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Livestock production and quality of societies' life in transition economies

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Abstract

Animals are beneficial to humans since they produce besides food, products for medical uses and energy. They are also used for transport, animal power, fertilizer, companion and sports. Intensification of animal agriculture has allowed reasonable economic growth in developing regions. This will continue more intensively with world globalization. As a consequence, traditional family farming is losing space to the enterprise organizations concerned with profit returns on investments. This circumstance together with the mechanization of agriculture is driving human populations to the cities and producing a trend to reduce growth on the rural areas of developing countries. Animal production will continue to increase both in volume and in productivity to meet the demand for high-value protein in these transition societies. However, official authorities of developing countries should consider the environmental problems and health issues raised by animal production in the most developed areas of the world. Improved livestock productivity to support economic development and sustainable resource management are not incompatible goals. Limits for the application of technologies should consider aspects of animal production in terms of food, animal welfare and protection of the environment. © 1999 Elsevier Science B.V. All rights reserved.

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1. Introduction

In developing countries, animal production is being submitted to great pressure to satisfy the increasing demand for animal protein required by the growing population and also to generate production surpluses for market and trade with the most developed countries. For instance, Brazil produces its own internal meat consumption and close to 1 million tons for export as shown in Table 1. According to CGIAR (1996), discussing output in develop-

ing countries, livestock and particularly poultry production is the second most important (US\$ 123 billion, 1987/89) agricultural sector after grain production (US\$ 147 billion). The growing appetite of the urban populations in transition societies for animal products such as meat, milk and eggs frequently causes environmental damage and disturbance to traditional family farming. At the same time, livestock contribute to food production at the expense of resource degradation such as water pollution, soil erosion and deforestation.

This situation calls for new policies to improve livestock production in terms of food, animal welfare

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Table 1
Estimated meat balance in Brazil in 1998 (1000 t)^a

Item	Swine		Poultry		Cattle		Total tons
	tons	Rank in the world	tons	Rank in the world	tons	Rank in the world	
Production	1620	5	4710	3	6020	2	12 350
Consumption	1525	6	3970	3	5970	2	11 465
Export	100	5	740	3	240	6	1080
Import	5	–	0	–	180	7	185

^a Desouzart (1998).

and an unharmed environment. Looking at these aspects the first need is to relate animals to man and the environment in transition societies (TS). The countries grouped as TS are related to the transition of their economic system. The group is predominated by the former socialists' countries where the economy was centrally planned. In developing countries, there are also continuous transformations of the society. State-owned companies are being privatized in an attempt to transform the state to its real role, which is to improve the social conditions of its population. Looking at the FAO's group of countries, it is possible to infer that East and Central European countries belong to the Transition Markets. Among the 183 developing countries listed by FAO there are many that also can be classified in the group of TS. Brazil, Mexico, South Korea, Taiwan, Singapore and Hong Kong among others form the newly industrialized countries, which belong to the TS group. In these countries more than 25% of GNP and more than 50% of exports are manufactured products (Vesentini, 1996). Increased unemployment, inflation privatization of the State companies typify the economies of the TS countries (Vesentini, 1996). A diversity of countries fulfill the conditions of a TS, however, our discussion will consider mainly Brazil as an example in the transition market group to explore some of the relationships of globalization with animal production.

2. Globalization and relationships with animal production

The production and the markets for meat and milk in developing countries are changing very quickly.

Transnational corporations (TNC) are taking command of numerous local companies and as a consequence, animal products are going to be managed by the TNC in the next few years. This is quite obvious in Latin America and characteristic of the new phenomenon of globalization. In fact, after the disruption of the Berlin wall in 1989, market internationalization has progressed without interruption. It is possible to infer that globalization is being established as a result of a combination of three forces: (a) the third technological revolution, which includes information, communication, artificial intelligence and biotechnology; (b) formation of geographic groups whose objective is to agree to self protection for free trade (Table 2) and (c) a growing tendency to interconnect financial markets around the world, factored by TNC (Conselho Editorial, 1997). All these forces impact on the animal production sector. According to CGIAR (1996) primary animal products (meat, milk, eggs and fiber) constitute about 25% of the total value of agriculture in developing regions. Improvements in livestock productivity and

Table 2
The main economic blocs expressed as gross internal product GIP or per capita income^a

Bloc ^b	Gross Internal Product (US\$ billions)	Per capita income (US\$)
EU	8380	21 833
NAFTA	7771	16 560
MERCOSUL	995	4633
APEC	15 490	12 375

^a World Bank (1997)

^b European Union (EU), North American Free Trade Agreement (NAFTA); Southern South America Market (MERCOSUL) and Asian and Pacific Economic Cooperation (APEC).

health are necessary to meet the substantial increase in demand for livestock products, especially in developing regions. However, it is not desirable to achieve these increases by damaging natural resources. Global strategies for livestock output growth must consider the environmental impact and improvement in productivity needed to support economic development and should be compatible with sustainable resource management. Trade among nations must consider differences in comparative and competitive advantages, which often do not correspond. Subsidies, price controls and trade barriers can neutralize the comparative advantage of developing countries for low-cost livestock production.

The limit to globalization may be related to the environmental risk and the gap that exists between rich and poor countries. With globalization there is also a tendency to boost unemployment rate. By their exclusion from their economic system low-income people tend to be disadvantaged by the global system that is being imposed in transition countries. The role of government in the developing countries is becoming fragile and very much dependent on the role of the TNCs. Seventy percent of the world's trade, and 90% of all technology and product patents worldwide are held by TNCs. On the other hand, production and trade of the TNCs have had an extensive impact on the environment as is reported by a United Nations study on climate that estimated more than 50% of global greenhouse gas emissions were in the area of TNC (Singer and Griffith-Jones, 1997).

3. Uruguay Round Agreement

The Uruguay Round Agreement which was initiated in 1986 and ended in 1994 (Vanzetti, 1996) was the last and the most successful attempt to promote liberalization of trade. Its great feature is to bring agriculture into the general rules of the General Agreement on Tariffs and Trade (GATT). Latin America carried unilateral reforms further than required by the agreement. However, other continents still need strong reforms in terms of trade liberalization. The next round will begin in the year 2000 and unless new facts occur, it may be worthless because important issues such as the environment and labor employment are not in harmony. According to Johnson (1997), the US is pursuing approval for the

fast-track authority. This means trade negotiation agreements in a bilateral and (or) multilateral way are being pursued without compromise, to discuss issues related to the environment, labor and other social aspects. The fast-track authority concept is not to link trade with the previous issues. In a world where deterioration of the environment is frequently more evident, it becomes clear that it is environmentally wrong not to take these aspects into consideration and without them the Round 2000 cannot be efficient.

4. Man, livestock and environment

According to Vesentini (1996), in pre-industrial society, where primary activities (agriculture and livestock production) were the basis for economic growth, the degree of technological development was very small. In that society, man existed in natural conditions. Economic activity was dependent on the natural soil fertility, climatic conditions, rain, fish, livestock, plants and forestry. With the industrial revolution, initiated in the XVII century in Europe and which later spread throughout the world, a new society was established. In this society the natural elements are being constantly changed or modified by human actions. Poor soils are being modified by irrigation and (or) fertilization. Livestock are raised in confinement with modern technologies to produce meat, or milk or eggs in a more profitable way. Natural pastures are improved to permit an increase in the number of animals per acre.

Most domesticated species, mainly in the poultry sector, have experienced unusual growth rates in the last four decades. The reasons for the increment can be related to the pressure for more efficient production of meat per unit of feed consumed, and also to the assumption that poultry meat is healthier than other meats. Other non-food functions, although of declining importance, are important for millions of small-holder farmers in developing countries. Animal power and nutrient recycling through manure compensate for the deficiency of access to modern technology such as tractors and fertilizer, and help to maintain the viability and environmental sustainability of production. However, in many places where animal production is being intensified, the balance of rational farming and the environment is in confronta-

Table 3
Primary products production in millions of metric tons FAO (1997)

Class	Developed countries 1990	Developing countries 1990	Developed countries 1997	Developing countries 1997	% Change in developed 1997/1990	% Change in developing 1997/1990
Beef and veal	34.8	17.9	30.7	24.3	- 11.8	35.8
Pig meat	38.4	31.3	35.2	53.4	- 8.3	70.6
Turkey meat	3.5	0.17	4.5	0.22	28.6	29.4
Chicken meat	21.7	13.6	24.6	25.1	13.4	84.6
Meat total	104.5	74.1	100.5	119.5	- 3.8	61.3
Cheese all kinds	13.1	1.8	13.1	2	0.0	11.1
Cow milk fresh	377.4	106.4	335.7	133.8	- 11.0	25.8
Milk total	382.7	160.9	340.9	202.9	- 10.9	26.1
Hen eggs	18.9	16.4	17.6	28.9	- 6.9	76.2
Eggs total	19	18.7	17.7	33.7	- 6.8	80.2

tion with the costs involved to implement sustainable practices and meet environmental concerns, frequently leading to environmental degradation. The results of animal growth are shown in Table 3. Developed economies only increased positively in avian meat production and presented negative growth for the other animal products. In addition, all listed products grew at high rates in developing countries. Chicken meat, eggs or pork attained individually more than 70% of growth between 1990 and 1997.

5. Quality of life

According to the World Health Report from the WHO (1996) in mid 1995, the global population was about 5.8 billion people. It is projected to reach 7.9 billion in 2020 and 9.8 billion in 2050. The rural population in developed countries is decreasing and urban population is growing at smaller rates than the urban population in developing countries (shown in Table 4). Full mechanization was reached many decades ago in the developed area while it is only now being implemented in developing regions. The substitution of capital for labour drives people from rural to urban areas.

Quality of life can be defined according to different points of view. Socio-economic, health, leisure activities, food supply are each important variables to consider. However, there is a scarcity of information to compare different countries. Taking data files from the World Health Organization and building up a matrix shown in Table 5 it is possible

to compare selected countries. Among them, a comparison on probability of dying before the fifth birthday is low in developed countries. Probability of death increases with the decreases in GNP and with lower government expenditure on health. The quality of life in the transition societies is lower than in traditional economies. Private investments are being used in the health segment to compensate government failure in the health sector. In addition, Table 5 present developing countries compared to USA and Japan as standards for quality of life based on socio-economic and health values. A human development index (HDI) calculated by the United Nation Organization (UNO, 1997) ranks all countries in the world according to longevity, purchasing power and standard of living. In general, developing countries hold an intermediate position among all nations by the HDI.

6. Role of livestock in the global world

Domesticated animals through their integration with crop agriculture contribute in many countries, to agricultural intensification and this, in turn, has allowed reasonable economic growth of these countries. For instance, feed production is a variable correlated with the size and quality of animal production. In Latin America in 1997 this totaled 63.7 million tons in 1997 (Table 6). In Brazil, which is the largest feed producer in Latin America there was an increment in the range of 69 to 132% in feed produced during the last seven years (Table 7). The

Table 4
Urban and rural populations in millions of people, FAO (1997)

Groups	Year			
	1965	1975	1985	1995
World	3342	4081	4847	5688
Rural	2153	2540	2851	3111
Urban	1189	1541	1996	2577
Population in developed countries				
Total	1030	1128	1213	1289
Rural	377	357	356	350
Urban	653	771	857	938
Population in developing countries				
Total	2312	2953	3635	4398
Rural	1776	2183	2495	2760
Urban	536	770	1140	1638
% of yearly growth in developed countries				
Rural developed	- 2	- 2	0	- 2
Urban developed	9	8	5	4
% of yearly growth in developing countries				
Rural developing	9	10	7	4
Urban developing	15	20	22	19

Table 5
Socio-economic and health development in selected countries according to the World Health Organization (WHO)

Item	Brazil	China	India	Japan	Korea	Poland	Russia	S. Africa	USA
Gross National Product per capita (US\$) ^a	2930	490	300	31 490	7660	2260	2340	2980	24 740
Annual growth rate of the GNP (%) ^a	0.3	8.2	3	3.4	8.2	0.4	- 1	- 0.2	1.7
Birth rate (per 1000 population) ^a	24.6	18.5	29.1	10.1	16.4	13.2	10.9	31.2	15.9
Death rate (per 1000 population) ^a	7.5	7.2	10	7.6	6.3	10.5	12.4	8.9	8.8
Total national health expenditure as % of GNP ^a	4.2	3.5	6	6.5	6.6	5.1	3	5.6	12.7
Total government health expenditure as % of GNP ^a	2.8	2.1	1.3	4.8	2.7	4.1	2	3.2	5.6
Infant mortality rate, % ^a	5.8	4.5	8.2	0.4	1.1	1.5	2.1	5.3	0.9
Probability of dying before fifth birthday ^a	0.067	0.042	0.095	0.006	0.012	0.019	0.029	0.068	0.009
Human development index (HDI) ^b	0.783	0.626	0.446	0.940	0.890	0.834	0.792	0.716	0.942
Ranking according to HDI ^c	68	108	138	7	32	58	67	90	4

^c UNO (1997)

^b Human Development Index (HDI) takes into consideration longevity, knowledge and standard of living (purchasing power parity).

^a Adapted from: WHO Statistical Information System (1997).

distribution of livestock and primary products, as well as human population in selected countries is shown in Table 8. In absolute totals, developing countries have more livestock than developed countries. However, total production of eggs, milk and meat is smaller which is made worse by the larger population in developing countries.

According with Steinfeld et al. (1997), pressure

for economic growth has made livestock production, an important factor in environmental degradation. Large land areas have become degraded through overgrazing and deforestation followed by ranching as is happening in the Amazon region (Fujisaka et al., 1996). Biodiversity is affected by extensive as well as intensive livestock production. Livestock affects water availability in low-rainfall areas. Land

Table 6
Feed production in Latin America, 1997^a

Countries	Millions metric tons
Brazil	28.7
Mexico	14
Argentina	5.3
Chile	3
Venezuela	3
Others	9.7
Total	63.7

^a Sources: Cassinelli and Gill (1997) and Anfar/Sindirações (1998)

Table 7
Evolution of the Brazilian feed production in millions of metric tons^a

Species	1990	1997	% of change 97/90
Broilers	8.19	13.89	69.6
Laying hens	1.45	2.45	69.0
Swine	3.86	8.95	131.9
Bovine	.89	1.78	100
Pet food	–	0.55	–
Horses	–	0.25	–
Fish	–	0.06	–
Others	0.44	0.75	70.5
Total	14.83	28.68	93.4

^a Anfar/Sindirações (1998).

and water is polluted through waste from animal production and processing where animal concentrations are high. Livestock is an important source of gaseous emission, contributing to global warming, projected to increase by 1.8°C worldwide over the next 35 years (Houghton et al., 1995 cited by Steinfeld et al. (1997)). It seems that because animals produce CO₂ from renewable and not from fossil energy, it is considered harmless to the environment (Tamminga and Verstegen, 1992). However, methane from bovine ruminants, whose production is 110 kg per head per year is an important source to consider in the greenhouse effect.

Most of the farms in developing countries are increasing in scale. Many small holder farmers are selling their land and moving to urban areas and technically modern, large operations are taking their places. Table 9 shows a 26% decrease in the number of farms and 55% reduction in swine farmers in Santa Catarina State in Brazil during the last decade.

In general, the entrepreneurs' and administrators' target is to obtain maximum returns on investments. All these pressures on the environment are the result of the role of livestock changing, due to rising demands for livestock commodities and to a different role for the environment. In essence, the conflict between livestock and the environment is an argument between human needs and values.

6.1. Public concerns on meat and milk intake

6.1.1. Meat

According to Cheeke (1993) protein from meat, has higher nutritional values than vegetable protein, in terms of amino acid composition, minerals except calcium and B complex vitamins. Many of the plant proteins contain anti-nutritional or toxic compounds, e.g. phytate, lectins, alkaloids, mold toxins, trypsin inhibitors and cyanide among others. The common concern about meat in developed societies is the fat content. Fat content will vary according to animal genetics and the techniques used in feeding. Per capita meat consumption is correlated with per capita income in a comparison of all countries. Red meat is a controversial issue and has become an image problem in the media. Because body fat in ruminants tends to have a higher proportion of saturated fatty acids than the fat of non-ruminants and ruminant meat contains a higher proportion of myoglobin in the muscle fiber, red meat has been associated indirectly with cardiovascular disease.

A use of recombinant somatotropin or beta agonists in swine, called repartitioning agents, are still under debate and may take several years to have a clear decision on their effects on health. Consumers decreased beef consumption and increased their poultry and pork consumption due to Bovine Spongiform Encephalopathy (BSE). The European Commission adopted a decision to introduce a total ban on the use of specific risk material for any purpose (Elliot, 1997a). In addition, avian influenza virus was pointed out as responsible for human deaths in Hong Kong and the WHO indicated some public health measures to be followed.

6.1.2. Milk

Lactose intolerance is a pathological disorder that comes from the low lactase secretion by certain

Table 8
Distribution of livestock, primary products and human population of selected countries, continents or groups of countries^a

	Pigs ^b	Cattle ^b	Sheep ^b	Chicken Meat ^c	Pig Meat ^c	Eggs ^c	Milk Total ^c	Meat Total ^c	Total population ^d	Rural population ^d	Urban population ^d
<i>Countries</i>											
Brazil	37	163	18	4.2	1.5	1.4	19	11.1	161	34	127
China	468	117	140	7.4	44	16.7	10	63.4	1232	848	384
India	15	197	46	0.5	0.4	1.6	69	4.3	945	689	256
<i>Continents</i>											
Asia	554	442	376	15.6	50	25.7	137	88.8	3488	2257	1231
Africa	22	201	212	2.2	0.8	1.7	23	9.5	739	480	259
Oceania	5	36	169	0.6	0.4	0.2	20	4.6	29	9	20
NC America	90	160	16	15.4	10.2	6.7	91	43.4	461	123	338
S America	58	298	88	7	2.5	2.7	43	20.4	322	69	253
Europe	167	106	137	7.6	21.3	6.7	160	42.7	729	190	539
<i>Groups</i>											
Developed all	293	355	419	24.6	35.2	17.6	341	100.5	1294	349	945
Developing all	646	969	654	25.1	53.4	28.9	203	119.5	4474	2779	1695
World	939	1324	1073	49.7	88.6	46.5	544	220	5768	3128	2640

^a Data adapted from FAO (1997) statistics.

^b Millions of heads in 1997.

^c Millions of metric tons in 1997.

^d Millions people in 1996.

Table 9
Evolution of herds, farms, farmers and production of swine in Santa Catarina State^a

Item	1985	1996	% of change 96/85
Farms	177 895	130 819	– 26.5
Swine farmers	54 176	24 382	– 55.0
Swine heads (1,000)	3185	4 536	42.4
Total production	3324	7 822	135.3

^a ACCS (1998).

groups of people. This allows undigested lactose into the colon. This is then fermented by bacteria in the colon, causing gases, distress in the lower tract and diarrhea. In addition, dairy products are rich in calcium and very efficient in preventing osteoporosis, a disease that reduces the bone mass mainly in white women in the post-menopausal stage (Cheeke, 1993).

Supplementation of BST (bovine somatotropin) increases bovine milk yield (5–25%) by modifying the lactation curve and maintaining high persistency compared to lactation curves for control animals. The response is influenced by the stage of production

and nutritional management conditions (Peel and Sauman, 1987; Chilliard, 1988 and Galton, 1997). However, a nine years' period of dispute on growth hormones between the North America and European Union is still effective. The final report of the World Trade Organization (WTO) concludes that food safety measures should be based on science (Elliot, 1997b). Disputes among members of WTO are complex and some trade barriers have been made using health measures as their basis.

6.2. Other non-food contributions from animals

6.2.1. Medical contribution

Livestock are raised for food but they are also a source of a number of products used in medicine or in the industry in general. Some of the products of animal origin are: Epinephrine from adrenal glands, thrombin from blood, insulin from pancreas, pepsin, ocytocin, albumin, imunoglobulins, TSH, ACTH, surgical suture, brushes, cosmetics, glue, skins, leather, wool and feathers. It is clear that the human quality of human life is improved by the wide use of medicinal products derived from the animals.

6.2.2. Companion animals

It has been accepted that companion animals have very positive effect on the elderly people and on the personality formation of the young.

Other areas where animals are important are: biogas and energy production, animal power, transport, fertilizer and sports.

6.3. A few considerations in modern animal production

The animal industry has to take in consideration the consumers perceptions and produce to meet their demands. Low fat meat and milk, no drug residues in carcasses, healthier foods, nutrient-enriched milk, eggs low in cholesterol are a few of the requests of our modern society. In addition, the consumer attitudes towards agriculture have presented remarkable changes in the last decade. Consumers have changed their perceptions of farmers being guardian of the countryside and the supplier of food to people they hold in suspicion (Williams, 1995). The suspicion can be measured by the headlines that directly concern agriculture, such as: saturated fats and coronary heart disease, food borne diseases, hormones, abuse of growth promotants, animal welfare and the environment. Some of these points have been outlined by Branscheid (1993) and a list of debatable topics is presented below.

6.3.1. Feed additives

These are non-nutritional ingredients or combinations of ingredients added to the basic feed mix or parts of this to fulfill a non-nutritive need associated with improved efficiency of the feed or animal performance. According to Cheeke (1993), the use of feed additives is controversial in livestock feeding. Critics of modern agricultural production techniques often claim that feed additives are hazardous to human health, may not be humane to animals by forcing them to achieve unnatural levels of production and are a symptom of undesirable reliance on chemicals. The population perceives some additives to be more threatening than others. Antibiotics, hormones, preservatives and growth promoting chemicals are suspect to many people. On the other hand, nearly as many people do not perceive en-

zymes, coloring and flavoring agents and probiotics as dangerous, which they may be. A report of a European Commission on feed additives cited by Lawrence (1992) shows interesting aspects of growth promoters and their relation to the environment. Besides promoting gain and improving feed efficiency some growth promoters (e.g. antibiotics) are effective in reducing pollution. Less drinking water is needed (42 l), less feed (14 kg) and consequently less slurry (43 l) containing lower amounts of N and P will be produced in growing pigs submitted to growth promoters. In addition, ionophores are additives that can reduce methane production in cattle, a gas pointed out as the second most important gas responsible for the greenhouse effect. Additives are frequently reported as harmful to human health but before any restriction on additive usage, it is necessary to study all the scientific aspects of their effects. A comprehensive list of additives and their applications can be found in Cheeke (1993), Feed Additive Compendium (1996) and in the Feed Industry Red Book (1997).

According to their function, additives belong to four main classes: feed stability and manufacturing enhancers, performance modifiers, animal health strengtheners and consumer acceptance intensifiers.

6.3.2. Antimicrobial resistance

Resistance of pathogens to antimicrobials has increased dramatically in the last decade, with a deadly impact on the control of diseases such tuberculosis, malaria, cholera, dysentery and pneumonia (WHO, 1996).

Foodborne diseases, have a major impact throughout the world. Estimates in the USA reach 80 million cases a year. The leading foodborne bacteria worldwide are *Salmonellae*, *Campylobacter*, *E. coli* and *Listeria*. Foodborne viruses including hepatitis A, are also common worldwide (WHO, 1996). Using an effective tool such as irradiation as a processing method to control food borne diseases can diminish current concerns for food safety.

6.3.3. Diseases from animals

Rabies is the most serious disease spread from animals to humans, causing around 60 000 deaths a

year. Human brucellosis, caught from farm animals is reported in 86 countries. (WHO, 1996).

6.3.4. Nitrate and nitrite

Used in some cured products may be converted to nitrosamines which are potent carcinogens.

6.3.5. Aflatoxin and fumonisin

Produced by molds that grow on grains are also potent carcinogens present in animal diets in many countries. There are technologies to decrease mold contamination and cope with this.

6.3.6. Biotechnology

Results from two surveys carried out by Hoban (1997) reflecting a view of 6000 respondents concludes that consumers will accept foods biotechnology engineered. However, it will be important to educate the media, health professionals and opinion leaders. The biotechnology industry, research organizations and government can foster greater confidence and trust by demonstrating ethical behavior and open communication. Agricultural biotechnology has to be put in a context that it will be used to develop new food products, and improve the existing ones at the right price. On the contrary, Wenk (1997) mentioned that consumers expect that their food and animal feed not to be genetically modified.

6.3.7. Animal welfare

To meet the human requirement for food, farm animals have undergone drastic changes in the systems of production. In general, the objective of many animal production systems is to decrease the cost of production by maintaining high standards in productivity. Concerns over declining farm animal welfare was mentioned by McInerney and Carruthers (1991) in relation to modern systems of production with lowered costs of production. Particularly important to aspects of animal welfare are the restraining devices (ties, crates), climate of the building (temperature – humidity-gases), floor construction (slatted, solid), stocking density and feeding management. Some of these can be related to fighting and tail biting in pigs or pecking in poultry. Friendly welfare does not end at the finishing phase for any

species. The farm loading, unloading and resting pens at the slaughter house are also important for diminishing porcine stress syndrome and others stresses.

Von Borell (1996) reviewed the current situation in the EU regarding the welfare of pigs. Recommendations for minimum pig protection and provisions for legislative and research actions in favor of pig welfare have been recently published. In the past it was difficult to have a scientific approach to measure animal welfare. Now, according to Broom (1996), there are a wide range of measurements of pigs welfare. They include time and energy allocation, preferences, fitness, physiological and immunological responses, diseases and injury incidence and animal behavior. One system that is an alternative to the confinement system that seems to attend the welfare question in pigs is the outdoor pig farm. In France (Le Denmat et al., 1995), in Denmark (Mortensen et al., 1994), and in Brazil (Dalla Costa and Santos Filho, 1996) outdoor pig production has been a successful and economically profitable alternative. The advantage originates mainly from a decrease in the housing cost. It is not correct to assume that methods used to benefit animal welfare would mean giving up gains in production. The betterment of animal welfare would result in a feeling of greater satisfaction for human beings and additionally would appear to give an economic benefit through higher product prices for characteristics desirable in farm products. The pressure for such products may grow because of more information, awareness and the changing perceptions of the public.

6.3.8. Health and safety of workers

Modern technologies, mechanization and the proper management of animals in the production system are becoming more professional every day. Workers have to enjoy a pleasant environment when taking care of animals. It was indicated by Gustafsson (1997) that workers in confined systems are exposed to a number of potential risks and health hazards. Among the risks are those related to ergonomics, dust, gases, noise, chemicals (washing), temperature and humidity and illumination. A successful program to prevent illness in farmers is reported by the

authors. It is based on health checks every two years, technical orientation with farm visiting by specialist staff every second year and consultation on health and safety at any time.

6.3.9. Sound environment

Modern animal productions' influence on the environment created a new and important area of studies, which is the environmental preservation. As widespread confinement of livestock increases in comparison to range animals, more problems with the safety of the environment are evident. Large numbers of animals on a limited area of land create more environmental problems. Modern building has to take into consideration not only the animal but also its wastes and the impact of these wastes on nature. A control of waste is possible but it takes economic resources to put it into practice. With current prices of livestock and primary products on the international market and without government help, it is difficult for the producer to maneuver the cost–benefit of such actions to improve the environment. In developed countries, there is an increasing concern due to the wastes and odor from animal production systems. It is important to prove to the media and the general population that surface water and ground water can be protected by proper technology. A system of lagoons, mechanical aerators, solid/liquid phase separators, filtering plants, energy production, other species feeding or correctly treated/distributed fertilizer can contribute to lowering the pollution of the environment. It is possible to diminish the odor from livestock systems with proper hygiene and storage. Nutrient reduction in the feed will reduce nutrient excretion. There may come a time when another constraint on feed formulation will be minimum levels of nutrients in the excreta as has been postulated by Tamminga and Verstegen (1992).

7. Conclusions and future research

- Most primary products in developed economies declined in output in the last decade. On the other hand, chicken meat, eggs and pork attained more than 70% of growth in the same period in the developing countries.
- In transition societies, there is a trend to become affected by globalization of the economy through increased unemployment and inflation. However, a transition country is faced with the prospect that the country can either move to common plateau of progress or regress to a condition of an economically unstable society.
- Quality of life as measured by the human development index of the United Nations, considering all countries, is intermediate in transition societies.
- The balance between rational farming and the environment is confronted by the economic value of implementing sustainable practices and the environmental concerns. New technologies should be applied considering food safety, animal welfare and an unharmed environment. Improved livestock productivity to support economic development and the sustainable management of resources are compatible goals.
- Controversial issues such as additives to feeds, food borne diseases, animal rights and environmental protection have to be well explained to the population. The public should be made aware of scientific results and international policies should be adopted based on technical principles.
- Developing countries must observe carefully the conflicting points in the chain of production of the animal industries which are specific to the developed countries and take advantage of that information to correct their own systems of animal production.

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