

The Cattle Industry at the Turn of the 21st Century: Its Role and Outlook

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Foreword

"The 1980's are to be considered a decade of squandered opportunities in so far as a more equitable distribution of resources is concerned. The economic growth registered by certain industrialized countries in both the East and West ran parallel to the stagnation and recession afflicting Africa and Latin America, where poverty brought into sharper relief the gap between the rich and poor nations."¹ The problems of hunger and malnutrition are anything but solved and the food supply needed to meet increasing demand remains one of the key issues to be faced in the coming millennium.

Assessing against such a backdrop the economic importance and the role of the cattle industry in its varying social contexts and surveying its typologies, range of production practices and the particular development that distinguishes them are but part of a far more multifaceted and complex world than may, at first glance, seem to be the case. Indeed, understanding and defining this sector are complicated even further by the far-reaching changes that have occurred over the last few years in the agricultural policies and trade relations of the world's leading agricultural producers as well as by the rapid transformation in the political and social fabric of both the former command-economy countries and those of the southern hemisphere. Then, too, the ongoing evolution in the modern dietary regimen and in the consumption patterns of meat and dairy products puts any interpretation of what is happening in the sphere of wishful thinking and makes any attempt to define the development prospects for the cattle industry very debatable.

The crux of these issues is first to be sought in the economic and social import as well as in the diverse technological profiles peculiar to a sector of the food industry that plays a key role in high-income countries, where the cattle industry is going through an altogether particular stage of development. Then it becomes a mat-

ter of delineating the development prospects for the industry's output in areas that by tradition and potential are surplus food producers. Lastly, it is necessary to identify the role this industry plays in those countries where the problem of food deficits must still be confronted and resolved.

A survey of the cattle industry in such an overall framework is thus a study from very differing viewpoints. It must be approached systematically in terms quantitative and technological as well as in relation to the changes in consumer habits and in the world's food-supply system.

The Cattle Industry: Stock and Output

"The relative importance of the cattle industry's economic role has varied down through history. Currently, food production occupies a privileged position in the developed countries, in nomad societies and in extensive farming systems whereas the emphasis in the developing countries is on energy (motive force) input."² The importance of the cattle industry can thus be quantitatively determined by the substance of its stock. The statistical figures subsume in the same class animals with very different biological, morphological and functional traits. Examples include the zebu (*Bos indicus*), found in large areas of America, throughout most of Africa and in the extensive regions of Asia and Australia located in the tropical and subtropical belt; the domestic ox (*Bos taurus*), usually found in cold temperate zones; the buffalo, which represents about 10% of the world's bovine population yet is of particular import and occupies specific functional niches by virtue of its territorial concentration; i.e. since it makes up one-fifth of all bovine animals in the 30° N-S belt, it is the main milk producer³ and a particularly efficient source of labor in tasks that do not require speed.⁴

Geographically, the developing countries account for two-thirds and the developing ones one-third of the world's cattle stock, more than 50% being concentrated

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in Asia and South America. The last decade has seen a drop in both absolute and relative terms in North America, Europe and Oceania and a rise everywhere else. The diminution in the twelve-member EU is the same period amounted to more than six million head in the UK, France and Germany, the Union's traditional leaders.

This dichotomy reflects diametrically opposed social and production conditions. The decrease in stock is registered in societies marked by low rates of population growth and high-yield production systems, which in turn have resulted in surplus supply. By contrast, the growth in stock is found in areas of high population growth under systems which, whether nomad or extensive, are marked by such low output and a failure to meet growing consumer demand as to represent in extreme situations man's food competitor. The territorial range of cattle, their genetic variability and the growth rates of each geographical area subsume extremely different conditions as to output concentration, economic importance and management techniques.

Cattle Industry Leaders

The map of the world cattle industry features several centers of production. Cattle raising for the meat industry enjoys pre-eminence in areas where grazing land and forage supply are plentiful, even reaching peak specialization levels when labor scarcity is added to these conditions. The overall 1992 output of cattle and buffalo meat approached 53 million metric tons, the latter type being of considerable importance in Asia where it is mainly concentrated.⁵ In absolute terms for the same year, this figure represented about 30% of all meats, a drop of almost four percentage points over the preceding decade.

The producers with an output of more than 500 thousand tons of meat yearly are South Africa in Africa, Canada, Mexico, USA in North America, Argentina, Brazil, Colombia in South America, China, India, Japan in Asia, France, Germany, Ireland, Italy, Poland, the UK in Europe, and Australia and New Zealand in Oceania. North America and Europe account for almost 48% of the world total, a figure that exceeds 66% if the other developed countries are included. Meat production per head of cattle is very similar in North America, Europe and Oceania, only half that in South America and less than one-fourth in Africa. The last decade has seen production increases in both developed and developing countries, albeit to a greater extent (about 5%) in the former than in the latter (about 1%), thereby widening the technology gap between the two.

Milk has played such an important role in man's life as to have left an indelible mark in history and myth.⁶ Advances in dairy milk production are perhaps one of the fields where genetics, diet and health controls

have been so successful in achieving ambitious goals as to make it difficult to foresee further developments in the near future. The 1992 output of milk from dairy cows was 454,678,000 tons, or 89% of total milk production.⁷ If to this figure we add that for buffalo milk, the total reaches 498,035,000 tons, or 97% of world output.

The producers with more than five million tons of bovine milk yearly are Canada, Mexico, the USA in North America, Argentina and Brazil in South America, India and Japan in Asia, Czechoslovakia, France, Germany, Italy, the Netherlands, Poland, Spain and the UK in Europe, and Australia and New Zealand in Oceania - a list that matches almost perfectly that of the leading meat producers. Europe accounts for 35% of the world total and 78% of the milk output in the developed countries.

Milk production per head of dairy stock varies widely in both developed and developing countries. The former have the highest rate, 6.7 tons yearly (registered in North America), and it is about threefold higher than that recorded in the former Soviet Union. The peak output in the developing world is found in Latin America, a rate threefold higher than that in Africa, which in turn is one-twentieth the peak in North America. The rise in the average output per dairy-stock head over the last decade was 1.7% in the developed and 2.1% in the developing countries - a rate still far below and incapable of meeting the increasing demand for this irreplaceable food staple.

Cattle continue to be a significant source of energy in areas where labor is being replaced at a slower rate by increases in capital investments.⁸ Of the total energy demand in agriculture, animal input still amounts to 13% in Latin America, 23% in the Far East and about 14% in Africa.⁹ It continues to be an irreplaceable means of production as well as a development factor in vast regions, especially in countries where capital is a relatively scarce labor resource and on the smallest farms where technical and financial constraints make the use of mechanically powered means prohibitive.

The distribution of these bovine production centers is evidently linked to conducive environmental conditions as they are concentrated in temperate regions that are most favorable for grass and forage crops. It also evinces the existence of specialization factors in stock management and differentiation in breeding systems.

Endogenous Specialization Factors in Cattle Breeding

The cattle production centers are correlated to *endogenous specialization factors* that have promoted their development and enabled them to achieve peak performance under optimum conditions. These factors include (i) favorable agronomic conditions and particular structural facilities; (ii) the use of bio- and mechanical technology in management; (iii) improved breeding practices and advances in health and disease

prevention and treatment; (iv) upgraded infrastructures for slaughtering and the production, storage and marketing of meat, milk and dairy products; (v) improved breeder training and farm management; and (vi) wholesale price levels.

(i) Favorable agronomic and structural conditions are among the key factors in the development and specialization of the cattle industry. Rainfall distribution and soil composition are the main factors affecting this production.¹⁰ Favorable agronomic conditions are common to all the cattle-breeding centers, including the entire Mediterranean Basin, where the concentration is greatest in the northern areas which enjoy a better rainfall distribution, water supply and soil make-up than the southern areas.

Systems of land holding or ownership and the size and fragmentation of farms can be important limiting factors.¹¹ Small holdings are a particularly important barrier to technical advances in breeding¹² that are aimed at increasing labor productivity and capital returns and that depend for their introduction on optimum size.¹³ Meat production in particular is closely linked to land supply, large holdings and mainly extensive breeding operations.

(ii) Cattle raising has contributed more than that of other animal species to increase labor and land productivity throughout the historical process of intensive agriculture by supplying energy and containing food competition with man via his capacity to exploit otherwise unusable by-products. One specific trait of the cattle industry is its being a processing system of available forage as well as of farm and agribusiness by-products. The low cost supply of feed - efficient dietary regimen¹⁴ - is synonymous with productivity in all environments. The progressive rise in acreage yields for forage crops and improvements in pasturage management have increased the number of cattle per unit of area. Advances in farming systems on the other hand have resulted in higher yields of crop by-products or of their industrial processing output, thereby enhancing the complementarity between crop and livestock raising that was already noted in the first agricultural revolution of the 1700s.¹⁵ The development of cattle rearing in tropical zones implies grazing land, given that the latter (both in the circumstances and in the environments where they are most frequently encountered) are the most economical source of food for ruminants.¹⁶

(iii) The advances in breeding genetics have influenced the yields and specialization in cattle raising, and those in health and disease prevention and treatment meat productivity and quality output in all environments.¹⁷ Those countries in which these innovations have spread more widely have achieved growth rates in supply that exceed those of demand. The structural

surpluses in the twelve-member European Union, the results of breeding, health and veterinary advances in the cattle industry, have necessitated the reduction of existing stock so as to reduce supply.¹⁸

(iv) The availability of infrastructures, cattle slaughter and processing and storage facilities of meat, milk and their by-products which meet the most rigorous international standards of technology is another condition for development and specialization in the cattle industry. No industry can grow if infrastructures do not develop along with techniques. The efficiency of laboratories and diagnostic, disease prevention and veterinary treatment facilities is essential to the cattle industry's pipeline, while slaughter houses and infrastructures for processing, storage and health-sanitary inspection are strategic to product marketing.¹⁹ An efficient land and sea transport system is a preliminary necessity for industry development in a market that is increasingly open to global trading practices.

(v) Improving human resources in production is an idea acquired over time. Some analysts have emphasized without qualification the fundamental role of human resources and technology in developing competitiveness, even to the point of concluding that "education and infrastructures are the backbone of development."²⁰ Upgrading the education and professional training of breeders is thus a key production factor, especially where specialization is most advanced and high levels of output achieved, i.e. in all those conditions where the achievement of a satisfactory economic performance is closely linked to stock health and proper dietary regimen.

In the evolution of social organization, the growth of the role of the family-run farm, which arose from the ruins of feudalism in Europe, is an important stage of industry development. Studies of production systems in transitional societies and developing countries indicate that the family farm can be an effective instrument both in overcoming the old social and land-holding systems and increasing output.²¹ For example, it is a known fact that increasing crop acreage diminishes the productivity of the land and labor, and in Africa the complexity of social relations is one of the main elements hindering growth of output. Attaining better resource distribution, especially land, and the overcoming of social barriers that still separate breeders and farmers can become further growth factors for the cattle industry.

(vi) The price levels of cattle products have been the main impetus to specialization and intensive production in the EU. The current situation of surplus production within the EU is the result of the simultaneous existence of areas that are markedly deficient and others of enormous production potential, the enactment of the EU's preferential trade policy and the pegging of prices at levels above those of the international market and, hence, very favorable to breeders. Conversely, low

prices would result in delaying the introduction of innovations and increasing output levels. More favorable environmental situations and better overall conditions for the spread of endogenous factors encouraging specialization in the cattle industry combine to differentiate typologies, breeding systems and the growth of supply rates.

Cattle Breeding and Supply-Control Systems

Cattle breeding operations can be classified into three general types: more or less extensive grazing, semi-grazing and more or less intensive stabling.²² The technical criteria underpinning this classification are the various stabling methods²³ and feed regimens, whereas the economic parameters used to differentiate them include the varying ratios of production inputs (land and labor) and capital outlays per head. The system classification above thus ranges from the less to more capital-intensive per head of raised stock.

As a rule, it can be stated that the more plentiful the supply of the above factors (i.e. less expensive), the more economically convenient its use. Thus, extensive grazing systems prevail wherever land is abundant and labor cheap, and, conversely, intensive stabling is the rule wherever land is scarce and the labor supply relatively so. Intermediate approaches are linked to land supply and the extent to which labor and capital replace each other, e.g. extensive systems prevail wherever capital is scarce. Increases in capital investment in the various breeding systems is usually associated with increasing output specialization, diversification of clinical disorders, high yield rates and raises in demand.

Seen from the standpoint of health, the evolution of breeding systems is linked to the diversification of clinical disorders and diseases, which become a limiting factor whenever cost increases for systematic veterinary care and management of the herd are not at least offset by an equal rise in market value. Attaining perfect health conditions is in effect a hardly realistic assumption even in the most advanced breeding systems. Indeed, it is so to such an extent that the presence of sub-clinical pathologies is thought to be an insurmountable barrier and, as an alternative to extreme productivity conditions, it may be more economically viable to reduce performance and concentrate more on sources of animal resistance to pathogens or turning to breeding and management practices that are integrated with the environment and the region. "Agriculture in the year 2000 will be increasingly viewed as an interaction of the environmental and social systems, thereby expressing on the one hand a respect for nature and on the other the new demands of the consumer."²⁴

Yet the possibility to increase overall supply as well as that from semi- and full grazing systems depends on the progressive use of ever more intensive practices to

enhance the yield of production factors. Indeed, it can be stated that expansion, i.e. the global increase in arable land, is an option that is practicable only with the utmost caution. Experiences under way in certain South American countries and the increasing awareness towards environmental issues indicate that it will be increasingly difficult to continue along some of the paths employed to date to raise output. The current attempt by European countries to reinstate extensive practices is linked to surpluses and a considerable, altogether particular pressure from livestock on the land. Here the support for extensive grazing is aimed at restricting output and environmental impact, and can be viewed as a transitory measure designed to stimulate the development of new breeding models integrated with the agro-industrial system and the surrounding area. With which typologies and where will cattle raising develop, what will the rise in supply rates be and for what products, all these questions are linked to a number of factors that are exogenous to the system of the cattle industry.

The Cattle Industry: Exogenous Factors and Consumer Patterns

The evolution of breeding systems has also been a response to the development of consumer patterns, which have changed along with variations in a number of factors outside the cattle industry that have combined to determine its growth rates. Of these factors, population increase plays a key role in determining the extent of demand. Yet, on the other hand, a good part of consumer-behavior modelling is based on the assumption of a direct long-term relation between consumption and income.²⁵ Consumption in actual fact is linked to complex behavior patterns that change in relation to both the above factors and to the variation of cultural models, which can profoundly influence consumer responses and change their preferences over time.²⁶ Cultural evolution and the intensity of population migrations²⁷ have historically provided the basis of behavioral change and once again may prove decisive, more so than other factors, in directing the growth of food consumption.

The outlook on the threshold of the twenty-first century can be defined, at least in a first approximation, by the rate of population growth²⁸ and average income per capita. According to FAO demographic projections, the average yearly growth rates of the world's population for the period 1980-2000 will be 1.6% worldwide, 1.6% in Asia, 3.1% in sub-Saharan Africa, 1.8% in Latin America, 0.4% in the OECD countries and 0.5% in the east European countries. It follows that demand will be greatest wherever in actual fact production conditions and output levels are less favorable. The countries in the worst situation are thus in sub-Saharan

Africa, followed by those in Latin America, although by virtue of their greater supply of resources the latter are projected to raise production by an average yearly rate of 2% and, hence, to offset the demographic increase.

The prospects for improvement in the average annual income per capita are more debatable. Projections by the World Bank indicate an average yearly growth rate for 1980-2000 of 2.3% in the developing and 2.1% in the industrialized countries.²⁹ This is an essentially optimistic outlook that, at least for the developing countries, further aggravates the food-demand situation. The last few decades indicate two other prevailing trends: a greater increase of consumption rates in developing rather than developed countries, a reflection of a stronger demographic trend, and a general shift in food demand patterns "away from traditional staples (which can vary from region to region) to other cereals and other staples, especially livestock products."³⁰ The demand for these latter is thus seen as very dynamic, with important consequences for production and breeding systems, the determination of future consumer patterns and the world market for these products.

Consumption Models and the World's Food System

Consumption models have changed greatly over time. Those of Europe's peoples have had a historical role in the spread and reproduction of dietary habits, attaining such an importance "in the wake of the broad migration stream of these populations in the 19th century"³¹ as to become a "Western model" towards which consumer patterns tended to gravitate. For example, meat consumption in France around 1840 was at the same level as that currently found in developing countries, and in the same country among the changes in the consumption of staples that of livestock products "almost tripled from 1850 to 1951"³² and "meat became the food around which meals centered." The Western model, even with its differing features,³³ calls for an increase in total calorie and protein intake, the latter being provided by a progressive increase in animal proteins. Influenced by Western cultural and nutritional models, these dietary habits have spread, albeit to lesser extent, to countries with markedly differing socio-economic structures to their agro-food production and distribution systems. Thus, meat in Japan accounted for slightly more than 1% of daily calorie intake in 1951 but almost 13% by 1981. This Western model, with its increased consumption of livestock products, is now spreading in a similar way throughout the developing countries.

There are striking disparities in the consumption of meat, milk and dairy products from one country to another as well as between differing areas of the same country and between social classes. "The population in

developing countries, which accounts for 70% of the world's total, consumes 60% of all calories but only 30% of these are of animal origin."³⁴ The estimated yearly consumption per capita of beef in the developed countries is about five-fold higher than in the developing ones and almost eleven-fold higher than in the countries of the Far East.³⁵ Milk consumption is ten-fold less in African countries than in North America and Europe.³⁶ **The role of cattle breeders in the world's food-supply system is at any rate a fundamental one, and all the indicators suggest that this position will continue if not grow in importance.**

Other favorable factors contributing to changes in the consumption patterns of meat and dairy products include migration flows from poor to wealthy countries, urban population rise in Third World countries and the imitation by the rural populace of urban consumer habits.³⁷ The differences in consumption between developed and developing countries suggest that differing development paths for the cattle industry can be traced in the world's food-supply system. While development in the latter will mainly concern production, the emphasis in the former will probably be on the outlet end of the pipeline, i.e. food processing and marketing activities will increasingly come to dominate production and consumption.

Deficit and Surplus Areas

The balance between rising demographics and the growth of output has always been a precarious one, and only in the last two decades has the increase in the food supply been able to meet the increase in demand. An analyses of the production and consumption of meat and dairy products indicates the existence of deficit and surplus areas, the latter playing a decisive role in the balance of the world's food supply and their dynamism being in large measure linked to the former.

A market analysis by commodity evinces certain trade differences in meat and milk and a geographical survey contrasting phenomena between areas. Europe and Oceania are the two main export zones in the world beef trade, together accounting for 93% of total 1992 intercontinental exports.³⁸ By contrast, the largest beef deficit was Asia, where Japan and Korea account for 67% of that continent's beef imports, followed by the area comprising the USA and Mexico. The main beef importers in Europe are Italy, ranking third behind Japan and the US, then Greece, both of which import beef from Eire, the Netherlands, Germany, Belgium and France. The only African country with a marked beef deficit, with imports of 134,651 metric tons (t), is Egypt. Thus, the beef trade essentially concerns the developed countries, which adjust amongst themselves deficits and surpluses, whereas all

of Africa, most of Asia and many of the countries in the Americas are relegated to the trade margins. Beef accounts for 40% of all meat traded and 45% of total market value.

A geographical analysis of the international milk market shows certain features that differ from the beef survey. The main difference is to be found between fresh milk and the powdered and condensed products. The former is limited in range to specific areas of deficit and surplus for obvious technical reasons. In the Americas, the US surpluses are taken up by Mexico and those of Uruguay by Argentina. In Europe, where fresh milk accounts for 94% of total world trade in this product, the leading importer is Italy (1,553,091 t in 1992), which takes up most of Germany's 1,602,960 t in exports, although this is trade between neighboring countries with a similar and reciprocal development profile.

Trade in powdered and condensed milk has none of these traits. Here are to be found vast deficit and very restricted surplus areas. Germany and France are the world's leading powdered milk exporters, followed by New Zealand and Australia, these latter having the same market share. All the countries of Africa, Asia and Latin America (excluding Uruguay) are net importers of powdered milk. Europe is the only surplus area for condensed milk, Germany accounting for 74% of the world's total exports.

If we combine these data with those for beef and fresh milk, the world trade picture that emerges brings to the foreground the enormous differences in food supply between the developed and developing countries - a profile already seen in consumption patterns. It indicates too that, although achieving a secure food supply has held center stage for most of the developing countries, the results to date are far indeed from the initial goals.³⁹ Demographic pressure, environmental deterioration, the instability of the world's economic system and the differing rates of productivity growth have widened, despite efforts to the contrary, the gap between surplus and deficit areas.

The Outlook for the Cattle Industry

The future prospects for the cattle industry and its market developments depend on a series of factors. These include a prompt PAC accord, greater international coordination in agricultural policy, liberalization of trade in agricultural commodities and the reduction of the effects linked to surpluses in this produce in Europe, as well as demographic pressure, income dynamics, and the migratory flows between countries and between town and countryside.

Generally speaking, a reduction of agricultural

subsidies in the OECD countries and, especially, a new PAC agreement should cause a short-term rise in the price of food staples,⁴⁰ particularly of meats and to a greater extent of pork and poultry. While this represents a development factor for the cattle industry, especially wherever there are the most favorable production specialization skills,⁴¹ it will also produce adverse effects on importers of these commodities, especially those countries lagging in economic development that even now evince low levels of consumption and depend heavily on imports of a basic food as irreplaceable as milk. This staple plays a strategic role. Beef, for example, can be effectively replaced by alternative meats, which are even cheaper, more convenient and plentiful than the energy and protein inputs needed to produce them. By contrast, bovine milk and dairy products have no substitutes that are either as readily available as those for beef, or that have the same nutritional and physiological value. Cattle in this sense is a strategic industry, even to the point of relegating beef to the status of a milk by-product. The future implications for the dairy industry, then, are that it will be all the more important wherever conditions are difficult or extreme. Given the further trade liberalization among industrialized countries, various studies see rising prices as the long-term outlook for the world beef market.⁴²

The future prospects of the cattle industry as a whole appear to be favorable, especially in those areas where immediate production conditions are best. On the other hand, demographic pressures, income dynamics and changes in dietary habits are factors that tend to increase the demand for the industry's commodities. However, unless efforts are coordinated and financial and human resources concentrated so as to determine the conditions (health above all) needed to increase bovine output in the less favored zones, there seems to be no way to narrow the gap between surplus and deficit areas. At any event, the cattle industry is on the whole less in food competition with man than other livestock operations. Yet, as it still depends on the supply of natural resources, including water, needed for forage crops, the reduction of arable land and the depletion of water resources for fodder production may become the main factors limiting the cattle industry's development.

Conclusions

As they emerge from the present context, the future prospects and the economic functions of the cattle industry stand out clearly in all their importance. The

veterinarian and disease control play strategic roles in this connection. The former is the physician of an animal organism that must be reared in the healthiest and cleanest conditions possible so as to meet man's growing food demands. The latter is the instrument needed to achieve this end.

Accounting for nearly 30% of the world's meat, 97% of its milk and contributing about 20% of the energy input needed in Asia, Latin America and Africa for agricultural production, the cattle industry occupies a strategic position in the world's food-supply pipeline. The growth rates of the industry's commodities depend on both endogenous and exogenous factors, which combine to differentiate productivity in the areas where the cattle industry is found. The more favorable rearing conditions enjoyed by the developed countries with respect to the developing ones so markedly separate these two worlds as the 21st century approaches as to give rise to extensive social phenomena, the dynamics of consumption models and the global food-supply system being projected for the near future.

The imbalances in population distribution between the developed and the developing nations, between their respective demographic and development rates, and the migratory fluxes represent the major factors of growth and the differentiation of a demand that will inevitably rise at higher rates in the latter. Then, too, variations in the supply of natural resources and the growth potential of the other production factors outside the cattle industry will affect its spread, typology and development.

Population increase, technology advances and accompanying changes in dietary regimen, the rapid rise in urban population and the spread of a 'Western model' around which the consumer preferences of the developing countries seem to turn are fuelling the growth of the consumer market and the nutritional habits that accord to wheat and cattle a privileged position with respect to traditional staples.

Meeting a growing demand for livestock products is possible only through the progressive introduction of innovations and intensive production practices. Demographic pressure is so strong that wherever forage crops can be grown there is no need to think about planting polyennial pasture grasses.⁴³ On the other hand, an unbalanced nutrition is the main factor inhibiting high livestock yields.⁴⁴ The search for more readily digestible fodder is thus one of the ways to follow in attempts to boost land productivity rates.

Supporting the spread of extensive production methods in Europe appears to be a transitory phenomenon linked to food surpluses amid prospects of developing breeding techniques that can be integrated with the agribusiness industry in a territorial context.⁴⁵ Extensive techniques seem at any rate to retain a stra-

tegic importance wherever alternatives to land and grazing resources are non-existent.⁴⁶ Noteworthy here is the fact that most of our knowledge concerning the variables influencing the quality of pasture grasses derive from surveys conducted in temperate zones and that the key to the best exploitation of these resources is the specific study of environments which do not admit of alternative uses. A similar observation may also hold true for other fields of research, including cattle disease prevention, which should direct future efforts to those geographic areas that today are less studied and where greater increases in both demand and output growth rates are most likely.

It can be assumed that beef and dairy products will continue to be less important in the human diet than other staples of animal origin, although to a differing extent for milk and dairy products with respect to meat (and the former to an even smaller extent than the latter two). Breeding to improve local and still unexplored stock, identifying animals with greater stress tolerance, advances in health and clinical veterinary medicine, and more effective techniques in disease-prevention and treatment are the lines of research and experimentation to be followed in milk production. It is likely that in the cattle industry, too, it will be necessary to enhance the differentiation of breeds and production specialization so as to stimulate and exploit in each geographic area the varying agronomic and climatic potentials as well as the genetic ones of local stock so as to upgrade output performance and enhance disease resistance. The pace of development and dissemination of these new technologies will depend on a number of factors, economic, social and political, and on the direction we give to research.

References

1. A. Vidal Naquet, Strategie di aiuto per la soluzione dei problemi alimentari nei paesi in via di sviluppo, Nuova Stamperia Parenti, Florence, 1992.
2. L. Maalassis, Economie agro-alimentaire III, Cujas, 1986, p. 93.
3. A. Santiago, El Cebu. Ganado bovino para los paises tropicales, U.T.E.H.A., Mexico, 1970, p. 566.
4. R.E. McDowell, Improvement of Livestock Production in Warm Climates, Freeman and Company, San Francisco, 1972, p. 591.
5. Quarterly Bulletin of Statistics, FAO, Vol. 5, 1992, 4.
6. Herakles in Greek myth achieves immortality by sucking the milk of Hera's breasts, which flowed so copiously from her in sleep as to cause a lily (symbol of prosperity and fertility) to bloom where it fell upon the ground and the Milky Way (the soul's path to immortality) to form in the heavens. The dairy industry is perhaps the oldest: all the products derived from milk were known to Neolithic man; Asiatic peoples around the year 1000 A.D. knew how to dehydrate milk for storage and later consumption; and Pliny cites recipes for milk flavored with mint and mountain celery, a favorite beverage of the day.
7. "Quarterly Bulletin of Sta-

tistics," FAO, Vol. 5, 1992, 4. 8. Buffaloes are an irreplaceable source of labor in Egypt and in the rice paddies of various Asian countries. 9. L. Malassis, op. cit. p. 99. 10. Mc Dowel op. cit., p. 213-214. 11. Whyte, Moir and Cooper, Grasses in Agriculture, FAO, Rome, 1975, p. 26. 12. Forage storage, dietary regime, farm organization and management. 13. This is the optimum mean size (OMS), i.e. the one matching the minimum cost per unit in the given conditions. 14. Together with good health of the stock itself. 15. This complementariness is frequently denied because farmers and cattle breeders are assumed to belong to opposing groups or social classes - an assumption that even in many places today separates rather than enhances them and their links in a situation where both must deal with the same decision making problems in production and marketing strategies. 16. R.S. McIlroy, Introduccion al cultivo de los pastos tropicales, Limusa, Mexico, 1976, p. 7. 17. Health aspects are important in all conditions and even more so in extreme situations, as in developing countries or those in particular situations of transition. It is estimated that livestock sanitary problems in a transitional economy like Albania's have resulted in 1992 in a 10% decline of the livestock population, or in monetary terms of an US \$80 million loss. 18. Studies conducted by the US OTA estimate that of the 57 technologies in the field of livestock, 27 will be available before 1990 and 30 from 1990 to the year 2000. They also indicate that the new technologies will trigger a significant rise in performance that will be faster in livestock breeding than in agriculture, and that these advances will be adopted more rapidly by the larger holdings, which have greater access to information and greater financial resources. 19. Several studies of transitional economies in countries with former command systems indicate these features as key factors for development of the cattle industry. Even the downturn in meat exports from producers in Latin America can also be linked to an inability to comply with international product standards. 20. A. Segrè, "La rivoluzione bianca. Processi di de-collettivizzazione agricola in Russia, Cina, Paesi Baltici, Albania", Mulino, Bologna, 1994. 22. G. Ballarini, "Conduite de l'élevage et pathologie bovine," *Proceedings of the "XVI Congreso Mundial de Buiatria, Interlink consultoria," Salvador-Bahia*, 1990, p. 2. 23. Stabling in turn determines the systems employed in cleanliness and control of both individual head and the herd's physiological-climatic characteristics. 24. F. Ghelfi, "La gestione

moderna delle aziende agricole," *Proceedings of the Società Italiana di Buiatria*, Vol. XXIV, 1992, p. 682. 25. P. Allard, "La modelisation de la consommation des ménages en France," *Revue d'économie politique*, no. 5, 1992, p. 727. 26. In ancient Roman culture "wheat, the grapevine and the olive were the prongs of a triade of production and cultural values which that civilization took as a symbol of its identity." Altogether different were the production approaches and cultural values of the contemporary Nordic populations, which found in hunting and forest-grazing of the pig, cattle and horse the main activities typifying their way of life. Here the food of primary value was not vegetables or cereals but meat. The decline of the "Roman" and the rise of the Germanic populations changed the ways of production and the dietary habits of the Empire. M. Montanari, *La fame e l'abbondanza*, Laterza, 1992, p. 12. 27. Dalle zone rurali alle città, in senso Nord-Sed e Sud-Sud, dagli ex paesi ad economia pianificata ai paesi ad economia di mercato. 28. The projections of food demand are very sensitive to demographic growth assumptions. M. Brown and I. Goldin, *L'avenir de l'agriculture: incidences sur les pays en développement*, OECD, Paris, 1992, p. 33. 29. World Bank (1989b), p. 21. 30. M. Brown and I. Goldin, op. cit., p. 27. 31. M. Montanari, op. cit., p. 31. 32. L. Malassis, *Economie Agro-alimentaire I*, Cujas, 1973, p. 97. 33. The Anglo-Saxon dietary model is Al modello nutrizionale anglosassone si affiancano altri modelli come quello mediterraneo. 34. L. Malassis, op. cit., Cujas, 1973, p. 63. 35. Meat consumption ranges from 4 kg per capita yearly for low-income countries to 35 kg per high-income ones. A. Bender, *Meat and meat products in human nutrition in developing countries*, FAO, 1992, p. 6. 36. S. K. Kon, *La leche y los productos lacteos en la nutrición humana*, Rome, FAO, 1972, p. 72. 37. J.P. Charvet, *Les graniers du monde*, Economica, Paris, 1985, p. 9. 38. Data reworked from the FAO Yearbook, Trade, Vol. 46, 1992. 39. A. Vidal-Naquet, op. cit., p. 3. 40. Brown M., Goldin I., Op. cit., pag 162. 41. The newly concluded GATT accords benefit all countries except the developing ones. 42. M. Brown and I. Goldin op. cit., p 199. 43. McDowel, op. cit., pp. 186-187. 44. McDowel; op. cit., p. 173. 45. Aimed, that is, at overcoming problems linked to the spread of 'industrial' breeding methods. Mal I, p. 251. 46. *Proceedings of Fe.Me.S.P.Rum.*, "Explotacion extensiva de ruminantes," Salamanca; 1992, p. 12.

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