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A Shift from Crop-Mixed Traditional Dairying to Market-Oriented Organised Dairy Farming – Plausible Factors Responsible for Structural Transformation in Indian Dairy Sector

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BACKGROUND

Demand for, and production of, livestock and livestock products in less developed countries (LDCs) is expected to double over the next 20 years (Delgado *et al.*, 1999; Parthasarathy Rao *et al.*, 2004). About 23 per cent of the world population live in developed countries and presently consumes three to four times the meat and fish and five to six times the milk as those in developing countries (Delgado *et al.*, 1998). The International Food Policy Research Institute (IFPRI), Washington, D.C. in a seminal work *Livestock to 2020* observed that population growth; urbanisation and income growth in developing countries have fuelled a massive global increase in demand for food of animal origin. With increased urbanisation and change in life style, food habits are changing leading to increased consumption of semi-processed and processed food of which milk and milk products and meat occupying significant place. Typically, this phenomenon is described by experts as “revolution” propelled by changes in the society and improvement in well-beings, and in the same context compared as “Green Revolution” of the late 1960s. Livestock production has been growing faster than any other agricultural sub-sector, and it is predicted that by 2020 livestock will account for more than half of total global agricultural output in financial terms (This process has been termed as ‘*livestock revolution*’) (Conroy, 2004). Nonetheless, it is qualified that while the green revolution was supply driven, the present livestock revolution is demand driven, and therefore changes in demand driven factors assume greater importance. One dimension of the livestock revolution has been the industrialisation of livestock production, with production changing from being the traditional local multi-purpose activity to an increasingly market-oriented and vertically-integrated business (Delgado *et al.*, 1999; Steinfeld, 2002).

On the other hand, the process of industrialisation affects the rural masses, engaged in small-scale livestock production. There is a real danger that large-scale intensive producers could undermine the viability of small-scale livestock production,

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thereby exacerbating rural poverty (Steinfeld, 2002). These smallholders obtain nearly half of their income from livestock (Shukla and Brahmanekar, 1999; Birthal *et al.*, 2003). However, small scale milk producers face many hidden costs that make it difficult for them to gain access to markets and productive assets (Staal *et al.*, 1997). Whether or not this happens will depend on two factors. One is government policies, and how supportive they are of small scale production. The other is the extent to which small-scale producers are able to increase the efficiency of their operations and the productivity of their animals. This in turn will depend partly on the efficacy of research and extension systems in supporting them (Conroy, 2004).

In developing countries, the combination of higher demand, more people and less space is rapidly leading to a global transformation of the livestock sector, from one that mobilises surplus and waste resources (backyard slopes, remote pastures and grasses indigestible by humans) to one that actively seeks new resources for the production of animal food products (Steinfeld *et al.*, 1997). Under this background, the plausible factors responsible for or leading towards the structural transformation of Indian dairy sector have been examined with the use of published/secondary information.

Urban Population

Urban population is associated with, not only higher average household incomes, but also differences vis-à-vis rural areas in the market value of time involved for food preparation (working wives), easier access to a more varied set of stores, more food consumed outside the home, increased contact with advertising and changing lifestyles more generally (ILRI, 2006).

Population growth increases the total demand for all food, including both animal source foods and staples. Growth in demand for animal based foods (due to income growth and urbanisation), improvements in markets and infrastructure and inter-regional trade are important drivers of livestock intensification (Birthal and Rao, 2004). Of the eight Asian countries, the growth in population during 1990-2000 is in the range of 1 to 2.5 per cent. The top four net contributors to world population in the second half of 1990s were in decreasing order of net new population: India, China, Pakistan and Indonesia (World Bank, 2005). It is important to note that population growth from 1970 to 1999 in the developed countries was only 0.7 per cent per annum (Delgado, 2005).

According to the *National Commission on Population Projection (2006)* the population of India is expected to increase from 1029 million to 1400 million during the period 2001-2026 – an increase of 36 per cent in 25 years, at the rate of 1.2 per cent per annum annually. By 2026, about 535 million people will be residing in towns and cities – a rise of 248 million from a base of 286 million of 2001. Overall, growth in urban population for the next 25 years is estimated at 2.5 per cent per annum. It means that urban population would grow at a higher rate than that of total population during 2001-2026.

In the next quarter of a century, 38 per cent of population is projected to reside in the urban areas—a rise of 10 percentage point from the base year of 2001. This means, by 2026, India would continue to be rural as 62 per cent of the total population would be residing in the villages. The results of the Technical Group, reveal that growth in urbanisation will be linear up to a point, viz., i.e., 2001-2021, but during the short span of next 5 years (2021-26), it would pick up considerably. Numerically, the level of urbanisation would increase from 28 per cent in 2001 to 30 per cent in 2011, 32 per cent in 2021 which would scale up to 38 per cent in 2026.

If we link this phenomenon with the primary sector (crop and livestock production), it is likely that considerable changes in possession of rural resources for agricultural production would take place. With these changes one can visualise that in future there could be consolidation in production of agricultural-cum-allied activities as considerable section of the population is projected to be away from the rural production system. Changes in structure of milch population holding would be stronger in view of the induced effect of higher growth in urbanisation, affecting shift in occupational characteristics away from primary production (Datta and Dadhich, 2007). Thus, the marginal or footloose producers would have to up scale production to cater to increased demand, which would be a major challenge in the agricultural/livestock production. It would not be out of place to believe that consolidation of farm size including dairy farms coupled with improvement in production conditions would be the net changes that one could visualise under the condition of faster urbanisation. Presently, the urban areas constitute about 5 per cent of milch animals. Increased urbanisation would probably affect the present structure of rural-urban distribution of milch animals with higher share of the urban areas in longer run. Under this condition, peri-urban dairy husbandry could flourish in the form of structured and organised dairy farms as the greater demand for agro products in the urban areas would likely to be met from the areas surrounding the urban centers.

Milk Demand

Whether a commodity is produced for the market or not is determined by the extent the producers sell the product. A subsistence commodity is essentially produced for self- consumption. Mostly, food products in the developing countries tend to be produced for meeting first the family requirements and then surplus is marketed through the available channels. Access to market however could change the profile, provided the producers receive a fair deal. Therefore, the commodity profile is an important determinant of commercial orientation.

With high growth rates in the agricultural sector, the average per capita income in the country shows an increase. This is accompanied by a fall in the per capita consumption of staple food. This decline indicates improvement in the welfare, as laid down by Engel's hypothesis. Kumar (1997) has pointed out that diversification in the food basket due to urbanisation will provide food security and improve the quality

of life by adding to the nutritional status and welfare of the population. With diversification, consumers are exposed to a wider choice of foods and shifts in dietary pattern either due to a rise in income or fall in price. Per capita consumption of food grains has been declining and some of this decline indicates an increase in the consumer's welfare (Rao, 2000). Radhakrishna (2005) has argued that this sharp decline in cereal consumption can be attributed to changes in consumer tastes--from food to non-food items and, within the food group, from cereals to non-cereal food items.

In India, milk is essentially produced for domestic consumption as the social and cultural practices of milk consumption is quite strong. In the traditional vegetarian diet, milk constitutes one of the major dietary supplements and is consumed in various forms. The food habits are different across regions, affecting milk consumption. National surveys have indicated that about 50 per cent of milk produced in the country is consumed within the perimeter of family, which means at present about half of the produce is marketed in some form or the other. Thus, the extent of market penetration appears to be moderate. Generally, in the southern states a relatively higher proportion of production is marketed in comparison with the northern region, where both the per capita as well as incidence of milk consumption among the people is high. In the western as well as in the eastern regions however the incidence of market penetration is moderate (45-60 per cent). Therefore, a mixed pattern is observed across various regions, largely influenced by food habits and cultural practices.

Various studies have estimated the demand of milk in India for the year 2020 to be in the range of 160-290 million tonnes with a growth rate of 4-8 per cent per annum during 2007-2020 (Table 1).

TABLE 1. ESTIMATES OF MILK DEMAND BY VARIOUS STUDIES

| Author (1) | Estimated demand (2020) (million tonnes) (2) |
|-------------------------------|---|
| Kumar (1998) | 182.8* |
| Radhakrishna and Reddy (2002) | 165.84 |
| Delgado <i>et al.</i> (1999) | 160.0 |
| Quirke <i>et al.</i> (2002) | 168.2 |
| Dastagiri (2004) | 227.2* |
| Mittal (2006) | 229.9* |
| Bhalla <i>et al.</i> (1999) | 289.6 [@] |

*at 7 per cent gross domestic product growth @ at 3.7 per cent per capita income growth.

It may be seen that the milk demand estimates given by various authors vary considerably. This variation can be attributed to the then market condition, food habits, income growth and the overall economic scenario at the time of estimation and based on which the futuristic scenario may have been envisaged. Therefore, the demand for milk is re-casted with the existing market and economic scenario.

Projection Model and Data Sources

The demand for milk is projected for the year 2020 in the following section based on the model given below.

$$D_t = D_{tr} + D_{tu}$$

$$D_{tr} = D_{or} * N_{tr} * (1 + y_r * e_r)^t$$

$$D_{tu} = D_{ou} * N_{tu} * (1 + y_u * e_u)^t$$

Where

D_{tr} = milk demand in year t (i.e., 2020) in rural areas,

D_{or} = per capita demand of milk in the base year (i.e., 2004-05) in rural areas,

y_r = growth in per capita rural income,

e_r = expenditure elasticity of rural milk demand,

N_{tr} = projected rural population in year t (2004-05).

Similarly, milk demand was projected for urban area (D_{tu})

The per capita milk demand was taken from 61st Round of *Consumer Expenditure Survey (2004-05)* of NSS. It may be noted that NSS gives the estimates of per capita consumption of milk at household level. The out of home consumption is assumed at the rate of 20 per cent of per capita household consumption based on the past studies (NDDDB, 2006). The expenditure elasticity of milk demand for rural and urban area computed from consumer expenditure survey data of 61st Round of NSS. Population for base year and projected population of terminal year for rural and urban area are taken from *National Commission on Population Projection* (2006), Government of India. The growth in GDP at constant price during last 8 years, i.e., from 1999-2000 to 2007-08, is 7.3 per cent per annum (NAS, 2008). Therefore, the milk demand is projected at three scenarios viz., at GDP growth of 6 per cent, 7 per cent and 8 per cent. The GDP growth for rural and urban area segregated based on the rural and urban income as given in NAS (2007). Table 2 presents demand projections for three scenarios as given below.

TABLE 2. PROJECTED MILK DEMAND FOR 2020

| GDP growth | Milk demand in million tonnes (2020) | Required growth rate to achieve the projected milk demand (2007-2020) (per cent per annum)* |
|-----------------------|---|---|
| (1) | (2) | (3) |
| 6 per cent (Low) | 216.1 | 5.3 |
| 7 per cent (Moderate) | 227.7 | 5.7 |
| 8 per cent (High) | 270.2 | 7.0 |

*Under the assumption that import and export of milk and milk products is negligible in respect to total quantity of milk produced in 2007 and hence, whatever produced is consumed domestically.

The country has so far maintained a secular growth of 4 per cent per annum in milk production. However, looking into the projected demand for milk, growth in milk production needs to be accelerated from the current level for meeting the estimated milk demand through domestic production. Under the above evidence, it may be fair to argue that despite high demand-pull for milk, the current practices are moderate and given the intensification of demand it is possible that the level of market access would rise and with the specialisation of primary production the processing sector would attain maturity. That means processing and value addition gives a fillip in production too. The relationship is of inter dependence between primary production and processing leads to efficiency in production. In advanced countries like Europe and US, more than 90 per cent of primary production is channelled through the processing sector: even the raw milk that is consumed is processed and sold in branded form. In the milk sector in India, despite higher demand, the proportion of industrially processed products occupies a miniscule share due to typical nature of demand of the commodities. The unpublished estimates indicate that 10-15 per cent of the national production and about 25-30 per cent of the marketable surplus is mobilised through the organised channels, largely passes through the processing and value addition process. Typically, this is a special feature of the consumption and industrial use of raw material, but it is believed that with change in lifestyles the commodity nature would undergo changes influencing demand for the processors.

With steeply rising demand for milk and milk based products, large farms may be necessary if India intends to remain (more or less) self-sufficient in milk production (Armentano *et al.*, 2006). The flip side of such transformation is – the viability of small and footloose producers may be undermined and the loss of income could not be restored from alternative employment. However, the impact of large farms on small producers may not be that strong as the demand for milk is burgeoning and therefore, there is a room for co-existence of commercial and smallholder producers.

Pattern in Milch Animal Holding

After having a look at the milk demand front, it is important to assess the situation at milk producer level, i.e., pattern and distribution of operational land and milch animal holding over a period of time.

Due to sub-division of land holding there would be reduction in dairy animal holding as crop-livestock mixed farming is a highly internalised system and there are considerable overlaps of inputs and outputs. In light of this, it is necessary to examine whether the sub-division of agricultural land has affected the structure of animal holding. The data published by National Sample Survey Organisation on operational land and animal holding gives a clear scenario in order to understand the changes taking place in terms of milch animal holding across the different land holding groups.

As indicated in Table 3, 84 per cent of total rural households are landless, marginal and small farmers in 1991-92 and the same is 90 per cent in 2002-03. While there is no significant variation in the marginal and small farmers population, the population of milch animals increased significantly in the case of marginal farmers. Interestingly, the landless farmers increased by 10 percentage points and on the other hand, milch animal holding declined during 1991-92 to 2002-03. The Gini co-efficient, a measure of equality (or inequality), has increased for ownership of milch asset from 0.28 (in 1991-92) to 0.38 (in 2002-03). It implies that the inequity has increased in milch animal ownership amongst the farmers. The increasing inequity is mainly due to compounding effect of a sharp increase in landless population and declining animal holding in same group of farmers.

TABLE 3. DISTRIBUTION OF HOUSEHOLDS AND MILCH ANIMALS

| Land holding group (1) | (per cent) | | | |
|---------------------------|-------------------|----------------------|-------------------|----------------------|
| | 1991-92 | | 2002-03 | |
| | Households (2) | Milch animals (3) | Households (4) | Milch animals (5) |
| Landless | 22 | 3 | 32 | 1 |
| Marginal | 48 | 43 | 47 | 53 |
| Small | 14 | 22 | 11 | 20 |
| Semi Medium | 10 | 17 | 6 | 14 |
| Medium | 5 | 11 | 3 | 10 |
| Large | 1 | 3 | 1 | 3 |
| All | 100 | 100 | 100 | 100 |
| Gini co-efficient | 0.28 | | 0.38 | |

Source: Deduced from data available from Land and Livestock Surveys (1991-92, 2002-03).

During the last decade ending in 2002-03, the milch animal holding per 100 rural households at aggregate level has decreased from 68 animals in 1991-92 to 62 animals in 2002-03. However, it is interesting to check the changes across the land holding groups. A shift in the distribution of animal holding may be noticed at country level. The withdrawal of landless farmers from milk husbandry is striking. It could be construed that returns from dairy farming might be unfavourable compared to opportunity costs of labour in the rural areas. The withdrawals of landless farmers from dairying may be argued from the point of view of better alternative occupational availability. One of the most successful poverty alleviation programmes in rural areas of the country – Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) – may have given a rise to such exit from dairying. The programme has not only assured employment income to rural households, but also provided leverage to landless milk producers to leave dairying. A landless farmer might even find dairy husbandry an occupation involving high risks and little safety mechanism

to absorb the uncertainty in the milk production enterprises. From the farm data analysed by International Farm Comparison Network (IFCN) in 4 states (IFCN, 2005), it was found that the landless farmers were at a disadvantageous position due to high input costs and associated risks in market access to inputs. The preliminary results of the Milk Recording and Cost of Milk Production project in Andhra Pradesh also come out with identical findings in the case of production economics of landless producers (NDDDB, 2005).

Though there is a decline in milch animal holding per household in the case of landless, the other categories of operational land holding witnessed rise in milch animal numbers per household (Table 4). Nonetheless, the extent of incremental stock varies across the groups.

TABLE 4. MILCH ANIMALS PER 100 HHS BY LAND HOLDING GROUPS (RURAL)

| Year (1) | <i>(No. per 100 rural households)</i> | | | | | | |
|---------------|---------------------------------------|-----------------|--------------|------------------------|---------------|--------------|------------|
| | Landless (2) | Marginal (3) | Small (4) | Semi- medium (5) | Medium (6) | Large (7) | All (8) |
| 1991-92 | 9 | 61 | 103 | 123 | 153 | 202 | 68 |
| 2002-03 | 1 | 69 | 108 | 142 | 210 | 343 | 62 |
| Change (nos.) | -8 | 8 | 5 | 19 | 57 | 141 | -6 |

Source: Deduced from data available from Land and Livestock Surveys (1991-92, 2002-03).

Here, the dimension of incidence of milch animal owning households across the land holding groups is missing as no published information is available in this regard. Nonetheless, with the reduction in agriculture support due to diminishing operational holding per household, it may be conjectured that the traditional animal husbandry practices may be passing through transformation, i.e., from backyard support activity supplementing the household income to main stream activity with a business acumen.

CONCLUSION

In India, livestock demand in general and demand of milk and milk products in particular is on the rise due to rise in income, changes in the lifestyle and food habits, socio-cultural changes and increased urbanisation. The milk demand would grow at a higher rate than that of the growth in milk production, offering ample scope for structural transformation in milk production system. Decline or marginal increase in milch animal holding in lower bracket of land holding groups indicates reduction in agriculture support for dairy activity due to diminishing operational holding. This would lead to structural changes at milk producers' level, from crop-mixed dairy farming to moderately organised dairy farming, with a commercial focus. Moreover, with higher demand for milk, the national milk production needs to increase at a rate in order to be commensurate with the projected demand if the self sufficiency in food

production is to be continuously maintained. Therefore, the transformation of specialised farming even in dairy sector is a welcome development.

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REFERENCES

- Armentano, Louis E., D. Dobson, William; V. Jeese, Edward; F. Olson, Norman and P. Vijay Sharma (2006), *The Dairy Sector of India: A Country Study*, Babcock Institute Discussion Paper No. 2006-2, The Babcock Institute for International Dairy Research and Development, University of Wisconsin-Madison, College of Agricultural and Life Science, Madison, WI, U.S.A
- Bhalla, G.S., Hazell Peter and Kerr John (1999), *Prospects for India's Cereal Supply and Demand to 2020*, International Food and Policy Research Institute (IFPRI), Discussion Paper 29, Washington, D.C., U.S.A
- Birthal, P.S. and P. Parthasarathy Rao (2004), "Intensification of Livestock Production in India: Patterns, Trends and Determinants", *Indian Journal of Agricultural Economics*, Vol. 59, No.3, July-September, pp. 555-565.
- Birthal, P.S., P.R. Deoghare, S. Kumar and Riyazuddin (2003), *Development of Small Ruminant Sector in India*, Project Report, National Centre for Agriculture Economics and Policy Research (NCAP), New Delhi, India.
- Conroy, C. (2004) *Livestock Sector Growth and Poverty, with Particular Reference to India*, Natural Resources Institute.
- Dastagiri, M.B. (2004), *Demand and Supply Projections for Livestock Products in India*, NCAP Policy Paper No. 21, National Centre for Agriculture Economics and Policy Research (NCAP), New Delhi.
- Datta, T.N. and C.L. Dadhich (2007), "Operational Land Holding and Ownership of Dairy Animals in India", *Sarvekshana*, 92nd Issue, Vol. XXVII No. 3 and 4, Journal of National Sample Survey Organisation, National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.
- Delgado, C.L. (2005), *Rising Demand for Meat and Milk in Developing Countries: Implications for Grasslands-Based Livestock Production*, in D.A. McGilloway (Ed), *Grassland: A Global Resource*, Proceedings of the Twentieth International Grassland Congress, Dublin, Ireland, 26-30 June 2005, Wageningen Academic Publishers, The Netherlands, pp. 29-39.
- Delgado, C.L., C. Courbois and M. Rosegrant (1998), *Global Food Demand and the Contribution of Livestock as we Enter the New Millennium*, Paper presented at the British Society of Animal Science-Kenya Agricultural Research Institute Conference on Food, Lands and Livelihoods: Setting Research Agendas for Animal Science, January 27-30, Nairobi, Kenya.
- Delgado, C.L., M. Rosegrant, H. Steinfeld, S. Ehui and C. Courbois (1999), *Livestock to 2020 – The Next Food Revolution*, Food, Agriculture and the Environment Discussion Paper 28, IFPRI/FAO/ILRI.
- Government of India, *Land and Livestock Surveys (1991-92, 2002-03)*, *Livestock Ownership Across Operational Land Holding Classes in India*, NSS 59th Round, Ministry of Statistics and Programme Implementation, New Delhi.
- Government of India, *Level and Pattern of Consumer Expenditure in India*, Consumer Expenditure Survey (1999-2000), NSS 55th Round, Ministry of Statistics and Programme Implementation, New Delhi.
- IFCN (2005), *Dairy Report 2005*, International Farm Comparison Network, IFCN Dairy Research Center, Keil, Germany.
- ILRI (2006), "Lessons from a Changing World: Implications for Livestock Research and Development", Proceedings of an International Workshop, P.S. Birthal V.K. Taneja, W. Thorpe (Ed.), NCAP-ICAR-ILRI, Nairobi (Kenya), New Delhi, pp: 65-112.

- Kumar, Praduman (1997), "Food Security: Supply and Demand Perspective", *Indian Farming*, December, pp. 4-9.
- Kumar, Praduman (1998), *Food Demand and Supply Projections for India*, Agricultural Economics Policy Paper 1998-2001, Indian Agricultural Research Institute, New Delhi, pp. 85.
- Mittal, Surabhi (2006), *Structural Shift in Demand for Food: Projections for 2020*, Working Paper No. 184, Indian Council for Research on International Economic Relations (ICRIER), New Delhi.
- NAS (2007), *National Accounts Statistics – Sources and Methods*, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.
- NAS (2008), *National Accounts Statistics*, Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India, New Delhi.
- National Commission on Population Projection (2006), *Population Projections for India and States 2001-2026*, Report of the Technical Group on Population Projections, Census of India, Government of India, May 2006.
- National Dairy Development Board (2005), *A Report on Milk Recording and Cost of Milk Production in Andhra Pradesh*, (mimeo.).
- National Dairy Development Board (2006), *Out of Home Milk Demand Estimation and Milk Marketing Strategies for a New Entrant*, (mimeo.).
- Quirke, Derek; Matthew Harding, David Vincent and David Garrett (2003), *Effects of Globalisation and Economic Development on the Asian Livestock Sector*, Australian Centre for International Agricultural Research (ACIAR), pp. 46.
- Radhakrishna, R. (2005), "Food and Nutrition Security of the Poor", *Economic and Political Weekly*, Vol. 40, No.18, 30 April - 6 May, pp. 1817-1821.
- Radhakrishna, R. and Venkata Reddy (2002), *Food Security and Nutrition: Vision 2020*, Planning Commission, Government of India, New Delhi.
(http://www.planningcommission.nic.in/reports/genrep/bkpap2020/16_bg2020.doc)
- Rao, C.H. Hanumantha (2000), "Declining Demand for Food-grains in Rural India: Causes and Implications", *Economic and Political Weekly*, 22 January, pp. 201-206.
- Rao P. Parthasarathy, P.S. BIRTHAL, D. Kar, S.H.G. Wickramaratne and H.R. Shrestha (2004), *Increasing Livestock Productivity in Mixed Crop-Livestock Systems in South Asia*, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India.
- Shukla, R.K. and S.D. Brahmanekar (1999), *Impact Evaluation of Operation Flood on the Rural Dairy Sector*, National Council of Applied Economic Research, New Delhi, pp. 56-57.
- Staal, S.J., C. Delgado and C. Nicholson (1997), "Smallholder Dairying Under Transaction Costs in East Africa", *World Development* 25, pp. 779-794.
- Steinfeld, H., C. De Haan and H. Blackburn (1997), "Livestock-Environment Interactions: Issues and Options", E.U. Development Policy Sustainable Development and Natural Resources, WRENmedia, Fressingfield, U.K.
- Steinfeld, H. (2002), "Increasing Global Demand for Animal Products", in *Responding to the Increasing Global Demand for Animal Products: Programs and Summaries of an International Conference Organised by BSAS, ASAS and MSAP*, Merida, Mexico, November 2002.
- World Bank (2005), *Agricultural Growth for the Poor: An Agenda for Development*, The World Bank, Washington, D.C., U.S.A.