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ASIA'S LIVESTOCK INDUSTRIES: CHANGES AND ENVIRONMENTAL CONSEQUENCES

Abstract

Asia's livestock populations and production of edible livestock have risen substantially in recent years. Asia has increased its global share of livestock and livestock products. Furthermore, it has greatly increased its involvement in world trade in edible livestock products, e.g., exports of poultry meat and pig meat and imports of bovine meat and milk products. This article highlights these changes focussing on China, considers the reasons for these and their possible consequences for the environment. Future possible threats to Asia's export of livestock products are also discussed, such as environmental and animal welfare concerns.

1. Introduction

Livestock industries in Asia, particularly East Asia, and especially China, have been undergoing significant change in recent years with livestock numbers showing considerable increases. In several Asian countries, such growth is associated with rising human population; increasing per capita incomes, changing technologies, availability of new techniques such as urea additions to roughage and straw to increase its digestibility by ruminants e.g., cattle, and altering tastes as a result of international contacts. The purpose of this paper is to highlight features of these developments, focussing in particular on China. What are the main changes? Why have they occurred? What are, or are likely to be their environmental consequences? What are some of the possible implications for international trade?

As Templeton and Scherr (1997, p. 22) state, 'relationships between human and animal population growth, production methods, and land quality are complex'. In low income countries, there is a tendency for livestock numbers to increase with human population but at a slower rate. Harrison (1992) for example, found that in developing countries between 1961 and 1985, human population increased at 2.3 per cent per annum and livestock numbers at 1.3 per cent per annum.

Templeton and Scherr (1997, p. 22) maintain that as human population rises from low to medium-high density (75-100/km^2), animal densities on ranges and pastures increase too, along with the total livestock population. However, when human population exceeds these densities, the trends in livestock population are reversed. In the earlier stage involving higher stocking densities, it is suggested that natural environmental quality declines. However, they suggest that environmental quality in some cases could improve when human population became high (Templeton and Scherr, 1997, p. 24; Cf. Scherr and Hazell, 1994) due to changing methods of animal husbandry and reduced stocking densities. Nevertheless, it is very difficult to generalise. For example, the Netherlands, a country with a very high density

of human population has experienced considerable environmental problems from livestock which have been stocked at high densities.

2. Changes in Asia's Livestock Industries

Asia is geographically and ethnically a very diverse region. The FAO statistics for livestock in Asia cover counties from Asia Minor and Saudi Arabia in the west to Japan in the east and Indonesia in the south. Within this region, livestock are kept under varied conditions – some on rangeland as in Inner Mongolia or hand-fed as in parts of Thailand and China.

In the last 5 years, Asia has significantly increased its proportion of the world's stocks of major livestock species as can be seen from Table 1. It now contains almost all the world's buffalo, one-third of its cattle, almost half of its chickens, most of its ducks, about two-thirds of its goats, almost a sixty per cent of its pigs, and over one-third of its sheep. In all these categories, except for buffalo where Asia's share was constant, noticeable increases in Asia's share of world stocks occurred between 1992 and 1997.

Table 1: Asia's Share of the World Stocks of some Selected Live Animals

Live Animals	Asia's % Share of the World Stocks	
	1992	**1997**
Buffaloes	96.61	96.61
Cattle	30.86	33.40
Chickens	45.37	48.97
Ducks	83.08	87.22
Goats	60.84	65.48
Pigs	52.66	59.02
Sheep	29.88	35.03

Source: Based on FAO statistics.

Because world stocks of major livestock species have been increasing, it follows from the above that Asia experienced considerable growth in its animal stocks between 1992 and 1997. The percentage growth levels are indicated in Table 2.

Table 2: Percentage Change of Asia's Live Animals (1992-97)

Live Animals	% Change
Buffaloes	3.83
Cattle	11.47
Chickens	24.20
Ducks	18.26
Goats	28.12
Pigs	21.05
Sheep	10.00

Source: Based on FAO statistics.

In the five-year period, 1992-97, Asia also significantly increased its share of most edible animal products as can be seen from Table 3. It recorded increases in all the edible animal products listed in Table 4, and would have also recorded substantial increases for pork production, goat and sheepmeat output and for broiler output, not listed here. Beef and veal production increased by a massive 72 per cent and egg production by over 60 per cent while cow milk production was up by more than one-eighth.

Table 3: Contribution of Selected Asia's Livestock Products to Total World Production

Livestock Products	Asia's Share of the Total World Production (%)	
	1992	1997
Beef and Veal	11.09	18.18
Butter and Ghee	27.08	35.48
Cheese (all kinds)	6.15	6.02
Cow milk (whole, fresh)	14.22	15.88
Eggs (primary)	47.28	59.30
Milk (total)	22.22	25.18

Source: Based on FAO statistics.

Table 4: Percentage Change in Asia's Production of Selected Livestock Products (1992-97)

Livestock Products	% Change
Beef and Veal	72.40
Butter and Ghee	24.77
Cheese (all kinds)	5.27
Cow milk (whole, fresh)	12.52
Eggs (primary)	61.48
Milk (total)	16.57

Source: Based on FAO statistics

Growth in animal stocks has varied between Asian countries, but livestock populations in China have shown strong growth for all categories of livestock as can be seen from Table 5. While growth rates for most livestock populations for India are lower than for China, except for chickens, ducks and pigs, China started from a much lower base.

Table 5: Percentage Growth of Some Selected Animal Stocks in Some Major Asian Countries (1992-97)

Asian Countries	Percentage Growth of Animal Stocks						
	Sheep	Buffaloes	Cattle	Goats	Chickens	Ducks	Pigs
China	26.42	7.22	40.90	71.99	23.93	23.04	23.19
Indonesia	23.93	- 7.64	8.45	23.47	53.24	3.18	-2.19
India	2.80	2.28	2.10	3.15	26.67	-	18.61
Malaysia	-2.39	-18.86	0.22	-10.79	19.37	4.17	15.47
Thailand	-26.39	0.06	0.80	-51.43	-18.62	7.42	-9.59

Source: Based on FAO statistics

China's contribution to world stocks of most livestock is substantial as can be seen from Table 6, and in all categories it increased its share of world stocks between 1992 and 1997.

Table 6: China's Contribution of Some Selected Live Animals to the Asia's and World Stocks

Live Animals	% of Asia's Stocks		% of World Stocks	
	1992	**1997**	**1992**	**1997**
Buffaloes	15.46	15.97	14.94	15.43
Cattle	20.85	26.36	6.43	8.80
Chickens	46.02	45.93	20.88	22.49
Ducks	73.85	76.83	61.35	67.01
Goats	26.85	36.05	16.34	23.61
Pigs	82.95	84.42	43.68	49.82
Sheep	32.46	37.30	9.70	13.07

Source: Based on FAO statistics.

Table 7 indicates China's contribution to selected edible livestock products in Asia. Between 1992 and 1997, China's contribution to Asian beef and veal production more than doubled. It is now Asia's major producer of beef and veal. It is Asia's major egg producer. It would also be Asia's major broiler producer and by far its major producer of pork.

Table 7: Contribution of China's Livestock Products to the Asia's Total Production

Livestock Products	China's Share of the Total Asia's Production	
	1992	**1997**
Beef and Veal	27.88	54.03
Butter and Ghee	3.71	3.17
Cheese (all kinds)	21.12	22.11
Cow Milk (whole, fresh)	7.96	8.87
Eggs (primary)	55.42	68.40
Milk (total)	6.87	7.23

Source: Based on FAO statistics.

Substantial growth and change has and is occurring in Asia's livestock industries. These are partially in response to rising populations (but the rate of growth of human populations are now relatively low in many Asian countries, e.g., China), rising per capita incomes, adoption of new livestock husbandry techniques and changing tastes due to increased contact with the Western world, e.g., increasing milk consumption in most East Asian countries. In the case of China, and other Asian countries in transition, market reforms, have also helped to stimulate livestock production. Before China's reforms its planned economy placed great emphasis on grain production at the expense of production of other agricultural products such as meat production. Prices and profit incentives now play a major role in directing the composition of China's agricultural production. Rising incomes, especially the emergence of a high income class, has increased demand for edible animal products significantly.

In many Asian countries, dualistic methods of animal raising have evolved in recent years. For example, in Thailand, traditionally pig and poultry production was limited to the village sector. Now almost all pig production is undertaken in commercial piggeries. While village chickens still account for 30-40 per cent of Thailand's stock, most of Thailand's chickens are in its commercial sector, controlled by multinational companies, mostly with headquarters in Japan (Tisdell *et al*., 1998). Thailand has been a major exporter of broilers,

but now it is facing considerable competition from China because China has lower costs of production. Several of the multinationals who have invested in the Thai broiler industry have switched their investment to China and this has created difficulties for Thailand's poultry industry. As can be seen from Table 5, Thailand's chicken stocks declined by more than 18 per cent between 1992 and 1997 due mainly to lack of stability in its commercial poultry sector due to variations in global competitiveness.

In Thailand, production of bovines remains essentially a sideline village activity with each village family having usually only two to four head of such stock (Murphy and Tisdell, 1996a). They form part of an integrated agricultural system and are used for multiple purposes: a store of value, for utilizing farm 'wastes' such as straw, crop residues, grass from roadsides and levee banks in the rice fields. Sometimes they may be tethered and allowed to graze in communal places but often the grass is cut and brought to cattle and buffaloes. The growing of pasture for livestock is rare. In some villages one or two villagers specialise in the rearing of cattle, mostly yellow native cattle. These cattle are normally only in the village in the dry season. In the wet season, when rice is growing on the farms, they are taken to the forests or communal areas for grazing (Murphy and Tisdell, 1996b).

Dairying has developed in recent years in Thailand with government support, but dairy herds are very small by international standards. The industry appears to rely on trade protection for its survival (Kehren and Tisdell, 1998).

3. Environmental Aspects of Asia's Changing Livestock Situation with particular Reference to China

Increasing livestock populations and changes in animal husbandry can have a variety of environmental impacts. These include:

(1) nitrate and plant-nutrient emissions from manure;

(2) release of greenhouse and ozone-depletion gases from ruminants ;

(3) contributions to acid rains;

(4) where extensive grazing is practised, accelerated soil erosion;

(5) loss of natural vegetation and induced changes in the composition of botanical species;

(6) increased competition with wildlife for food and water, and

(7) loss of biodiversity (Cf. Preston, 1995).

There is a potential for Asia to experience all of these impacts. Currently, however, official emphasis appears to be on the positive environmental impacts of measures to increase livestock populations.

New developments in the treatment of crop residues, e.g., anaerobic fermentation prevention and treatment with urea have for example helped to boost China's beef production and that of mutton and the potential of the techniques to increase production even further is considerable (Tingshuang and Zhenhai, 1996). With their increasing adoption since 1990, these techniques have accelerated China's beef and mutton production. These measures help to economise on feed grain for livestock and have resulted in cropping areas replacing pastures. Tingshuang and Zhenhai (1996) point out that extra cattle provide extra farmyard and manure and 'the extensive use of farmyard manure can reduce the cost of chemical fertilizer, thus not only lowering costs but also improving agricultural production'. They go on (p.3) to point to other environmental advantages of the crop-residue techniques:

'Many places along the Yantze River are schistosomiasis-endemic areas. Cattle grazing near the river (as well as lakes and water holes) become parasite hosts. Utilising ammoniated crop residue to feed cattle and moving from grazing to stall feeding, breaks the schistosome cycle and helps to control the spread of the disease. Also, utilising more

crop residues helps to avoid atmospheric pollution from burning crop residue which is a problem in highly populated areas'.

The essay of Tingshuang and Zhenhai (1996) gives the impression that no environmental disadvantages are present from livestock systems based on the use of crop residues. In this respect, however, it paints an overly optimistic picture. For example, the technique may result in residues which were previously composted or directly ploughed into the soil being fed to ruminants. It is possible therefore that there could be some reduction in compost availability and materials for maintaining soil humus and structure. Nevertheless, in those cases where straw or residue is burnt, the alternative of feeding it to ruminants would be preferable.

As for farmyard manure, its environmental impact depends on how thinly it is spread and whether it is spread quickly. Groundwater contamination is likely to result from concentrations of farmyard manure. One of the most serious problems is the nutrient-enrichment of water bodies (particularly increased nitrogen and phosphorous availability in water) which encourages the growth of water weeds (both micro and macro) and can accelerate eutrophication. Deterioration in water quality can affect its suitability for consumption by humans and livestock. Aquaculture and fisheries can also be affected adversely. China must consider seriously any possible adverse environmental impacts on its aquaculture because it has the largest aquaculture industry in the world and aquaculture provides a valuable source of animal protein for its people.

One way to reduce possible leakages from the local environmental system is by means of integrated farming systems which include aquaculture as a component with the livestock manure being used to fertilise aquaculture ponds, so as to promote the growth of aquatic plants which can be eaten by fish. However, there may be leakages of nutrients from ponds and the other problem is the organic content of livestock manure results in oxygen absorption from the water. Large quantities of farmyard manure create considerable oxygen-demand and can reduce oxygen levels in ponds to levels where

more valuable species of fish cannot be grown, or fish are stunted in their growth or in extreme cases, the growing of fish becomes impossible. Chan (1996) describes several methods for reducing the biochemical oxygen demand (BOD) of farmyard manure before releasing it to aquaculture ponds, namely:

(1) the use of digesters which involve holding the manure in airtight containers for a time (biogas can be obtained as a by-product), and

(2) oxidation of the digested fluid or washwater in shallow basins employing algae to supply oxygen naturally.

The economics of these methods need to be assessed along with other suggestions made by Chan (1996) for ecologically balanced Integrated Farming Systems.

Preston and Leng (1995) suggest that crop residues and straw digested partly using urea-based technology will, when fed to ruminants, reduce their methane emissions substantially. While this is so, account needs to be taken of any methane released in or following the digester process. Furthermore, even if methane emissions per beast are reduced if the technology permits a sufficient increase in numbers of ruminants, total methane emissions may rise. Preston and Leng (1995, p. 1) point out that 'Methane production appears to be a major issue although it only presently contributes 18% of the overall warming. It is accumulating at a fast rate and is apparently responsible for some of the depletion of the protective ozone layer. Methane arises largely from natural anaerobic ecosystems, rice paddies and ruminant animals'. Ruminants are believed to contribute about 18 per cent of methane emissions (Bolle *et al.,* 1986).

The use of treated straw and residue for feeding ruminants has and is spreading rapidly in China as can be seen from Table 8. There are several reasons for this: urea is heavily subsidised, the method is quite profitable, little investment is required, scale is not an important constraint so farmers with few ruminants can adopt it and it can be tried incrementally. There has been considerable extension work undertaken since livestock production based on crop residues was included in the State Agriculture Comprehensive

Development Project commencing in 1992. These techniques would also seem to have good prospects for adoption in other developing countries.

Table 8: Number of Chinese Farmers Treating Crop Residues (Straw) for feeding to Ruminants and Quality Treated, 1990-1995

Year	Farmers (millions)	Treated Straw (million tons)
1990	0.8	2.6
1991	1.2	3.7
1992	2.3	7.1
1993	3.8	11.7
1994	5.3	15.9
1995	7.1	21.5

Source: Tingshuang, Gao and Zhehei, Yang (1995) p. 3.

Findlayson *et al.,* (1995) have examined the economics of utilising treated fibrous residues of crops for beef production in China. At present cost: price ratios, they find that this is quite profitable for cattle fattening in Henan and Hebei, (in the first case using urea and in the latter cases adding ammonia, NH3) as a feed supplement. Using economic analysis, they provide estimates of profit and determine the most profitable quantity of fibrous supplement. Their results, however, do cover special cases.

China also has large pastoral regions in its western areas, where in some areas sheep and goats are important forms of livestock. In their study of such areas, Longworth and Williamson (1993, p. 301) found a close link between the trend in rural human population levels and herbivorous livestock numbers. In fact, they found that the correlation between values of these variables increased as both human population levels and livestock numbers rose. They came to the following conclusion:

'The increasing population pressure on the rangelands of China since 1949 can be traced to three basic policy initiatives of the central government: the expansion of cultivation in the pastoral region, the introduction of the household registration system; and the granting of family concessions to minorities. Taken together these three national

policies have imposed major constraints on sustainable economic development in pastoral areas and, as a result, they have perpetuated regional poverty and attendant environmental decline' (Longworth and Williamson, 1993, p. 304).

The extent to which the environmental degradation of China's rangelands have been ameliorated since China began its economic reforms requires investigation. There are still strong pressures to extend cultivation in rangeland areas. Although more scope has been created for private agricultural initiatives since China's reforms, the extent to which these have impacted on pastoral areas is unclear to me. Furthermore, private economic incentives and higher prices for agricultural produce do not always result in more sustainable livestock practises or increased environmental conservation especially if property rights are ill-defined or felt to be insecure or if grazing land is largely communal and its use by individuals is not carefully managed.

The above by no means exhausts possible environmental consequences of expansion in Asia's and China's livestock industries. For example, with improved communications in Asia, there is now the potential to spread livestock diseases rapidly. Control of livestock diseases is a growing issue and with increasing livestock populations, the cost of not controlling infectious livestock diseases is rising. With increasing populations of livestock and humans, the probability of diseases jumping between species increases, e.g., the so called chicken-flu seems to be an example and it is believed that some new strains of flu originate in pigs and then subsequently infect humans. Increasing animal population densities (as with human population) are favourable to the occurrence of epidemics unless appropriate precautions are taken.

4. Aspects of Imports and Exports of Livestock Products in Relation to Asia and China

Asian has been more involved in international trade in livestock products in recent years. Both China and Thailand have, for example, become major exporters of poultry meat. China, for example, increased it export from 51,924 MT in 1990 to 308, 975 MT

in 1995, almost a six-fold increase. Thailand increased its exports of poultry meat from 143,689 MT to 193,732 MT in the same period, but has found it difficult to sustain its exports mainly because of competition from China which has had lower costs of production due to lower wage rates. Between 1990 and 1995 China's export of pigmeat increased by almost 50 per cent and the value of these exports almost doubled.

One the other hand, China's exports of bovine meat declined and its imports of bovine meat rose by more than 50 per cent, making China a substantial net importer of bovine meat in 1995. This reflects increasing consumption of beef in China. Although China's beef production has risen greatly, it is inadequate to meet rising demand.

China's exports of dairy products (including eggs) declined slightly in the period 1990 to 1995 and its imports rose by more than one-third, making China a substantial importer of dairy products. Most East Asian countries have become major importers of dairy products (mostly milk-based products) and their imports have risen substantially.

East Asia has been able to provide increasing market opportunities for Australia and New Zealand beef and dairy products and also for the US.

Environmental concerns do not appear as yet to have become a reason for discriminating against exports from Asia of items like chicken-meat and pork, but environmental health considerations have the potential to disrupt seriously export of edible livestock products by Asian countries. For example, if chicken-flu, capable of being transmitted to humans, were to be found in China's or Thailand's chicken flocks, one could anticipate widespread bans on the importation of chicken products from those countries.

Another factor which could potentially affect Asian exports could be animal welfare concerns. These have not achieved the degree of prominence in Asian countries as in higher income Western ones. However, it cannot be assumed that livestock are kept under worse conditions in Asian countries than in Western ones. From Table 9, it can be seen that broiler stocking densities in Thailand are lower than for The Netherlands and

France. But of course, crowding is only one issue. Other issues include the risks to humans of the use of antibiotics, growth hormones and chemical additives to food used in rearing livestock.

Table 9: Comparisons for the Six Major Broiler Exporting Countries

Variable	Brazil	USA	China	Thailand	Netherlands	France
Stocking Density (bird/sq.m)	10-12	14	15-16	8-12	23	16-25
Mortality (%)	5.0	5.0	5.0	5.7	4.9	3.0 - 7.5
Feed Cost/ton (US$)	165	176	289	280	384	315
Wholesale Price (US cents/kg)	94	123	133	140	194	205

Source: Based on Anon (1996), p. 26.

5. Concluding Comments

Asia has experienced substantial changes in its livestock industries in recent years. The population of all major livestock in Asia have increased in many cases by large amounts. Asia has both increased its share of world livestock populations and its share in world production of edible livestock products. Impressive growth has been recorded in developing East Asian countries, especially China, and these changes have been highlighted.

Dualism in livestock production has developed in many Asian countries and this is especially apparent in chicken and pig production. The development of commercial industrial-type livestock systems along Western lines can be expected to entail similar

difficulties and environmental problems to those which have arisen in Western countries, e.g, similar problems in disposal of manure, similar animal welfare problems. The problems at the village level are rather different – it may be easier to utilise extra animal manure at this level without creating pollution problems, but on the other hand, increasing livestock numbers can be expected to result in more intensive land-use and can create ecological imbalance.

Despite increased animal production in Asia, supply of beef and milk products particularly in East Asia, has been unable to keep up with rising demand and this has created export markets for countries like Australia, New Zealand and the USA. On the other hand, both China and Thailand have developed into major exporters of chicken meat and China is a major exporter of pork. This has changed the nature of international trade in livestock products. Such specialised trade is, however, extremely vulnerable to environmental health variations.

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