



# Feed the Future Innovation Lab for Livestock Systems

Cambodia:

Animal-Source Food Production and Marketing

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The Management Entity at the University of Florida



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## 1. Introduction

Cambodia is located on the Indochina Peninsula in South-Eastern Asia. It shares borders with Thailand and Laos to the north and Vietnam to the east and south, with the Gulf of Thailand bordering to the southwest. Cambodia has a population of just over 13.4 million (National Institute of Statistics [NIS], 2008). The topography of Cambodia resembles a basin: lowlands gradually rise into hills and highlands. The lowest elevation is in the center of the country around the Mekong River and the highest elevation is Phnom Aural, a peak in the southwestern Cardamom Mountains. More than two-thirds of the population resides in the Central Plains, a highly agricultural region characterized by fertile soil and seasonal flooding (Naron, 2012). More than 96% of the population speaks the official language, Khmer, which is heavily influenced by Thai, Lao, and Vietnamese due to geographical proximity; the remaining 4% speak Cham, an indigenous Malayo-Polynesian language. The largest ethnic group is Khmer (90%); other groups include Vietnamese (5%), Chinese (1%), and Cham, Thai and Lao (4%). The official religion of Cambodia is Buddhism (96.9%) and the secondary religion is Islam (1.9%), which is almost exclusively practiced by Chams (CIA, 2015).

Cambodia has experienced consistent economic growth of about 7% per annum over the past 10 years (World Bank, 2016). As of 2012, about 18% of the population, almost 3 million,

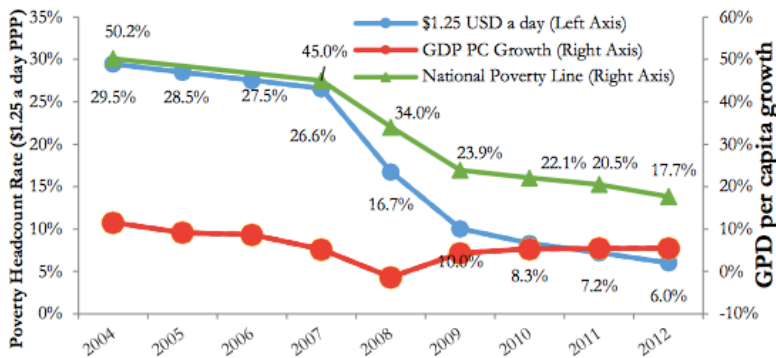


Figure 1 Cambodia/ GDP per capita growth and poverty rate headcount. Source: Ly, Mejia, and Aldaz-Carroll, 2015 using CSES data

Cambodians, lived below the national poverty line, and 8.1 million that are near-poor, those who live on less than \$2.30 per day per person, (World Bank, 2016). However, the economic situation in Cambodia does appear to be improving. Recent economic growth has encouraged a rapid expansion in job opportunities and higher wages, leading to considerable poverty reduction. Figure 2 shows declining trends in poverty, when compared to both national (from Cambodia) and international (\$1.25 per day) poverty lines (Ly, Mejia, & Aldaz-Carroll, 2015). Whether or not Cambodia's improved economic stability is sustainable, however, is debated. According to a World Bank report (Eliste et al., 2015) Cambodia's poverty declined to 21% in 2011 as compared to 50% in 2007. Vulnerability, particularly within poorer households, is steadily increasing, opposite the declining trends in poverty. (Eliste et al., 2015) mostly because the vast majority of households who escaped poverty were only able to do so by a small margin, making them vulnerable to external shocks (World Bank, 2016).

## 2. Agriculture and Livestock in Cambodia

Despite increased industrialization and growth of the textile and manufacturing sectors, Cambodia remains a highly agrarian society. The rural population was measured at 80% the total population in 2015 (MAFF, 2015b). According to a 2013 Agricultural Census, around 75% (1.6 million) of all household agricultural holdings in Cambodia raised livestock and/or poultry (National Institute of Statistics, Ministry of Planning [NIS-MoP], 2015).

In 2014, agriculture contributed about 30% to the GDP (MAFF, 2015b). The vast majority of livestock production is small scale, and the contribution of these operations to total agricultural product fluctuates annually. In 2015, the livestock subsector made up about 14% of the total agricultural product and 3.3% of the national GDP (MAFF, 2015b).

In Cambodia, agriculture and livestock are highly dependent on rainfall due to lack of infrastructure for irrigation technology (International Fund for Agricultural Development, [IFAD] 2013a). Approximately 97% of arable land is rain-fed (Devendra, 2012). The wet season is particularly important for meeting subsistence needs and is characterized by heavy rainfall during the planting season from June to November followed by a harvest season from November to January. The dry season lasts from December through April. Improved productivity during the dry season has a greater potential to improve incomes of farmers (1.85% annual growth from dry season in comparison to 1.62% from the wet season) though both are essential to address poverty rates and food security (Sophea, 2012).

Livestock are a source of food, draft power, and manure. Large animals (buffalo and cattle) are key investments that can act as savings in rural areas, as they can be sold when the household faces a cash need. Small animal livestock (pigs and poultry) are more commonly used for generating household income (UNDP, 2011). Meat exports from Cambodia are negligible and only a small amount of GDP is generated from live animal export, a total of less than \$2 million USD (FAO, 2005).

The Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) estimates that between 2010-2014 chicken production increased by 17%, duck production increased 40.5%, and pig production increased by 14.8%. Chicken production is predominant among these in terms of total number of animals, topping off at approximately 18 million head. Egg production has also increased in conjunction with the poultry production. The majority of egg production remains in the hands of traditional, smallholder collectives with some semi-intensive development beginning to take hold outside of urban centers (Knips, 2004). From 2009-2013, cattle production decreased from 3.60 million heads to 3.40 million heads (-4.20%) while the buffalo production decreased from 740,000 heads in 2009 to 619,000 heads in 2013 (-16.40%). Reduction in the use of cattle for plowing is cited as the main reason for the decrease in cattle numbers. (MAFF, 2015b). Currently dairy cattle play a minimal role in the livestock market, but rising demand for dairy products is pushing the government to invest in local options for supply (Muyhong, 2014).

Although fisheries are not always included within the livestock subsector, they are of particular importance in Cambodia. According to Baran (2010) proteins obtained from fish make up to 37% of the total protein intake and 76% of the animal protein intake for Cambodians. Available natural resource systems, primarily the annual flooding of rice paddies, strongly favors inland freshwater fisheries. This allows for minimal management of land and only part-time commitment to production (Lieng & Valbo-Jorgensen, 2004).

The Agriculture Sector Strategic Development Plan was developed by MAFF in accordance with the Cambodian Government's National Strategic Development Plan (NSDP). The main goals of the plan are to address major barriers and opportunities in agricultural production, including the livestock subsector. The priorities of this plan are outlined here:

- Increased agricultural growth of 5% per annum
- Diversification, intensification, and commercialization
- Livestock and aquaculture promotion
- Improved sustainability
- Improved resource management of forestry and fishery subsectors
- Promotion of paddy rice export

### 3. Management practices

#### **Poultry Managements systems**

In Cambodia the poultry industry can be divided into three production management systems based on size/scale and primary ownership of the farm. These systems include the following:

- Small-scale, private
- Commercial, private
- Commercial, contracted

Poultry production in Cambodia is strongly focused on the first management system, small-scale, private (or “backyard”) producers. This group accounts for more than 90% of poultry owners in the country. This means that every Cambodian household, aside from urban households, is involved in some poultry production. Additionally, there are 1,133 privately owned commercial poultry farms in Cambodia including chicken layer and broiler, and duck farms. The majority of these operations are medium-scale, with the average farm producing 1,400 head per annum (FAO, 2004).

Chickens account for 82% of the poultry market and ducks account for 18% (FAO, 2004). Chicken is the second most important livestock commodity in Cambodia, falling behind pork. There are approximately 14.4 million chickens in Cambodia, which produce 19,000 tons of meat and 19,000 tons of eggs per year (Otte, 2014). With respect to both duck and chicken production, farmers use local breeds almost exclusively. Predominant chicken breeds include Skouy, Sampeov, & Kragnas, and duck breeds include Tear Angkam, Tear Smpeov, and Tear Kapa (Muskovy) (FAO, 2004).

#### **Chickens**

The vast majority of chicken production in Cambodia takes place on small-scale, private farms where chickens are raised with minimal input. Within the traditional, small-scale production system, chicken eggs are sometimes eaten or sold for supplementary income. However, since duck eggs are preferred in the Cambodian diet, chicken eggs only represent 40% of the egg market. The preference for duck eggs allows most private chicken farmers to supply their own chicks through on-site breeding. Commercial feed may be given to start chicks, though homegrown feed, usually rice bran, is given as supplemental feed to adults (Knips, 2004). The majority of the chicken diets on small scale farms depend on foraging.

In the case of contracted commercial farms, the contractor provides animals and supplies, including veterinary products, while the farmer is responsible for building the facility and labor costs. Payment to the farmer is based on the performance of the operation (e.g., number of eggs or broilers) (Knips, 2004). Broilers and layers both are raised continuously on commercial feed. The startup investment associated with contracted farms is considerably higher than private farms, though resources like production advice are made more accessible to farmers through the commercial system. Contracted commercial farms cull layers when the production rate falls below 60% and harvest broilers at 1.88kg.

In many ways, private commercial farms follow a mixed model for broiler and egg production. Young broilers and layers are fed commercial feed and transitioned to rations mixed at the farm from wholesale

purchased raw ingredients (rice bran, maize, soybean, dried fish, premix). Private broiler farms purchase day old chicks (DOCs) and layer farms purchase pullets from either Medivet or C.P., Cambodia's primary farm contractor. Both private and contracted commercial farms use either closed or semi-enclosed housing, whereas layer farms use individual cages.

### **Ducks**

The majority of duck farms fall within the small-scale, private, or private-commercial, management categories. There is almost no formal contracting of duck farms, with only some informal oral agreements between hatcheries and broiler farms. Commercial duck farms are also less standardized than chicken farms, leading to considerable variation in management systems among farmers. Typically, however, ducks are raised outdoors and on commercial feed for the first two weeks followed by transition to on-farm mixed rations. In commercial settings, meat ducks are raised for approximately 65 days until a weight of 2.7kg. Layers are often sold at the end of the 24-month production cycle for meat. Male ducks are harvested at 4 months (FAO, 2004b). There is an income barrier associated with middle-scale and larger duck farms because of dependence on concentrate feed (FAO, 2008).

### **Cattle and Buffalo**

Similar to poultry, buffalo and cattle are almost exclusively produced on smallholder farms in Cambodia (Pen et al., 2010). Due to several constraints on the smallholder farmer, which will be discussed in later sections, cattle and buffalo are primarily viewed as supplementary products under the umbrella of crop (usually rice) production. The main function of both cattle and buffalo is draft power on rice farms. Rice remains the priority crop and is planted on 90% of Cambodia's cultivated land (Harding, Quirke, & Werner, 2007). Buffalo and cattle represent important tools in rice production as mechanization through tractors and other tools is rare throughout most of the country (Eliste et al., 2015). Cattle and buffalo are further used as sources of manure for fertilizer (Harding, Quirke, & Werner, 2007).

Yellow cattle, a local breed, is the most common variety in Cambodia. Less prominent breeds include Haryana and Brahman, both originating from India. Yellow cattle are typically smaller (250-300kg) than the Indian breeds (400-450kg) (Harding, Quirke, & Werner, 2007). Crosses between Haryana and Yellow cattle appear to be the dominant, and preferred, breed for work and sale (Sath, Borin, & Preston, 2008).

Cattle and buffalo production can be broken down into two categories: lowland and upland production. Lowland production is the dominant system and produces 90% of Cambodia's cattle and buffalo (Pham et al., 2015). These production systems share some common features, including free-range grazing on common land, limited hand feeding, and limited selective breeding. Access to feed is a major problem during the wet season for lowland cattle farms and during the dry season among upland farms. This is because lowland agriculture is highly focused on rice production during the wet season, therefore cattle grazing is more restricted during this time to reduce damage to crops. During the dry season, cattle on lowland farms gain condition because they are fed rice straw, a plentiful resource. Upland farms have low availability of forage during the dry season. While this forage limitation would normally push farmers to move their cattle to different areas during the dry season, much of the land in these regions is no longer available for communal use (Harding, Quirke, & Werner, 2007).

Housing for cattle is minimal. Most cattle are kept on communal grazing lands, shared among multiple families. This leads to some issues with overstocking shared lands and therefore high rates of undernutrition among cattle throughout much of Cambodia.

Meat from cattle and buffalo is typically processed at a small-scale slaughterhouse. In 2014 there were 25 slaughterhouses that met the hygienic standards set in place by the Royal Government of Cambodia (RGC, 2014). Live animal weights are not taken prior to slaughter but the carcass is weighed before distribution to retailers. Due to the priority of using cattle and buffalo as draft animals, processing for meat is a secondary objective. As a result, cattle in Cambodia have a high age at slaughter (Harding, Quirke, & Werner, 2007). Farmers prefer to sell cattle to middlemen (40.2% of sales) or other farmers

(48.9% of sales) than to slaughterhouses (0.9% of sales). Crossbred cattle and young female heifers are typically worth more in the market in comparison to the local breed and young male cattle (Sath, Borin, & Preston, 2008; Pen et al., 2010).

### **Pigs**

Pork dominates Cambodia's livestock market, and, from 2000-2012, the market experienced a growth rate of 9.6% each year. There are approximately 2.1 million pigs in Cambodia, producing 93,000 tons of meat per year (Otte, 2014). Pigs are more commonly used for supplementing income than cattle, as their value is mainly attributed to meat production. Pigs are occasionally harvested for on-farm consumption where fish supply is low or financial security is higher (FAO, 2005). It is more typical for farmers to sell to meat processors (slaughterhouses or butchers) than to other farmers.

Pig production can be divided into three categories: small-scale, semi-intensive, and intensive. Like other livestock species, most pigs are raised by smallholder farms on small-scale farming operations. The typical small-scale farmer owns one or two pigs (average of 1.6 head/farmer). On-site breeding is rare; instead, pigs are bred by a breeder (FAO, 2005). This may be due to barriers in animal health services and expertise faced by smallholder farms. Rather than purchasing feed, most small-scale farmers use byproducts from rice crops (broken rice, rice bran, rice straw) (Wallberg, 2011).

Semi-intensive and intensive pig production are centered around urban areas, primarily Battambang and Phnom Penh (Saroeun et al., 2007). The cost of initial investment is much greater for these operations, with the potential for larger rewards over time (FAO, 2005). Improved equipment and breeding expertise allow more commercial operations to produce more pigs at a faster rate. Breeding on site also means that farms at this level do not depend on breeders. Both semi-intensive and intensive pig farms use commercial feeds; however, semi-intensive farmers utilizing integrated farming techniques will often supplement rice byproducts to reduce feed costs (FAO, 2005; Wallberg, 2011).

Most farmers raise the local hog breed because it is resistant to many endemic diseases and gains weight relatively efficiently on a limited diet. Large, commercial pig farms prefer exotic breeds, primarily Yorkshire and Landrace, because of a faster and more efficient weight gain (Huynh et al., 2007; Wallberg, 2011). Because commercial farms have access to better health services and improved feed for animals, the risk of disease susceptibility or lack of resources are not major inhibitors of these breeds (Wallberg, 2011).

### **Main forages and feeds and their production**

All livestock species contained in the livestock subsector of Cambodia are closely tied to rice production. Forage is highly dependent on rice production and byproducts like rice straw, for example. Other major types of forage include para grass, cassava, leucaena, and water hyacinth (Sath, 2012). Farmers use cut-and-carry methods, harvesting and transporting native grasses to grazing areas, during the wet season to prevent crop damage in rice fields. This is both time consuming and has a relatively low reward due to the lower nutrient content of native grasses. Lack of feedstuffs is one of the biggest challenges facing Cambodian livestock owners (Pen et al., 2010).

### **Main feeds and production**

Similar to forage in Cambodia, feed is highly dependent on rice production because it is the primary source of income for most farmers. Smallholder farmers rarely purchase commercial feed for livestock and, instead, use rice byproducts as their primary feed source. Kitchen scraps are used to supplement feed (FAO, 2005). If feed can be produced at the local level, however, it may be an affordable option for lower-income, smallholder farmers. Feed produced in rural areas may serve as an additional source of income for farmers and is less expensive than commercial feed. Pig farming creates the greatest demand for feed, particularly on the local level (USAID, 2012).

Major feed types include rice bran and broken rice (FAO, 2005; Saroeun et al., 2007). Non-rice based feedstuffs include soybean, corn, cassava, and dried fish. Medium-scale farms may utilize rice byproducts in addition to commercial feeds, depending on price of feed and availability of local feed resources. Large-scale farms use commercial feed exclusively through the entire production cycle (FAO, 2005b). Major commercial feed producers in Cambodia include C.P., Green Feed, Medivet, and New Hope Group. C.P. has more than double the production rate of the second largest producer, Green Feed (USAID, 2012).

### **Support systems and new technologies**

The MAFF is responsible for all policy development and implementation of Extension services in Cambodia. In the livestock subsector, these services center on production, marketing, and processing. Under the umbrella of MAFF, the Department of Agriculture Extension (DAE) receives government funding to support public Extension services. However, there is a government push to privatize areas of the DAE that deal with certain areas of agriculture, including aquaculture, livestock, and larger-scale agriculture operations (MAFF, 2015).

Education and training in nonformal livestock education is currently provided through the following government-funded and privatized channels:

#### Government-funded

- Department of Agricultural Extension (DAE)
- Regional Agriculture Research and Training Centers of the General Directorate of Agriculture (GDA)

#### Privatized

- Nongovernmental organizations (NGOs)
- Farmer promoters
- Commercial traders
- Input suppliers

Support through Extension advisory services (EAS) are minimal, particularly with respect to service delivery on the ground. This is mainly because EAS personnel are concentrated at the provincial level, with few district and field-level Extension agents available to work directly with farmers (Sothath & Sophal, 2010). It is important to note that there are significant gender disparities within EAS; women represent only 12% of field-level staff (GFRAS, 2016). These disparities reinforce disadvantages against women farmers. The Food and Agriculture Organization (FAO) estimates that Cambodian women receive less than 10% of available Extension services. As a result, women have reduced access to improved technologies. Women experience a gap of approximately 17% nationwide and as low as 23% in rural provinces, with respect to agricultural technologies (FAO, NIS, MOP, 2010).

New technologies in livestock push farmers towards increased meat production and minimized integration of animals (particularly cattle and buffalo) into rice production. This is mainly accomplished through increasing the availability and accessibility of mechanized crop maintenance. Due to the high investment cost of new crop technologies on smallholder farmers, it remains difficult to significantly increase meat production because meat production remains largely dominated by smallholder farmers. This has led to a push for “pro-poor” livestock policies to protect farmers and promote development of usable technologies (Ear, 2005).

Currently, improvement of technologies and services are focused on animal health because of overall high animal mortality rates seen throughout the livestock subsector. Village Animal Health Workers (VAHWs) fill the demand for veterinary services without the high cost. This is particularly important for smallholder farmers who otherwise cannot afford or would not have access to service from a private veterinarian. In a



study by Tornimbene et al. (date), more than half of small-scale pig producers reported assistance from VAHWs when their animals were sick. VAHWs have been essential for diagnosing controlling diseases, especially highly pathogenic avian influenza (HPAI) and foot and mouth disease (FMD) (Stratton et al., 2015).

### **Use of Manure and Waste**

Livestock production compliments rice (mainly) and other crop production for soil maintenance. Use of manure is important in Cambodian agriculture because soil quality is generally low throughout the country. Use of inorganic fertilizers is low (less than 30%), mainly due to cost of purchase (USDA, 2010). Manure is seen as an essential element for rice production to the extent that some farmers keep cattle and buffalo exclusively for draft power and manure (Knips, 2004).

### **Production constraints**

#### Animal health

Cambodia faces a critical situation with respect to animal disease and mortality rates, which are high throughout the country. Poor livestock nutrition plays a crucial role in increasing the susceptibility of livestock species to major diseases. Poor nutrition is often the result of lack of sufficient feed and forage. Key livestock diseases include: hemorrhagic septicaemia (HS), foot and mouth disease (FMD), and highly pathogenic avian influenza (HPAV). Veterinary service is often unaffordable for low-income farmers or inaccessible because of low health services coverage in rural and remote areas. Finally, the rates of vaccination against common diseases is low nationwide (Knips, 2004).

#### Uncertain land tenure

Uncertain land titling and tenure is mostly the result of unclear government policies. Livestock production depends on land for grazing and availability of feedstuffs. Furthermore, land ownership increases the financial security of farmers—allowing for increased investment towards essential resources (breeding, health services, supplementary feed). Vulnerable groups, particularly women farmers and indigenous populations, are at risk to land-rights insecurity (USAID, 2011).

#### Feed availability

High quality feed is limited in Cambodia, which is mainly due to prioritization of rice production over livestock. Livestock (mainly cattle and buffalo) are restricted from grazing during the wet season, when they pose a risk to the growing rice crop. During this time of year, forage is largely dependent on cut-and-carry harvest methods that are highly labor intensive, taking up six hours per day for the average farmer (Pen et al., 2010). During the dry season, livestock are fed a mix of rice stubble, straw, and broken rice (when available), which are high in crude fiber but low in protein; this nutrient composition results in a poor body condition and low growth rates. Finally, low feed availability affects breeding potential, especially in cattle, often leading to prolonged anestrus (Perry et al., 1991; Lalman et al., 1997).

## **4. Marketing and Exports**

Livestock export is minimal from Cambodia. In terms of international trade, garment and forestry products account for over 60% of all exports (FAO, 2005). There is some live animal trade, predominantly cattle and buffalo, to Vietnam and Thailand. This is due to the increase in demand for red meat in neighboring countries (Pen et al., 2013). Animals are often moved through informal border crossings, mainly by herding livestock through forests or transport via small roads. This makes it difficult to estimate the number of animals leaving and entering Cambodia. Monitoring trade is further complicated by the lack of a formal monitoring system (Ramsay & Maclean, 1998).

## **Marketing system**

### Actors and profits

The livestock market in Cambodia reflects its production systems, meaning the market system is largely informal and extensive. The livestock market relies on local buying, selling, and trading between the following major actors: farmers, middlemen traders, slaughterhouses, retailers, and consumers. The core of livestock trade is local, in-town buying and selling between farmers, rather than sale to slaughterhouses or nonlocal market sellers (Ahuja, 2012). Research has found that the livestock system depends significantly on middlemen who come to various towns to buy directly from the farmer. Middlemen then transport live animals to slaughterhouses closer to urban centers. Farmers do not typically bring livestock to town to sell directly to slaughterhouses (Ramsay & Maclean, 1998).

### Role of the government

The role of the government in livestock marketing is minimal. There is little data on regulated taxation on livestock products, including value-added items (e.g., hides, processed meat) (Knips, 2004).

## **Major markets**

### Domestic

Cambodia's livestock market runs at an export deficit. Pigs, eggs, milk, and some poultry are imported to meet domestic demand for livestock products. The deficit between milk production and consumption is particularly severe with Cambodia importing approximately 78% of its milk (FAO, 2005). Demand for meat is rising more rapidly in urban centers than rural areas. As a result, livestock and livestock products are transported from smallholder farms to larger cities and are rarely consumed by the farmer (Kerr et al, 2012).

### Export

Livestock trading partners of Cambodia include Thailand and Vietnam as the major contributors, and Laos as a secondary contributor. Cambodia also serves as a channel to transport livestock, mainly cattle, from Thailand to Vietnam and vice versa. Through an "early harvest" agreement with China, Cambodia enjoys free access to Chinese markets during select times of the year. The Association of South East Asian Nations (ASEAN) Free Trade Area Common Effective Preferential Tariff regulates a reduced tax rate of 10% for imported livestock (FAO, 2005).

## **Key bottlenecks of market systems**

In 2002, Cambodia moved to a decentralized government strategy, a plan that intended to give local governments greater control over their economies. This has resulted in unequal taxation of smallholder farmers and becomes particularly evident in the transport costs of livestock. According to Ear (2005) taxation per animal can go up to 3,500 Riels per kilo, or 5.8% of the total profit for that animal.

Finally, high production costs of Cambodian meat (due to lack of feed, poor land security, and limited access to markets) make it difficult for Cambodian farmers to compete in the international market (Knips, 2004). The possibility of lower-cost imported eggs and meat, for example, increase the risk to the smallholder farmer and decrease

motivation to invest in livestock as an income-generating activity (FAO, 2005).

Poor market infrastructure, primarily roads, also reduces participation and access of smallholder farmers to livestock marketing systems. Demand for meat is concentrated in urban centers, which requires meat or animals to be transported from rural areas into cities. Without sufficient income to invest in transport

vehicles, or reliable roads to travel, transport of livestock represents a risk to the average farmer (FAO, 2005).

## **5. Processing: traditional and modern systems**

Processing of livestock products (meat, eggs, dairy) is minimal in Cambodia. This is mainly due to lack of infrastructure, namely processing facilities, and investment in processing. Instead, processing of livestock products is largely traditional and products are taken from slaughterhouses or farms, to a middleman trader, to a retail center. Less often, products are sold directly from farmer to retailer or consumer. Cambodia relies on imports, primarily from the United States, for processed meat and dairy products (FAO, 2005).

### **Slaughterhouses and other facilities**

The majority of slaughterhouses in Cambodia use traditional processing methods. Animals are inspected prior to slaughter by a veterinarian, who then assesses meat quality after slaughter. The cost of veterinary inspection is about \$0.75USD/head (Muniroth et al., 2015). Most Cambodian slaughterhouses use simple tools rather than mechanized equipment. Weight is only taken after slaughter prior to sale. Processing at a slaughterhouse outside of Phnom Penh costs vendors approximately \$2.50-\$3.75USD per animal; however, the cost is higher in the capital (Muniroth et al., 2015). The meat sold “hot” to consumers, meaning meat is not refrigerated prior to sale (FAO, 2010). In general, blood is collected and sold separately from meat and viscera. Internal organs (offal) are in high demand in Cambodia because they play a large role in traditional cuisine (RGC & EU, 2003).

### Key Bottlenecks

Following decentralization of the Cambodian government, slaughterhouses have reorganized from a few centralized processing centers into many small-scale, privatized slaughterhouses (Knips, 2004). This has raised several issues including a decline in hygienic practices caused, at least in part, by reduced governmental oversight. Major contributors to poor facility management practices include lack of knowledge about food safety and minimal facility mechanization (including unidirectional slaughter and refrigeration) (Muniroth et al., 2015). Not surprisingly, this has led to an increased incidence of food-borne diseases, raising concerns from the Department of Animal Health and Production (DAHP) in Phnom Penh and Provincial DAHPs outside of the capital (Schlundt et al., 2004).

## **6. Consumption**

### **Domestic trends and preferences**

The average Cambodian diet consists primarily of rice, which accounts for two-thirds of the daily caloric intake (IFADa, 2013). Fish constitutes 80% of consumed animal protein and is considered the secondary staple food. Rice and fish are supplemented with sparing amounts of vegetables, fruit, poultry, and meat (IFADa, 2013). Meat consumption has been gradually increasing, primarily in Cambodian urban centers. When rural buyers purchase meat, they have a preference for higher fat content than urban consumers, who typically prefer leaner meat (Jabbar et al., 2010). According to a study by Borin et al. (date), 60% of urban and rural consumers are willing to pay 10% more for guaranteed higher quality meat. Food safety, however, is a greater priority among rural consumers, who also are more willing to pay a 10% premium for meat that is guaranteed safe (Jabbar et al., 2010).

## **Export trends and preferences**

Cambodia has served as a channel for livestock export between Thailand and Vietnam for the past 10 years. The economic growth of Thailand and Vietnam has led to huge increases in demand for livestock, predominantly cattle. Rising incomes in Thailand and Vietnam have led to a shift in dietary preferences for high quality protein over traditional staples (i.e. rice) (FAO, 2004).

## **7. Major Projects**

### **Production**

Many production projects focus on improving feeding systems. Poor animal nutrition is a limiting factor of Cambodia's livestock market, and improved forage is seen as a key opportunity for increasing the income-generating potential of livestock. In 2011, IFAD funded a program that extended through Cambodia, Laos, and Vietnam, a region also referred to as the CLV development triangle. Implementation of the project, officially called the *Improved Forage-Based Feeding Systems for Smallholder Livelihoods in the Cambodia-Laos-Vietnam Development Triangle*, is overseen by the International Center for Tropical Agriculture (CIAT) (Maxwell, 2012). Two main objectives of this project are (1) to introduce a forage crop based production system (FCP) through forage seed banks and (2) to increase adoption of improved forage by farmers (Nguyen, 2012).

It is important to note that almost all funding for the Department of Animal Health (DAHP) comes from grants. The FAO, French Authorities, and the European Commission all fund livestock based health projects through cooperation with the RGC's DAHP (Ear, 2005).

### **Processing**

The FAO and the European Commission (EC) collaborate on a project that targets food safety in small processing facilities outside of Phnom Penh. Participants in the program, officially titled *Micro and Small Enterprise Development to Achieve Food Security, Food Safety And Self-Reliance for Urban Poor In Phnom Penh*, are predominantly low-income residents in peri-urban areas. FAO and EC work to establish 200 small businesses that focus on food processing and aquaculture, while strengthening knowledge and practice of food safety and quality (FAO, 2011).

## Literature Cited

- An introduction to Cambodia's inland fisheries. (n.d.). Mekong Development Series, 4. Retrieved from <http://www.mrcmekong.org/assets/Publications/report-management-develop/Mek-Dev-No4-Mekong-Fisheries-Cambodia-Eng.pdf>
- Baran E., "Mekong fisheries and mainstream dams", Fisheries sections in: ICEM 2010, Mekong River Commission Strategic Environmental Assessment of hydropower on the Mekong mainstream, International Centre for Environmental Management, Hanoi, Viet Nam, pp.145, 2010.
- CIA. (2015). CIA World Factbook. Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/geos/cb.html>
- Department of Animal Health and Production. 2015. Overview of the Livestock Industry in Cambodia. Retrieved from <http://www.dahp-maff.org/blog/overview-of-the-livestock-industry/>
- Devendra, C. 2012. Rainfed areas and animal agriculture in Asia: The wanting agenda for transforming productivity, growth, and rural poverty. *Asian-Australas J Anim Sci*, 25(1), 122–142. <http://doi.org/10.5713/ajas.2011.r.09>
- Ear, S. 2005. The political economy of pro-poor livestock policy in Cambodia. Pro-Poor Livestock Policy Initiative. Retrieved from <http://r4d.dfid.gov.uk/PDF/Outputs/Livestock/PPLPIwp26.pdf>
- Eliste, Paavo; Zorya, Sergiy. 2015. Cambodian agriculture in transition: opportunities and risks. Washington, D.C. World Bank Group. Retrieved from <http://documents.worldbank.org/curated/en/805091467993504209/Cambodian-agriculture-in-transition-opportunities-and-risks>
- FAO. 2011. Food and Agriculture Organization of the United Nations. Cambodia and FAO: Achievements and success stories. Retrieved from <http://www.fao.org/3/a-at004e.pdf>
- 2010. Abattoir development: Options and designs for hygienic basic and medium-sized abattoirs (Animal Production and Health Commission for Asia and the Pacific). Retrieved from <http://www.fao.org/docrep/010/ai410e/AI410E00.htm#Contents>
  - 2005. Livestock Sector Brief: Cambodia. Retrieved from [http://www.fao.org/ag/againfo/resources/en/publications/sector\\_briefs/lisb\\_KHM.pdf](http://www.fao.org/ag/againfo/resources/en/publications/sector_briefs/lisb_KHM.pdf)
- Harding, M., Quirke, D., & Werner, R. 2007. Cattle and buffalo in Cambodia and Laos: The economic policy environment for smallholders. ACIAR, Australia. Retrieved from <http://aciarc.gov.au/files/node/5196/Final%20Report%20PLIA-2006-012%20part%202.pdf>
- Huynh, T., Aarnink, A., Drucker, A., & Verstegen, M. 2007. Pig production in Cambodia, Laos, Philippines, and Vietnam: A review. *Asian Journal of Agriculture and Development*, 3(1 & 2), 70–90.
- ILRI 2012. International Livestock Research Institute Asian livestock: Challenges opportunities and the response. Bangkok, Thailand. Retrieved from <http://www.fao.org/docrep/017/i3166e/i3166e00.pdf>

- Jabbar, M., Baker, D., & Fadiga, M. 2010. Demand for livestock products in developing countries with a focus on quality and safety attributes: Evidence from case studies (Research report No. 24). International Livestock Research Institute (ILRI). Retrieved from <http://ageconsearch.umn.edu/bitstream/97973/2/2010-Demand%20for%20quality%20in%20livestock%20products-ILRIRR24.pdf>
- Kerr, J., Sieng, S., & Scoizec, A. 2012. Working with traders to understand livestock movements and spread of animal diseases in Cambodia and Lao PDR (Animal biosecurity in the Mekong: Future directions for research and development) (pp. 59–64). ACIAR, Australia. Retrieved from [http://aciarc.gov.au/files/node/14481/pr137\\_pdf\\_76587.pdf#page=60](http://aciarc.gov.au/files/node/14481/pr137_pdf_76587.pdf#page=60)
- Knips, V. 2004. Review of the livestock sector in the Mekong countries. Food and Agriculture Association of the United Nations (FAO). Retrieved from [http://www.fao.org/ag/againfo/resources/en/publications/sector\\_reports/lsr\\_mekong.pdf](http://www.fao.org/ag/againfo/resources/en/publications/sector_reports/lsr_mekong.pdf)
- Lalman, D. L., Keisler, D. H., Williams, J. E., Scholljegerdes, E. J., & Mallett, D. M. 1997. Influence of postpartum weight and body condition change on duration of anestrus by undernourished suckled beef heifers. *Journal of Animal Science*, 75(8), 2003–2008.
- Ly, S., Mejia, C., & Aldaz-Carroll, E. 2015. EAP Update April 2015-- Cambodia. Retrieved from [http://www.worldbank.org/content/dam/Worldbank/document/EAP/cambodia/Cambodia\\_EAP\\_Update-Apr2015\\_ENG.pdf](http://www.worldbank.org/content/dam/Worldbank/document/EAP/cambodia/Cambodia_EAP_Update-Apr2015_ENG.pdf)
- Maxwell, T. W., Songly, Y., Ung, B., Peou, L., & Reid, J. 2012. The social and other impacts of a cattle/crop innovation in Cambodia. *Agricultural Systems*, 107, 83–91. <http://doi.org/10.1016/j.agsy.2011.10.008>
- Ministry of Agriculture, Forestry, and Fisheries [MAFF]. 2015a. Agricultural Extension Policy in Cambodia. Retrieved from <http://faolex.fao.org/docs/pdf/cam152453.pdf>
- 2015b. Agriculture Sector Strategic Development Plan 2014-2018. Retrieved from <http://twgfr.org/download/Meetings/DP%20Meeting/DP%20Meeting%20on%2016-Feb-2015/8-Draft%20Agriculture%20Strategic%20Development%20Plan%202014-2018.pdf>
- National Institute of Statistics, Ministry of Planning 2008. Provisional Population Totals of Population Census 2008. Retrieved from <http://www.nis.gov.kh/index.php/en/find-statistic/site-administrator/cips-2004/provisional-pop-cen-2008?highlight=WyJwb3B1bGF0aW9uIl0=>
- National Institute of Statistics, Ministry of Planning in collaboration with the Ministry of Agriculture, Forestry and Fisheries 2015. Census of Agriculture of the Kingdom of Cambodia 2013. Retrieved from <http://www.nis.gov.kh/index.php/en/find-statistic/economic-statistics/cac2013>
- Muniroth, S., Patrick, I., & Smith, G. 2015. Cattle market chain in South-East of Cambodia (No. AH/2010/046). ACIAR, Australia. Retrieved from <http://aciarc.gov.au/project/ah/2010/046>
- Muyhong, C. 2014. Milking the market: Hope for dairy producers. Phnom Peng Post. Retrieved from <http://www.phnompenhpost.com/post-weekend/milking-market-hope-dairy-producers>
- Naron, H. C. 2012. Cambodian Economy: charting the course of a brighter future: a survey of progress, problems, and prospects. Institute of South East Asian Studies.

- Nguyen, A. 2012. Improving forage-based feeding systems in the Cambodia-Laos-Vietnam development triangle. CGIAR. Retrieved from <https://livestockfish.cgiar.org/2012/05/01/improving-forage-based-feeding-systems-in-the-cambodia-laos-vietnam-development-triangle/>
- Otte, J. 2014. Bridging the technology gap for ASEAN livestock production. First ASEAN Regional Conference on Animal Production (1st ARCAP), 1–5. Retrieved from <http://www.cabi.org/cabdirect/FullTextPDF/2014/20143322988.pdf>
- Pen, M., Savage, D., Stur, W., Lorn, S., & Seng, M. 2010. Cattle feeding and management practices of small-holder farmers in Kampong Cham Province, Cambodia. *International Journal of Environmental and Rural Development*, 1(1), 132–138. Retrieved from <http://iserd.net/ijerd11/11132.pdf>
- Perry, R. C., Corah, L. R., Cochran, R. C., Beal, W. E., Stevenson, J. S., Minton, J. E., Brethour, J. R. 1991. Influence of dietary energy on follicular development, serum gonadotropins, and first postpartum ovulation in suckled beef cows. *Journal of Animal Science*, 69(9), 3762–3773.
- Pham, L., Smith, D., Sotheun, S., & Vitau, S. 2015. Cambodia beef cattle industry. Regional Workshop on Beef Markets and Trade in Southeast Asia and China. Retrieved from <https://www.uq.edu.au/agriculture/docs/CAEG/Cambodia.pdf>
- RGC 2013. Royal Government of Cambodia.. Rectangular Strategy for Growth, Employment, Equity, and Efficiency Phase III. Retrieved from <http://faolex.fao.org/docs/pdf/cam145560.pdf>
- 2015. Agriculture Sector Strategic Development Plan 2014-2018. Retrieved from <http://twgfr.org/download/Meetings/DP%20Meeting/DP%20Meeting%20on%2016-Feb-2015/8-Draft%20Agriculture%20Strategic%20Development%20Plan%202014-2018.pdf>
- Royal Government of Cambodia (RGC) and European Union (EU) 2003. Livestock marketing in Cambodia (Technical Assistance Report). Retrieved from [http://cdn.aphca.org/dmdocuments/Study/PAP\\_07\\_Cambodia%20Livestock%20Marketing.pdf](http://cdn.aphca.org/dmdocuments/Study/PAP_07_Cambodia%20Livestock%20Marketing.pdf)
- Saroeun K., Sokerya S., Samkol P., Ty C., Theara S., Sunnara S., Sokchea H., Soveasna M. and Borin K. 2007. Assessment of pig production, feed and feeding practices in three main agro-ecological zones of Cambodia. Center for livestock and Agriculture Development, MEKARN Regional Conference 2007: Matching Livestock Systems with Available Resources.
- Sath, K. 2012. Nutrient utilization in growing Cambodian cattle: Effect of different feed sources and feed conversion techniques. SLU Service/ Repreo, Uppsala. Retrieved from [http://pub.epsilon.slu.se/9276/1/sath\\_k\\_121129.pdf](http://pub.epsilon.slu.se/9276/1/sath_k_121129.pdf)
- Sath, K., Borin, K., & Preston, T. (2008). Survey on feed utilization for cattle production in Takeo province. Livestock research for rural development. Retrieved from <http://www.lrrd.org/lrrd20/supplement/sath1.htm>
- Serey, M., Mom, S., Kouch, T., & Bunna, C. 2014. Cattle production systems in NW Cambodia. *Livestock Research for Rural Development*, 26(3). Retrieved from <http://www.lrrd.org/lrrd26/3/sere26042.htm>
- Sothath, N., & Sophal, C. 2010. Agriculture sector financing and services for smallholder farmers. Cambodian Economic Association (CEA). Retrieved from

[http://takkagri.weebly.com/uploads/3/0/3/1/30319257/aep\\_agriculture\\_financing\\_english\\_final.pdf](http://takkagri.weebly.com/uploads/3/0/3/1/30319257/aep_agriculture_financing_english_final.pdf)

Stratton, J., Toribio, J.-A. L. M. L., Suon, S., Young, J. R., Cowled, B., & Windsor, P. A. 2015. Are Village Animal Health Workers Able to Assist in Strengthening Transboundary Animal Disease Control in Cambodia? *Transboundary and Emerging Diseases*, n/a–n/a.

<http://doi.org/10.1111/tbed.12432>

Tornimbene, B., Chhim, V., Sorn, S., Drew, T. W., & Guitian, J. 2014. Knowledge, attitudes and practices of Cambodian swine producers in relation to porcine reproductive and respiratory syndrome (PRRS). *Preventive Veterinary Medicine*, 116(3), 252–267.

<http://doi.org/10.1016/j.prevetmed.2013.12.009>

UNDP 2011. United Nations Development Project. *Climate Change and Agriculture: Cambodia Human Development Report 2011*. Retrieved from

[http://hdr.undp.org/sites/default/files/cambodia\\_2011\\_nhdr\\_thematic\\_highlight\\_agriculture\\_eng.pdf](http://hdr.undp.org/sites/default/files/cambodia_2011_nhdr_thematic_highlight_agriculture_eng.pdf)

USAID 2012. *Animal feed assessment: Final report (Cambodia MSME 2/BEE Project)*. Retrieved from

[http://pdf.usaid.gov/pdf\\_docs/pnaec939.pdf](http://pdf.usaid.gov/pdf_docs/pnaec939.pdf)

USDA 2010. United States Department of Agriculture Cambodia: Future growth rate of rice production uncertain (Commodity Intelligence Report). Retrieved from

<http://www.pecad.fas.usda.gov/highlights/2010/01/cambodia/>

Wallberg, E. 2011. Small scale pig production in Takeo province in a rural area of Cambodia. Department of Animal Nutrition and Management: Swedish University of Animal Science, 1–23. Retrieved from

[http://stud.epsilon.slu.se/3632/1/wallberg\\_e\\_111121.pdf](http://stud.epsilon.slu.se/3632/1/wallberg_e_111121.pdf)

World Bank 2016. *Country Overview Cambodia*. Retrieved from

<http://www.worldbank.org/en/country/cambodia/overview>