

Sharing Lessons of Smallholders' Pig System in South Asia and Southeast Asia: a Review

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Abstract

South Asia and Southeast (SE) Asia have some historical links from the past in respect of religion, tradition, culture, food habits, trade, language and population migration. Pig rearing is an important part of smallholders' livelihood and socio-cultural belief among pig producers in both regions. Its distribution is largely determined by ethnicity and religion. Because of socio-religious sentiments towards pig rearing and pork consumption, pigs population in South Asia is much smaller than in SE Asia. Vietnam and the Philippines are the two major producers of pig among the SE Asian countries while India is the leading country in South Asia. The pig sub-sector in some of the countries in SE Asia is growing at a faster pace because of industrialisation of farming system and transformation of smallholder backyard system to more commercial farming system in response to market demand. Industrialisation of pig farming in South Asia is yet to take place although the transformation is going on at a slower pace. Naturally, SE Asia is endowed by a few more productive indigenous breeds compared to South Asia. Artificial insemination in pigs is more widely prevalent in SE Asia than in South Asia, although natural breeding is still predominant at smallholders' level in both regions. Feed regime for pigs is found to be better in SE Asia than in South Asia in terms of use of more grains and protein sources. Cultivation of food-feed crops (sweet potato, maize, cassava etc.) for feeding of pigs is more popular in SE Asia than in South Asia. The housing system in both regions is in a transformation stage from scavenging to semi-intensive to intensive although the degree widely varies among the countries. There are many common diseases affecting pigs in both regions. Among these, classical swine fever (CSF) is a major disease affecting pigs in both regions. Vaccination against CSF is more common in SE Asia than in South Asia. The porcine reproductive and respiratory syndrome (PRRS) that has been posing a major threat to the pig industry in SE Asia for the last several years has just been reported recently in South Asia (NE India). Disease prevention mechanisms through vaccination and deworming are more common and widely practiced in SE Asia. Marketing system of pig/ pork in rural areas is almost the same in both regions although it is more advanced in urban centers in SE Asia. The pig subsector in SE Asia has been a prominent component of the government development policies more than it has historically been in South Asia. Export market for pork is more vibrant and growing rapidly in a few countries (eg. Thailand, Vietnam) in SE Asia while this is almost nil in South Asia. Pork safety is an important issue in both regions although there are wide country variations. Overall, the pig subsector in SE Asia is more advanced in terms of wider prevalence of better breed, feed, healthcare, processing and market infrastructure including industrial farming system and export-import market than South Asia. It could be anticipated that South Asia could be benefited from some of the lessons of pig systems in SE Asia.

1. Introduction

From the ancient time, there has been a social and cultural connection between southeast (SE) Asia and South Asia which is evident from the use of several Sanskrit names in SE Asia e.g. *Suvarnabhumi* (land of gold), *Suvarnadvipa* (island of gold), *Narikeladvipa* (island of coconuts), *Karpuradvipa* (island of camphor) etc. (Mishra, 2001). In the past, the Sanskrit language, the Hindu-Buddhist culture and the Indian concept of royalty were the predominant features in SE Asia. A strong influence of Hinduism can be observed in the presence of several ancient Hindu temples of God and Goddesses in the region and the missionary activities of the Buddhists. This could also be presumed from the popularity of the stories of the great epic of Hindu- *Ramayana* and Hindu deities in SE Asia.

On the other hand, most tribal people residing in North East (NE) India, a region geographically adjacent to Myanmar and China, migrated from SE Asia including China at different times in the past, according to the region's history. Most of the people in NE India and Bhutan exhibit the culture, tradition, language and food habits that are closer to SE Asian culture. This area brings both the regions together which enabled cultural amalgamation of both regions.

Among different links between both regions, one link was related to the practices of pig production and marketing. In this paper, we discuss the similarities and differences among South and SE Asian countries in respect of pig production and marketing system. We analyse the pig system of both regions from the macro-level perspective on the basis of our understanding of both regions and review of existing literature. For micro-level analysis, more structured study needs to be conducted in both regions to capture the diversity across countries in terms of population, landmass, per capita GDP, economy, government policies and programmes and religion. The key objective of this paper is to contribute to building a basic understanding about the pig systems that prevail in both regions and to benefit from each other's learning and experience.

Definitions of the regions may vary, but it is generally considered that SE Asia comprises of Myanmar, Thailand, Laos, Vietnam, Cambodia, Indonesia, Malaysia, Singapore and the Philippines while South Asia is comprised of India, Nepal, Bhutan, Bangladesh, Sri Lanka, Pakistan, Afghanistan and Maldives. The regions meet at the hilly terrains of North East India and Myanmar.

2. Pig systems in South Asia and SE Asia- basic comparison

Asia is the largest producer of pork in the world accounting for 56% of global pork production (109,216 thousand tones), surpassing Europe (25%) and America (17%). China alone accounts for 48% of the total pork production in the world (FAOSTAT, 2011). In most of SE Asian countries, pig is the most important livestock species and pork is the most preferred meat, except in Thailand, Indonesia, Malaysia and Myanmar where chicken is more important (FAO, 2007). In contrast, pig is not considered as an important livestock species in South Asia and pork is not a commonly preferred meat in most parts of the region largely due to cultural preferences. Because of ethnicity and religious taboo associated with consumption of pork, pig rearing/ pork consumption is popular only in certain areas dominated by tribal people, lower caste Hindu people and Christian people in South Asia.

In both regions, pigs play an important role in the livelihood of rural communities. It contributes about 20-30% of the rural household income but can be higher, even up to 41% in North Vietnam (Lemke et.al, 2007). Apart from the economic functions, pigs also play important socio-cultural functions. Considering the importance of piggery in the life and livelihood of people in SE Asia, governments give more attention to the development of this sector than in South Asia where pigs are not considered as an important livestock species for the people. In both South and SE Asia, small-scale pig rearing in the backyard is the most predominant practice. The percentage of smallholders and average size of farms varies from country to country. In Vietnam, Laos, The Philippines and Cambodia, about 80% of pigs are raised by smallholders (Huynh et al.). In Myanmar, the percentage may go above 90% as commercial pig farming accounts for only a small portion of

total pig production. Exceptionally, in Thailand around 80% of pigs produced are from intensive farming systems and 56% of these are from farms with over 1000 pigs (Cameron, 2000). In South Asia, the percentage of pigs under smallholders system would be more than 95%. The definition of a smallholder pig farm varies amongst countries. For instance, in the Philippines and Vietnam, a small farm has less than 20 pigs, while small farms in Myanmar, Cambodia and Laos have less than 5 pigs (FAO, 2005). The case is similar in South Asia where smallholder farms rear less than 5 pigs, mainly 1-3 pigs (Deka et al. 2007).

Large scale pig farms account for 15-20% of the total regional pig population (Northoff 2006). Of these, about 15% belongs to medium scale and 5% belongs to large scale (La et. al 2002). Pig farming in peri-urban areas and most of the cities of the Philippines, Cambodia, Indonesia, Thailand and Vietnam is becoming more commercially-oriented, rearing 2,000-18,000 pigs per farm; however, the speed and extent of commercialization varies from country to country (Huynh et al.). This commercial sector produces most of the slaughter pigs for the commercial market. These farms are well-equipped, well-managed, and have a high productivity level. Alongside, there are joint ventures and private large-scale commercial companies involved in breeding herds, fattening, feed supply, slaughter, and processing. The commercial pig industry sometimes also arranges a contract with small farmers to grow and fatten pigs (Lapar et al. 2003). Such companies provide all the inputs and other technical support, while the farmers supply labour and the housing facilities.

Unlike SE Asia, there is hardly any big pig industry under the private or government sector in South Asia. Also, there are no big contract farmers or integrators. Indeed, there are some small-medium size farms both under government and private sector which houses 10-500 pigs. This may account for less than 5% of total pig population in the region. The government farms are mainly meant for supplying quality piglets to smallholders. Some of these government farms are running well while others are not.

3. Distribution of Pigs

In SE Asia, major concentrations of pigs are found (Fig 2) particularly around the major urban centres of Vietnam (around Hanoi in the north and Ho Chi Minh in the south), around Manila area in the Philippines, and around the Bangkok area in Thailand (Costales, 2007), around Phnom Penh in Cambodia, northern mountainous part in Lao PRD, some part of Indonesia, Malaysia and Myanmar. In South Asia, pig population is mainly concentrated in the North Eastern part of India, some parts of Northern and Southern India, eastern hill zones of Nepal (Joshi, 2008), costal belts of Western and North western provinces of Sri Lanka, and southern parts of Bhutan. In Bangladesh, there are some thousands pigs reared by some minority group of people who reside particularly in Rajshahi, Chapainawabgonj, and Naogaon areas but exact figures are not available (Biswas, 1992). Pig rearing is not popular in rural areas of Sri Lanka because of objections raised by religious groups and environmentalist (FAO). In Pakistan, domesticated pigs are not available. There are several thousand wild boars available in Punjab and Sind province and in and around Islamabad city which cause nuisance to Pakistani Muslim people. Wild boar is considered as an important vertebrate pest in Pakistan agriculture (Brooks & Ahmed). It is reported that in Afghanistan, there is only one pig that is kept in the zoo (Motevalli, 2009).

In SE Asia, the majority of households rear pigs with the exception of Muslim population in Indonesia and Malaysia and some Buddhist groups in Myanmar and Laos. Myanmar's Buddhist sentiment does not permit them to rear pig or slaughter animals (National Consultative Committee report, Myanmar). But of late this religious sentiment is disappearing and both pig production and consumption are growing rapidly in the country. However, in South Asia, pigs are not socially well accepted. There is strong religious sentiment against rearing and consumption of pork among the Muslims and high caste Hindu and Buddhist groups. In India, Nepal, Bhutan and Sri Lanka, mainly the tribal people (eg. Bodo, Karbi, Mising, Naga, Mizo, Khasi etc. in NE India), lower caste Hindu people (eg. Rai, Limbu, Magar, Tamang, Gurung, Sherpa & Tharu in Nepal & Bhutan), and Christian people (in NE India and some part of South India) rear pigs. Of late, pig rearing and consumption is gaining popularity among the other communities as well. Traditionally, Muslim people neither rear pigs nor consume pork.

Table 1: Pig population and growth in South and Southeast Asian countries (2013)

| South East Asia | | | South Asia | | |
|-----------------|--------------------|--------------------|-------------|------------|--------------------|
| Country | Population | Growth in 2013 (%) | Country | Population | Growth in 2013 (%) |
| Cambodia | 2,150,000 | 1.40 | Bhutan | 15,373 | -91.79 |
| Indonesia | 8,246,000 | 4.20 | India | 9,300,000 | -1.08 |
| Lao PDR | 2,280,000 | -22.54 | Nepal | 1,160,035 | 1.94 |
| Malaysia | 1,725,000 | -4.27 | Sri Lanka | 90,000 | 0.83 |
| Myanmar | 10,530,000 | 0.28 | Bangladesh | | |
| Philippines | 11,843,051 | -0.17 | Pakistan | | |
| Thailand | 7,850,000 | 0.64 | Afghanistan | - | |
| Vietnam | 26,261,400 | -0.89 | | | |
| Cambodia | 2,150,000 | 1.40 | | | |
| China | 482,248,000 | 1.70 | | | |

Source: FAOSTAT, 2014

Among the Southeast Asian countries, Vietnam has the highest pig population (26.26 million) followed by the Philippines (11.84 million) and Indonesia (8.24 million). In terms of growth in pig population (please see the Table 1), Indonesia is the front runners, many other countries are showing negative growth. In South Asia, India is the largest producer of pigs with 9.30 million pigs, followed by Nepal (1.16 million) and Sri Lanka (0.090 million). In India, pig population started showing a declining trend from 2003; total pig population declined from 13.5 million (in 2003) to 11.13 million (in 2007), registering a negative growth of 4.74% during that period and further declined to 10.29 million (in 2012) registering a negative growth of 7.54% during 2007-'12 (Govt. of India, 2014).

4. Breeds and Breeding

In both South and SE Asia, pigs are either reared for breeding or fattening purpose, or for both, but the percentage of smallholders rearing pigs for breeding purpose is relatively higher in SE Asia than in South Asia.

There are several indigenous breeds of pigs available in both SE and South Asia. For instance, Mong Cai, Muong Khuong, Soc, Meo and Ban pigs in Vietnam (Costales, 2007), short eared pigs in Thailand (Nakai, 2008); Lath, Chid, Hmong and Khong pig in Lao PDR; native pig (small head, concave back, pendulous belly) in Myanmar; Bampudke, Chwanche and Hurra in Nepal (Joshi, 2008); Dogar, Darla, Bongo, Naja, Machay Madhuri pigs in Bhutan (Nidup, 2010); Mini Pig in Sri Lanka; Ghungroo, Ankamali, Doom pigs in India, have been documented. Most of the indigenous pigs of SE Asia are considered to be different from South Asia mainly in two aspects: a) Indigenous pigs of SE Asia are fatter compared to that of South Asian pigs and b) Indigenous pigs of SE Asia generally have concave back while indigenous pigs of South Asia have straight back. It is observed that some of the indigenous breeds of pigs in SE Asia are more productive (eg Mong cai pigs in Vietnam) than indigenous pigs in South Asia. Overall however, the indigenous breeds of SE and South Asia are low productive compared to exotic breeds or their crosses available in both regions. Despite low productivity of indigenous pigs, they are hardy, resistant to many diseases, achieve early sexual maturity and adaptable to harsh rural environment under low inputs. Also in local markets, pork from indigenous pigs fetches a premium price. Because of these strengths, a section of pig producers from India, Nepal, Sri Lanka (60% of total pigs), Bhutan, Myanmar, Thailand, Vietnam and Laos still prefer to rear indigenous breeds, although their population is sharply decreasing over the years because of indiscriminate crossing/ replacing with the improved breed/exotic pigs.

In near urban cities as well as in well accessible rural areas of SE and South Asia, pig population is dominated by cross-bred pigs. In Vietnam, only 10% of the smallholder pig producers rear exotic breeds; others raise mainly local breeds or a mixture of local and cross-breeds (CAP-ILRI). The story is the same in the case of South Asia although the percentage of exotic pigs reared by smallholders is negligible. The large majority of smallholders rear cross bred pigs (Deka et. al., 2007). Artificial insemination (AI) is an effective technology for breeding, although it is available only in well accessible rural areas or near the boar station and in big commercial farms (Lemke et al, 2007). In South Asia, AI is not a popular practice. It is available sporadically in certain pockets. Therefore, inadequate availability of good breeding stock is the major challenge for improvement of piggery in South Asia.

In rural areas, natural breeding is still predominant throughout SE and South Asia. In the villages, only a few households rear boars which are used for breeding sows in the villages irrespective of their breed/ size. Natural breeding is fee based in both regions, and payment for boar services is usually in cash or in kind (Deka et al. 2007). In both regions, smallholders have inadequate knowledge about the breeding system and breeding management.

The industrial pig production system in SE Asia is dominated by exotic pigs. The major exotic breeds available in the region are Hampshire, Landrace, Tamworth, Saddleback, Large White Yorkshire, Duroc and Large Black. In South Asia, most of the government farms reported to have pigs of exotic nature that mainly belong to Hampshire, Large Balck, Large White Yorkshire, Duroc and Saddleback

breed. Government institutes in India is also promoting a cross breed called T&D and a local breed called Ghungroo. The private pig farms in SE Asia supply almost all the grandparent stock, breeding sows, and piglets to medium scale producers in and around the cities. These industrial farms are well-equipped, well-managed and have a high productivity. In South Asia, there is hardly any of that kind of private parent stock farm.

5. Feeds and Feeding

Smallholder farmers use locally available feedstuffs using family labour (Tu et.al, 2010, Deka et al. 2007). Pigs are fed mainly with kitchen wastes and rice bran, and occasionally limited amounts of purchased concentrates. Pig feeds mainly depend on availability rather than on nutritional requirements at different stages of the production cycle (Lemke et al. 2007). This results in low productivity of the pigs. In well accessible rural/ peri-urban areas of South Asia, under confined system of pig rearing, feed is composed mainly of kitchen wastes (leftover foods, vegetable peels), residue of rice beer, bran (maize, millet, wheat, rice), jungle forages, pumpkins, yams, taro etc. While in some SE Asian countries, smallholders use a mixture of concentrate feed (maize, rice polish, wheat bran, soybean meal, oil cakes etc) and crop by-products like cassava leaves/ meals, sweet potatoes, fresh sweet potato vine, small amount of salted fish water hyacinth, water spinach (*Ipomoea reptans*), banana tree, soya bean, cotton seed, coconut oil, fish meal, rice meal, and sea shells etc. (Kunavongkrit and Heard, 2000). In both regions, non conventional feed ingredients are generally chopped, mixed and cooked before offering to pigs.

As far as feeding regime is concerned, there are variations among the countries/ regions based on topography, cropping system, access to sea fish, agro-ecosystem, food habits of the people, ethnicity of pig producers, socio-cultural belief, religion, accessibility to the market etc. The major noticeable difference between Southeast and South Asia is observed in terms of cultivation practices for feeding of pigs. In SE Asia, cultivation of food-feed crops like sweet potato, maize, tapioca, colocasia (yam) etc. in the backyard for feeding of pigs is a common practice while in South Asia, it is not commonly seen. In Vietnam (the second largest world producer of sweet potato), 75% of sweet potato, mainly vines and roots, is used as pig feed (Peters 2004). In addition to Vietnam, sweet potato-pig system ("Sweet Pig") is playing an important role in the rural economy of many parts of Asia, including China, Philippines, Korea, Taiwan and Indonesia (Bali and Papua). Besides, the pig producers in well accessible rural areas of SE Asia use more concentrate and feed supplements (e.g. minerals and vitamins) compared to that of pig producers in South Asia.

In both regions, pigs at smallholder level do not get adequate feed in terms of quantity and quality. The lack of protein in traditional diet restricts the growth of pigs, with the average daily weight gain being no more than 100 gm per day (Thorne, 2005). Nevertheless, in some SE Asian countries as for instance in Laos, some legume crops (eg. *Stylosanthes guianensis*) are being promoted. High cost of feed is the major problem for managing pigs purely on concentrates in both regions.

Commonly, commercial pig farms use cereal grains with either soybean meal or fish meal or combinations of the two as the feed base (Samkol et.al, 2008). In industrial farms, where only concentrates are fed, pigs grow faster. There is a competition between human food and pig feed for

grains in SE Asia due to increasing use of concentrate in industrial farm, which is not very apparent in South Asia where concentrate feed use for feeding of pigs is negligible.

6. Housing

A few decades ago, most of the pigs in rural areas of SE and South Asia were housed under free-range/ scavenging condition. But over the years, the number of households keeping pigs under free range condition has come down significantly and this has been replaced by tethering/ enclosure/ pan/paddock etc. Nevertheless, scavenging is still considered as an important farming system in Nepal (73% of the total) (Joshi, 2008), Bhutan (13% of the total) (Timsina, 2005), Laos and Cambodia.

In most parts of the rural areas of both SE and South Asia, pigs are housed either in a small confined pigsty constructed usually with locally available materials (stones, wood, bamboo, tree stem, thatch, tins etc.) or in an enclosure. Tethering is also a common and popular practice in certain rural areas (eg. India, Bhutan, Laos). Pig housing in upland areas of both the regions is generally wooden or bamboo-made platform type floor. Pig producers are not very aware about the importance of clean and hygiene practices required in management of farms leaving the farming practices unhygienic, although the degree of cleanliness varies from house to house or place to place. Drainage system and manure disposal process is very poor which may cause air and water pollution. The percentage of households having concrete pig sty in SE Asia is relatively higher than the concrete pig sty available in South Asia.

Under private industrial farming system in SE Asia, there are lot of advancement on scientific housing and management including cage system of pig housing, air condition housing, evaporative cooling method, radio-frequency identification technology for pig identification and trace back etc. In South Asia, such of type of advancement has not taking place in pig housing. Instead, there is a unique system under which a herd of 20-200 pigs are reared under free range condition and the herds are moved from one place to another in search of feed round the year. Earlier, the system was quite popular in plain areas of NE and eastern part of India but the system is losing its existence over the years.

7. Diseases and Prevention

The common diseases affecting the pig population in Southeast and South Asia are classical swine fever (CSF), swine pox, swine erysipelas, porcine reproductive and respiratory syndrome (PRRS)/ porcine blue ear disease, foot and mouth disease (FMD), piglet anaemia, swine dysentery, parasitic infestation (both internal & external), and minor congenital problems like atresia ani, hernia etc. Out of these, classical swine fever is the major disease problem in both regions. Among SE Asian countries, incidence of CSF is higher in Indonesia, Vietnam and the Philippines and much lesser in Singapore, Thailand and Myanmar (Edward, 2000). The disease cause more damage in terms of morbidity and economy in South Asia than SE Asia mainly because of poor vaccination and control programme. In South Asia, less than 2% pigs are vaccinated against CSF, mainly due to inadequate availability of vaccine and/or poor awareness among smallholders. While in SE Asia, 50-90% (the nearer to the town, the higher the percentage) pigs are vaccinated against CSF (in Thailand, no

outbreak has been recorded in the industrial farms). Besides vaccination, there are policies for movement control of diseased animal and slaughter of diseased animal in certain countries like Thailand, Vietnam, and Malaysia (Edward 2000).

In respect of PRRS, it is a major threat to the pig industry in SE Asia because of high morbidity and mortality rate. The disease has already affected pigs in most of the SE Asian countries including Myanmar (Khy, 2011). Of late this has also been reported in NE India, posing serious risk to pig population in the country. The majority of smallholders in SE Asia (for instance 71% in Vietnam) uses deworming drugs while its use in South Asia is much less. The number of pig producers with access to extension and veterinary services is also higher in SE Asia compared to South Asia although there is individual country variation.

Selling of diseased pigs in the market or feeding of leftover meat to pigs is common in many parts of SE and South Asia, both important contributors for transmission of diseases (Northoff 2006).

In both regions, farmers tend to take care of diseased pigs by themselves at initial stage. Only in severe cases do they take the help of veterinarian. They hardly go for costly treatment. Diseased pigs are treated by 80% of households (the nearer to the town, the higher the percentage), dewormed by 71% of households and vaccinated by 88% of households in Vietnam (Lemke, 2007) although the figures significantly varies from place to place. Vietnam has established a disease-free zone about 30 km from Ho Chi Minh City for export purposes (Samkol et al 2008). In South Asia, only a small section of households go for treatment/deworming/vaccinating the pigs. For instance, in NE India about 64% of households treat sick pigs, but about 67% of these households treat the pigs by themselves using pharmaceuticals products or traditional medicine (Bernard et.al, 2012).

8. Market for pigs and pork

Throughout the SE and South Asia, weaners are sold to other farmers/ traders while fatteners are mainly sold to traders and slaughterers (Lemke, 2007). Smallholders in Laos and Vietnam usually sell their pigs in other villages or provinces and need to go through a lot of paperwork, e.g. license, and health quarantine certificates. Certain factors such as the restricted movement due to disease control, high transportation fare, inaccessible market information, and absence of refrigerated lorry serve as limiting factor that prevent remote smallholders from getting a fair market price for their pigs (Huynh et.al). Insufficient marketing outlets, and limited market information, coupled with the lack of guaranteed prices, are major deterrents for small farmers (Sovann and San 2002).

While in South Asia, pigs are mainly traded at the farm gate or in the nearby daily/weekly market, therefore no paper work is generally involved. Traders do not face much problem in transporting the pigs for a short distance but need to avail health certificates for transporting pig from one province/country to another. Unlike SE Asia, in South Asia, there is no such big player in pig/pork market and therefore market competition and price fluctuation is much less.

In SE Asia, pigs are mainly transported by motorbike or by truck while in South Asia, auto van, mini truck, truck, or train are most commonly used for transporting pigs from one place to another.

In rural areas of both regions, pork is marketed mainly through the informal sector as warm, fresh meat. Demand for processed and frozen meat is much higher in SE Asia than in South Asia. In rural areas of both regions, slaughter and selling infrastructure are very poor, resulting in unhygienic slaughtering and selling of pork products. Nevertheless, in many urban areas of SE Asia, pork slaughtering and selling is much more hygienic than in South Asia. In both the regions, pork of indigenous pig fetches higher price than pork of cross bred/ exotic pigs because of perceived better taste of pork of indigenous pigs.

9. Trend of Consumption and Growth

The relative importance of pork as compared to other sources of meat varies among countries in SE Asia. Among the SE Asian countries, Vietnam is the highest consumer of pork (71.5%) in proportion to total meat produced, followed by the Philippines (58.3%), Cambodia (53%), Thailand (36.8%), Laos (32.4%) and Myanmar (27%)(Costales, 2007). On the other hand, poultry is the most popular meat source in Malaysia, Indonesia, and Thailand. The lesser significance of pork in Malaysia and Indonesia could be due to cultural and religious traditions influencing tastes and preferences of the general population. In Lao PDR bovine meat is the most dominant. This may not only reflect consumer preferences but also the relative abundance of resources in the production of cattle and buffalo, as compared to the other countries (Costales, 2007). Among South Asian countries, especially in Nepal, consumption of pork in proportion to total meat would not be more than 7% (Joshi, 2008).

Table 2: Pork production (in tones) and growth in South and SE Asia in 2012

| Country | Production (tones) | Growth in 2012 | Country | Production (tones) | Growth in 2012 |
|--------------|--------------------|----------------|-------------|--------------------|----------------|
| Cambodia | 98,500 | 1.02 | Bhutan | 990 | 2.93 |
| Indonesia | 728,750 | 1.06 | India | 329,171 | 0.00 |
| Lao PDR | 62,000 | 8.71 | Nepal | 18,277 | 1.94 |
| Malaysia | 235,640 | 1.86 | Sri Lanka | 1,400 | -27.14 |
| Myanmar | 620,000 | 0.15 | Pakistan | | |
| Philippines | 1,677,500 | 1.68 | Bangladesh | | |
| Thailand | 886,250 | 2.14 | Afghanistan | | |
| Vietnam | 3,160,050 | 1.94 | | | |
| China | 50,003,600 | 1.21 | | | |

Source: FAOSTAT, 2014

In SE Asian countries, an increasing trend (1.5-5% per annum) in per capita consumption of meat was exhibited between 1990 and 2002, with the strongest rates of growth observed in Vietnam (5%) and The Philippines (4.3%) (FAOSTAT, 2006). This trend reflects the growing demand for meat

products in the region. As of 2002, pork consumption was highest in Vietnam and the Philippines (>15 kg/cap). Least consumption (<6 kg/cap, FAO, 2006) was registered in Indonesia and Lao PDR (Costales, 2007). In South Asia, per capita pork consumption is much less. For instance in India, average per capita consumption of pork is only about 0.76 kg/ annum. Nagaland, a northeast Indian state, has possibly recorded the highest per capita consumption of pork in the South Asia region which is 8.37kg/ annum. The South Asia region does not export any pork/ pork products while India and Nepal import a small quantity of pork.

Table 3: Quantity (in tons) of pork exported and imported in both regions in 2011

| Country | Export (in tones) | Import (tones) | Country | Export (in tones) | Import (tones) |
|-------------------------|-------------------|----------------|-------------------|-------------------|----------------|
| South East Asia | | | South Asia | | |
| Cambodia | | | Bhutan | | |
| Indonesia | 45 | 134 | India | | 3 |
| Lao PDR | | | Nepal | | 3 |
| Malaysia | 144 | 9034 | Sri Lanka | | |
| Myanmar | | | Bangladesh | | |
| Philippines | | 47,307 | Pakistan | | |
| Thailand | 2,280 | 46 | Afghanistan | | |
| Vietnam | 7,032 | | | | |
| Singapore | 495 | 55,525 | | | |
| China (mainland) | 71,647 | 316,775 | | | |

Source: FAOSTAT, 2014

In SE Asia, Thailand and Vietnam have emerged as the leading net exporters of pork (please refer to Table 3) and Singapore, Malaysia and the Philippines have emerged as the major importers of pork . In future, the net export position of Thailand and Vietnam points to the challenges for exporters, as food safety standards continue to be tightened especially in markets of developed countries.

10. Food Safety and Zoonosis

Poor slaughter and selling infrastructure coupled with poor hygiene and sanitation maintained at the slaughter and selling places, pose health risk for the consumers in both South and SE Asia. Meat produced from diseased and parasitic pigs creates further health risk to the pork consumers. In both regions, diseased pigs are sold in the market, especially in the rural areas where pig producers are not very aware about the roots transmission of diseases. Research in North East India suggests that about 27% pork samples contain classical swine fever (CSF) virus (Sarma, 2010). This means that CSF can be transmitted through contaminated pork, if left over meat/ kitchen waste are fed to pigs. Studies in NE India (Nagaland) and Vietnam suggest that pork sample in both the regions contain antibiotic residue above acceptable level (Grace et al., 2011). This clearly indicates that diseased pigs are sold after treatment to the market, if no recovery is expected. Similarly, pork samples in both regions have coliform count and total bacterial count above acceptable level (Grace et al., 2011).

This is a clear evidence of poor handling and faecal contamination of pork samples during slaughtering and selling of pig. The studies also suggest that formal markets in poor countries are often not safer than informal ones.

In both regions, worm infestation of pig is very common because of poor hygiene practises adopted at farm level. Poor awareness about the importance of deworming at regular interval further aggravates the situation, especially in rural areas. Cysticercosis (*Cysticercosis cellulosae*) caused by the tape worm *Taenia solium*, is commonly seen in both South and SE Asia, which may cause neurocysticercosis resulting in acquired epilepsy in human (Joshi, 2008). Sero-prevalence of toxoplasmosis, a zoonotic disease, is also reported in 20% pigs in Bangladesh and therefore there is chance of human infection (Biswas et al., 1992)

Japanese Encephalitis (JE) is endemic in SE and South Asia and pigs are one of the most important amplifying hosts. Incidence of Japanese Encephalitis varies from region to region but are more commonly identified in some places of India and Bangladesh (Biswas et al, 1992).

11. Conclusion

From the discussions above, it can be concluded that although the pig systems in both regions are at transformation stage from rural backyard to intensive commercial system, the pace of growth is faster in SE Asia than in South Asia. This gives a unique opportunity for South Asia to learn from the experience of SE Asia. Piggery being a less preferred livestock species in South Asia, the distribution of the sub sector is more sporadic in nature and there is relatively poor policy and development focus of the governments in the region. The lessons which may benefit South Asia are: a) better feeding through cultivation of food-feed crops, b) popularisation of vaccination and deworming programme among smallholders, c) more private investment on pig breeding and feed milling, d) government stimulation package and conducive policy environment for industrial pig production s, e) better veterinary, extension and input service delivery mechanism and f) better hygiene for pig production and pork marketing. To widen the scope of cross learning, different donors and research and development organisations may come forward to organise exposure visit and South-South symposium activities in the region.

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