converting feed to meat. In Lao PDR antimicrobial use in the livestock and poultry sectors is a common practice. Available data suggest that antimicrobials are used in most phases of swine and poultry production and that usage has been increasing, most frequently through in-feed additives. When antimicrobials are used for therapeutic and prophylactic purposes,

they help treat and prevent disease in exposed animals. When used at low levels in animal diets and feed for sub-therapeutic (essentially nonmedical) purposes, antimicrobials help improve animal growth rates and feed efficiency, and also help reduce mortality and morbidity and may improve reproductive performance. Some studies show that higher growth rates from sub-therapeutic antimicrobials have positively influenced producer incomes and resulted in higher per-animal net returns.

However, certain bacteria are becoming increasingly resistant to these drugs, and that antimicrobial resistance may be transferred from animals to humans through the consumption or handling of meat that contains resistant bacteria. Public health experts also attribute such resistance to a number of other causes, such as overuse of antimicrobial drugs by medical professionals and their patients.

Many antimicrobials are approved for treatment or growth promotion in the Lao PDR. Antimicrobials used in livestock / fisheries as therapeutic agents to treat infections are: Pen-step, Dufamox 15% LA, Oxtetracycline 20% LA, Bio-Tetra 10% WSP (Powder), Bio-Tetra 200 LA, Enrofloxacin, Oxtacin-En 5%, Bio-tylo 200, Bio-Tycosone, Genta-tylosin, LA, Bio-analzine, Bio-TMPS 48%, Bio-Primix, Spira-Tylocol, Enrovita, Kinococ, Bio-New Diarrhea Stop, Dexon-A, Triprim, Gentavet, Kanamycin, Oxycline, Bio-b12, Betamycine, Vioxin, Losin, sulfonamides and others.

Antiseptics and disinfectants used in livestock products:
Potasium Permanganate, Blue Spray Tetrave, Formaldehyde solution 40%, Alcohol 90, Dertodine, Biodine, Negasunt.

Vitamins and minerals:
Fer+Genta-Tylo, Oxytocin, Multivitamins Inj, Bio-B Complex Inj, Vitadex B 12 Inj, Vit AD3 E Inj, Three Mix (Powder), Three Mix (Solution), Anti-stress, Swine mineral, Chicken mineral, Royalfac.

Cattle and Buffalo: There is an opportunity to considerably increase cattle and buffalo production in Lao PDR. Remote upland areas are well suited to breed / supply cattle and buffalo which can then be fattened for sale closer to markets. In the Mekong Corridor, available feed resources are limiting expansion of cattle and buffalo production, particularly in areas where irrigation enables farmers to grow two rice crops. Foot and Mouth Disease, Hemorrhagic Septicemia, Samonellosis, E. coli sp, Blackleg, B. Anthracis may also be involved. Although many antimicrobials are available to treat enteric diseases, little information is available describing which of these drugs are being used and at what frequency.

Poultry. Chicken population increased from 20 million in 2010 to 40 million chickens in year 2011-2012; the industry grew to be highly integrated, with few companies controlling most birds, feed mills, farms, and slaughter and processing facilities. Poultry are typically raised under confinement in pens containing 200 to 20,000 birds. Integration led to standardized management practices, including drug treatment policies and procedures, and to many successes in the prevention and control of infectious diseases. Many problematic infectious diseases are controlled with antimicrobials (Enrovita, Oxtetracycline, Bio-Tetra, Bio-New

Diarrhea Stop, Bio-TMPS) and anti-coccidial drugs. Vitamins and minerals (e.g., bio-vitamin, anti–stress, chicken mineral compounds) are used for prevention and treatment in water to an entire flock (usually thousands of birds contained within a single barn) because single-bird treatment is not practical.

Swine. Swine are usually raised in confinement, either from birth through slaughter (farrow-finish) or in age segregated management systems (i.e. nursery, grower, finishing), with many farms of both types practicing all-in, all-out management to control infectious diseases. Average herd size is increasing; in 2011, 50 % of pigs were raised on farms of 200 to 1,000 pigs.

Antimicrobials used for growth promotion or disease prevention and prophylaxis are typically removed at the finishing stages of production. Therapeutic treatments are also administered in feed, although producers also treat individual swine. Most pigs receive antimicrobials in feed after weaning ("starter rations"), when they are most vulnerable to infectious diseases such as Classical Swine Fever, Foot and Mouth Disease, round worm, piglet diarrhoea, Erysipelas, Porcine Reproductive and Respiratory Syndrome (PRRS / Blue Ear), Cysticercosis.

Several antimicrobials (e.g., Bio-Tycosone, Bio-Primix, Bio-analzine, Bio-New Diarrhea Stop, sulfonamides, tetracyclines, Fer+Genta-tylo) are used to treat and prevent pneumonia, an important problem among swine. Gentamycin, Bio-New Diarrhea Stop, sulfonamides and neomycin are used to treat bacterial diarrhea. Other important problems are caused by organisms such as *E. coli* and Salmonella spp. Overall, the antimicrobials used most frequently in swine are tetracyclines, Gentamycin, tylosin, and sulfamethazine or other sulfas.

Opportunities to improve pig and poultry production clearly exist, but expansion is somewhat limited by the relatively small (albeit increasing) size of the domestic market. Farmers in the Lao PDR are unlikely to be able to produce pigs and poultry competitively for large-scale export, although some trade opportunities may develop for districts near borders with the People's Republic of China, Thailand and Viet Nam. While the Lao PDR has a comparative advantage in ruminant (cattle, buffalo and goat) production, this is not the case with pigs and poultry.

Current and planned arrangements for monitoring of antimicrobial use in livestock antimicrobial residues in livestock products and surveillance for antimicrobial resistance

Antimicrobial residues

Presently antimicrobials are used in livestock / fisheries as therapeutic agents to treat infections, bacterial diseases of livestock and aquatic animals in intensive and extensive farming systems. Livestock / fisheries products are very important for Lao people, they are a source of income for the family and saving bank for the villages in rural areas and source of protein for consumers health in the country. But meat products may be contaminated with antibiotics.

Antibiotics are widely used in veterinary medicine and subsequently drug residues may persist in food derived from animals, which may pose an adverse health effect for the consumer.

Department of Livestock and Fisheries apply methods fail to detect the maximum residue limits in animal and fisheries products. Recently for detection of antimicrobial use in livestock / fisheries products used standard determined by OIE table 1.

Table 1. Maximum residue limits (milk: mg/l, meat: mg/kg)

No	Description	Fresh milk	Shrimp	Chicken	Pork	Beef	Fish
1	Amoxillin	0.001	0.004	0.004	0.004		0.004
2	Ampicilin	0.001	-	-	-	-	-
3	Bacitracin	0.56	-	0.4	0.2	-	-
4	Chlotetracycline	0.05	0.2	0.2	0.2	-	0.2
5	Eritromycin	0.5	-	0.4	0.4	-	-
6.	Gentamycin	-	-	0.2	0.4	-	-
7	Kanamycin	2.0	-	-	-	-	-
8	Neomycin	-	-	1.0	2.0	-	-
9	Oxytetracycline	0.1	0.2	0.4	0.4	0.2	0.2
10	Rifampicin	0.01	-	-	-	-	-
11	Penicillin	0.001	0.004	0.004	0.004	0.004	0.004
12	Streptomycin	-	-	0.5	0.5	-	-
13	Sulfadimathoxine	0.5	0.125	0.5	0.5	0.5	-
14	Tetracycline	0.1	0.1	0.2	0.2	-	0.1
15	Tylosin	0.0625	-	0.125	0.125	-	-
Accuracy(%)		91.7	92	95	92	-	92
Sensitivity(%)		100	80	90	66.7	-	80
Specificity(%)		90.5	92.6	100	97.6	-	92.6
Kappa Coefficient (%)		0.70	0.46	0.90	0.70	-	0.46

Monitoring of food products from animal origin for the presence of antimicrobial residues is preferably done using test kits for determination of drug residue in meat. The methods because of their high cost-effectiveness and low cost appropriate services.

AMR in animal pathogens

Antimicrobial resistance is also a concern for animal health, but little is known about the magnitude of this problem. The antimicrobial resistance in exclusive animal pathogens is poor with surveillance of zoonotic diseases.

Antimicrobial susceptibility testing of bacterial isolates not only allows for discrimination between isolates, but for assessment of developing resistance. Susceptibility testing methods include disk diffusion.

For the antimicrobial susceptibility test dish use in ADDL (NAHC) import two brand Difco and Oxoid. Few data are available on the prevalence of resistance in the bacteria because of lack of resources, lack of facilities and equipment for testing; perceived low priority, lack of coordination for collection and antimicrobial testing methods; and concerns about sampling bias because most bacterial infections are barriers.

The National Animal Health Center performs analyses of animal parasites and diseases and tests and certifies the safety of unprocessed livestock products and animal feed. The Center is divided into five diagnostic units: Avian Influenza (since 2004 with FAO support), Bacteriology, Parasitology, Serology, and Rabies but its analytic program is limited by its operating budget. The Animal Feed Laboratory collects and analyzes samples from the feed mills. Fish disease diagnosis is being done by Namxuang Aquaculture Development Center and Living Aquatic Resource Research Center. There is, however, no capacity for pesticide and chemical residue testing in meat and fish products.

The diagnostic infrastructure also includes six animal disease diagnostic laboratories in the provinces that can perform simple parasitological tests. Most of the diagnoses, however, are performed only at the NAHC laboratory; the provincial laboratories provide support in the collection and preservation of samples. On the northern border with China, there is a small laboratory (in collaboration with China) already with equipment but not yet operational.

The NAHC is weak with regard to the number of trained staff. They have only general veterinarians and para-vets with a general agricultural training at the Agricultural College (diploma) or the Faculty of Agriculture (Bachelor of Science); there are no specialists for pathology. The quality assurance system of the Animal Feed Laboratory is likewise hampered by limited staff, inadequate equipment and methods of analysis, and the often unavailable chemicals and reagents. Department of Livestock and Fisheries, National Animal Health Centre responsibility for Disease Control and Prevention, Animal Disease Surveillance, susceptibilities of zoonotic pathogens from animal to animal to human health, specimens from healthy farm and from raw product of food-producing animals at slaughter and processing plant. The National Animal Health Center (NAHC) of the Department of Livestock and Fisheries is the key to providing diagnostic services and the capacity of NAHC to provide field support for livestock projects is crucial to the success of a project. While support for the laboratory and diagnostic capability is likely to continue with assistance from ACIAR, OIE and the EU Livestock Project, the field capacity of NAHC needs to be supported by all projects requiring this services.

A primary obstacle to gauging Lao PDR ability to prevent, contain, or manage AMR was the lack of a defined Lao target for performance. Most Lao PDR reports were less descriptive in nature, reporting rates or numbers of AMR cases or drug use.

There existed a tension between the desire to create standardized surveillance programs that allowed for international comparison with those that can provide tailored local data, trading off standard methods and centralized laboratories with the flexibility required to address local issues.

Patterns and extent of AMR in animal pathogens

The Lao PDR is a predominantly rural society with approximately 85% of the population depending on agriculture for their livelihood. Subsistence farming is common with 94% of households producing food mainly for their own consumption.

Smallholder farmers operate mixed farming system such as pigs and poultry producing largely for home/village consumption and local markets. Ways of feeding and managing animals have evolved in response to the predominant cropping system and the available feed resources. These include fallow cropland, communal areas along roads, rivers, areas around fields and villages, dedicated grazing land, secondary forests and other non-cropped communal land. Additionally, crop by-products such as rice straw are also fed to ruminants.

Commercial livestock production has developed only around major population centers such as Vientiane, supplying meat, eggs and milk to the urban population. Commercial pig and poultry farms are found near population centers such as Vientiane. Most of these agribusinesses are small cottage industries with few employees. In general, production costs tend to be high since semi-intensive pig and poultry production is dependent on concentrate feed which, in many cases, is imported from Thailand. Concentrate feeds are mixed with locally available feeds such as rice bran and brewers grain to reduce production costs. In several cases, commercial pig and poultry production is attached to rice mills.

Commercial pig and poultry production in the Lao PDR is disadvantaged by higher feed costs for monogastric animals (pigs and poultry) than neighboring countries which have access to cheaper ingredients for concentrate feeds (e.g. by-products of industrial crops such as sugarcane, cassava and coconuts, and port access for importation) and a larger domestic market. Gold Coin, the only larger scale (150 tons per day) animal feed producer in Lao PDR is unlikely to be able to compete with Thai feed mills given the higher cost of raw materials and transport costs.

Antibiotics have been used widely in poultry and pig farms in order to treat and prevent infectious bacterial diseases. They have also been used at low levels in feed as growth promoters. Such practice has improved pig and poultry performance effectively and economically but an increase in numbers of antibiotic-resistant bacterial strains like *Escherichia coli*, *Staphylococcus spp*. and *Enterococcus spp.* did occur which can be transmitted from pig and poultry to humans through the food chain with serious consequences on public health.

The present situation underlines the increased public and governmental interest in eliminating sub-therapeutic use of antibiotics in poultry and livestock products; particularly those that are also used to treat humans. There is need for more rational use of antibiotics in animal production and more prudent use in humans. It is important to take concerted action to improve antibiotic resistance surveillance capacity worldwide with a view to monitoring the emerging resistance genes and their transfer in both animal and human strains.

Department of Livestock and Fisheries is a very comprehensive set of rules governing most aspects of animal raising and management in the Lao PDR. The Regulation provides for the marking and registration of livestock, the movement of animals and their products and veterinary supplies in and out of and internally within the Lao PDR, and contains conditions relating to animal disease prevention and vaccination, the slaughter of animals and meat inspection, and the conservation of breeding stocks.

Department of Livestock and Fisheries lack of standardized methods is a major problem in evaluating and making recommendations to address the problem of antimicrobial resistance. Lack of methods for antimicrobial susceptibility testing for livestock/aquatic pathogens, and their interpretation.

Lack of maximum concentration of residue resulting from the use of veterinary drug (expressed in mg/kg on a fresh weight basis) that is legally permitted or recognized as acceptable in livestock/fish products.