DAIRY ASIA: TOWARDS SUSTAINABILITY

Elements of a Regional Strategy for Sustainable Dairy Development in Asia
Dairy Asia: Towards Sustainability

Elements of a Regional Strategy for Sustainable Dairy Development in Asia

Food and Agriculture Organization of the United Nations
Regional Office for Asia and the Pacific
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The Asian dairy sector is on the cusp of transformation. Consumption of milk and milk products has risen rapidly in the region making Asia the strongest growing region for dairy product consumption during the last three decades. Asian consumers have generated nearly half of the global dairy product demand in this period. While production has responded strongly to growing demand, and within the region, India is now the world’s largest producer of milk, the supply continues to fall short of demand (Table 1). Consequently, net imports of milk and milk products regionally have increased threefold. The recent OECD-FAO Agricultural Outlook estimates that the demand for milk and milk products in Asia will reach almost 320 million tonnes by 2021 (OECD-FAO 2012). This means the region will need to increase milk availability, either by production gains and/or imports, by another 50 million tonnes within this decade.

Within these strong production and consumption trends there is wide variety in production and consumption patterns as well as socio-economic and cultural contexts. While South Asia has a longer tradition of milk production, and dairying in South Asia has been and continues to be an important livelihood support activity (often aided by public policy and investment support), recent growth in milk production in East and Southeast Asia (China and Viet Nam in particular) has largely been led by large-scale private sector investment. The investment in such enterprises has also received public policy support in these countries as these operations are perceived as more hygienic and efficient (although not always supported by evidence). This growth is occurring at a time when there is re-evaluation of the desirability and sustainability of concentrated large-scale production models in developed countries.

Despite these trends, traditional smallholder production systems remain dominant in Asia and contribute a substantial proportion of national and regional milk production. These systems rely on farm-produced and low-cost feed rations, family labour and remain a source of food security, nutrition, livelihood support and risk mitigation for millions of rural households.

Asia is home to two-thirds of the world’s poor and undernourished people and in some countries the proportion of undernourished children exceeds 40 percent of the total child population. Given that milk is a good source of energy, protein, vitamins and minerals, a daily glass of milk for Asian children can significantly boost their nutritional levels during these important development stages of life. At the same time, many people in the region now consume excessive amounts of sugar and fats leading to obesity and poor health. Rapid growth in demand for dairy products needs to be placed in the context of undernourishment, micronutrient deficiencies and overweight/obesity.

This growth in demand for dairy products and the associated changes in the production structure are happening at a time when concerns about resource scarcity, climate change impact and the need for equitable economic development are becoming increasingly important. In this changing landscape, meeting the future challenges of food and nutrition security requires substantial investment in improved resource-use efficiencies, promotion of appropriate technologies and control along the value chain in a manner that facilitates integration of environmental health, economic profitability and social, ethical and economic equity goals.
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*Figures in parentheses are percentages to total consumption.
# The global figures in this row refer to total world trade in milk and milk products.
Source: FAOSTAT.
This also requires a series of actions, including capacity development and information dissemination in support of adopting good production practices; better feeding and breeding strategies to increase productivity; and developing tools, methods and systems to monitor animal, public and environmental health.

In the light of the foregoing, this paper attempts to articulate what may be described as the ‘Elements of a Dairy Strategy for Asia’. Such an approach recognizes that a single regional dairy strategy cannot capture the diversity that exists in dairy production systems and policy priorities across countries in the region. However, an articulation of various elements in what may be described as a ‘common framework’ can provide some strategic guidelines to national governments and other stakeholders to help them develop/adjust their own strategies and programmes in the light of broader trends and specific national priorities.

The elements contained in this framework document were identified in a multistakeholder consultative meeting ‘Dairy Asia – Towards Sustainability’ held in Bangkok from 21 to 23 May 2014. The meeting was attended by approximately 90 participants from 20 countries comprising stakeholders from governments, national and international research agencies, civil society organizations, multilateral institutions, think tanks, the private sector and regional and global networks. The deliberations during the meeting took due note of another consultative process during 2007-2008 which had culminated in a regional dairy strategy and investment plan for smallholder dairy development and had elaborated a strategic vision for smallholder dairy development – *Asian milk for health and prosperity* – known as the Chiang Mai Declaration (see Annex 1 for key elements of the Chiang Mai Declaration and the smallholder dairy development strategy)

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The meeting recognized that the elements of the strategy enshrined in the Chiang Mai Declaration remain as relevant as ever. Concomitantly, however there has been growing realization in recent years about increasing resource scarcity, climate change, growing pressure on feed resources and rising feed prices. Farmers worldwide face the challenge of producing more food with fewer resources at a time when yield increases are slowing, while at the same time addressing climate change and impacts on ecosystems. The agriculture sector in general is under pressure to increase the efficiency of natural resource use to meet society’s growing food and environmental needs. Investing in sustainable dairy is no longer a question of choice. It is the only option.

Transition to a more sustainable path must consider sustainability in its full complexity encompassing all three of its pillars—economic, ecological, and social. Partial solutions will not produce the desired results. For example, any efforts towards natural resource conservation that ignore the need for economic development, food security and productive livelihoods are unlikely to succeed. Conversely, socio-economic development will not be sustainable if it does not maintain the ability of the ecosystem and society to adapt to short- and long-term changes. This complexity necessitates consideration of sustainability as a societal issue and requires integrated efforts by a wide range of stakeholders to capitalize on the strength of dairy production systems in Asia and to minimize the potential negative impacts (food-feed competition, public health, nutrient overloads, greenhouse gas emissions and so forth) of rapid growth in the production of milk and milk products in the region. It is also imperative that such efforts be realistic, equitable and aware of the region's ecological, socio-economic and cultural dimensions, while at the same time recognizing that much of the change will be driven by largely exogenous market forces and private investment.

‘Any solution which ignores the livelihood issues would be inequitable.’

T. Nanda Kumar, Chairman, National Dairy Development Board, India
This strategy builds on the Chiang Mai Declaration and proposes a modified vision ‘A socially and environmentally responsible Asian Dairy Sector that enhances rural livelihoods, improves nutrition, and contributes to economic prosperity’. The new vision seeks to foster multistakeholder collaboration to achieve sustainable growth in the dairy sector through market-based solutions while at the same time positioning the sector as a positive driver of food security, environmental sustainability and equitable economic growth in the region. The strategic objectives of the regional strategy, as identified by the stakeholders, are:

1. Increase farm profitability and milk productivity sustainably to meet the increasing demand for dairy products.

2. Promote fair and efficient markets, including institutional structures to integrate small-scale producers in the modern value chain.

3. Improve dairy food quality and safety.

4. Enhance consumer education to enable more informed choices, including emphasis on publicly-supported school milk programmes linked to local dairy operations.

5. Strengthen stakeholder capacity to cope with production and market risks and for greater innovation.

6. Minimize the environmental footprint of the dairy sector and improve mitigation/adaptation measures of the dairy sector to climate changes.

1. Increase farm profitability and milk productivity sustainably to meet the increasing demand for dairy products.

With growing scarcity and competition for natural resources, the region must produce milk more efficiently to profitably compete in a price- and increasingly quality-conscious market. Although some countries have made advances in improving dairy productivity in the region, the milk yield gap remains high, and much work remains to be done in the region to improve the genetic stock, better utilize feed resources, minimize the impacts of production-constraining diseases and improve the management skills of dairy farmers.

Specific interventions under the profitability and productivity enhancement objective would possibly fall under three broad groups—(i) those related to improving the genetic stock of dairy cattle, (ii) those related to augmenting feed resources, improving feeding practices and enhancing overall nutrient management and (iii) those related to farm-level management and husbandry practices, including better health management of dairy animals. All three interventions must go hand-in-hand. Special care is needed when promoting cross-breeding to ensure that adequate feed resources and other management practices are in place to realize the full potential of animals of higher genetic potential; otherwise the vulnerability of smallholder resource-poor farmers might be exacerbated.

While the precise balance of interventions and actual practices would vary depending on the country and production context, the strategy recommends a holistic approach placing emphasis on systems to support the improvement of genetic potential and upgrading of local breeds while avoiding indiscriminate cross-breeding.2 This would require: (i) building infrastructure for progeny testing of bulls, semen production and processing; (ii) putting in place field-based progeny-testing programmes for identified breeds;3 (iii) establishing a Pedigree and Performance Recording Scheme and quality control systems;4 (iv) expanding, making more efficient and modernizing artificial insemination infrastructure; (v) establishing infrastructure for data collection and transmission of information; (vi) enhancing the capacity of institutions responsible for running genetic improvement programmes; and (vii) putting in place a fair regulatory and policy environment for delivery of genetic improvement programmes and services by multiple service providers including the private sector. In this context, there are also substantial opportunities for regional cooperation particularly in areas such as developing standard operating procedures and guidelines for implementing animal genetic improvement programmes and capacity development through knowledge exchange and promotion of collaborative ground activities.

With respect to husbandry and feeding practices, it is essential to make sustained efforts to implement strategies and programmes to augment the availability of feed and

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2 The genetic improvement programmes should be guided by not only milk yield but also all other traits which impact on the overall sustainability of dairy farming.

3 For breeds for which it may not be feasible to initiate progeny-testing programmes, a pedigree selection programme may be implemented in their respective native tracts.

4 This refers to any scheme which collects biographical and performance data in a systematic manner and manages and uses them. The performance data depend on the circumstances, but generally it is recommended to record data on all performance traits which have some bearing on the economics of the animal. For dairy cattle, records usually include birth weight, weights at various ages, adult weight, all mating dates, all calving dates, diseases and treatments, exit date, as well as milk yield and various milk contents on a regular basis during lactations.

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‘Farm level profitability is the key driver of the dairy system and as we drive profitability for farmers we can unlock the potential for addressing the sustainability challenge.’

Jack Holden, Sustainability and Social Responsibility Manager, Fonterra Co-operative Group
fodder and to significantly increase the efficiency of their utilization. It is also essential that such an approach be anchored in sound scientific knowledge about nutritional management at the animal and the environment level and be adapted to local systems\textsuperscript{5}. For example in South Asia dairy is mostly dependent on crop residues, while in East Asia there is greater dependence on planted forages. In this context, the strategy recommends concerted stakeholder action towards the development and enlargement of local feed resources and promotion of ration balancing programmes; adoption of technology and techniques for fodder storage; promotion of strategic feed supplements (such as urea-molasses mineral blocks [UMMB], bypass protein supplement, bypass fat supplement and region specific mineral mixtures), incentivization of high quality forage production, including strengthening of forage seed production and distribution infrastructure, and development and dissemination of practical guidelines for feeding and feed resource management. Linking dairy development with programmes related to natural resource development and management and to crop production development is crucial. Dairy production development in isolation will be less sustainable. New genomic tools are now available to breed food crops with higher digestibility of straw and stover, so investment in research will have wide-scale impact. Investment in generating sound livestock-related data such as feed assessment, herd structure, feed balance, feeding system and losses will bring high returns by enabling structured growth of the dairy sector and formulation of sound policies. Many feed technologies, for example preparation of UMMB, mineral-vitamin mixtures, mineral blocks, densified crop residue-based blocks, among others, have the potential to engage young people and promote entrepreneurship (FAO 2011).\textsuperscript{6} All these actions are consistent with the ‘sustainable animal diet’ framework which is considered vital for sustainable dairying.\textsuperscript{7}

Productivity, profitability, safety and quality of the food chain are also affected by the welfare of farm animals. Stress factors, poor housing, poor welfare and imbalanced nutrition can increase susceptibility to diseases among animals thus resulting in increased production costs, higher risks to food consumers, decreased profitability and threats to environmental sustainability. In intensive production systems, animals are being pushed towards maximizing productivity while in the extensive and smallholder systems in developing countries animal productivity and welfare are compromised by inadequate nutrition, poor husbandry and handling practices and continued prevalence of preventable animal diseases and discomfort. An array of management-related factors – such as housing and bedding, restraining systems, space and crowding, transport conditions and

\textsuperscript{5} Nutritional management at the animal level here refers to understanding the nutritional requirements of dairy cows in terms of macronutrients (energy, protein), minerals (calcium, phosphorus and magnesium) and micronutrients (vitamins, trace-elements), and aligning feeding strategies towards a balanced supply of various nutrient types. While at the environment level, nutrient management encompasses, for example, decrease in wastage of feed, pre- and postharvest and proper and efficient management of manure nutrients for production of food or feed crops.

\textsuperscript{6} FAO, 2011. Successes and failures with animal nutrition practices and technologies in developing countries. Proceedings of an FAO Electronic Conference held on 1-30 September 2010

so forth affect welfare and productivity. Good animal welfare practices also strengthen the immune systems of animals to fight mastitis, lameness and inability to breed and contribute towards mitigation of the potential disaster of antibiotic resistance among livestock and humans.

It is however important to recognize that animal welfare practices need to be specific to production systems and compatible with the incentive structure at the farmer level. Any such practice that does not increase farmers’ incomes is unlikely to be followed. But the information on practices that promote animal welfare while at the same time improving animal productivity and incomes are scant at best. Considering the expected growth in demand and the concomitant structural changes in the production, processing and distribution systems, the strategy recommends development of region specific good animal welfare practices and guidelines by paying attention to animals’ comfort, housing, and diets on the one hand and rural livelihoods, livestock productivity and profitability and animal product quality on the other.

For improving management and husbandry practices, it is essential to design, implement and strengthen research, extension and education within local production contexts. This requires mapping existing production practices, understanding more carefully why dairy farmers follow certain practices, how the practices followed by more progressive farmers are different than other dairy farmers in the area and how the farmers within local production systems can become more efficient in a manner that enhances their livelihoods, improves the well-being of the community and animals, and reduces impact on the environment. Advisory services need to be established to promote farmer-to-farmer transfer of technologies and knowledge and to take advantage of experiences from more entrepreneurial dairy farmers who may be able and willing to work in a hands-on manner with smallholder farmers. Such advisory services may be promoted by the government, the private sector, producer institutions or in various joint mechanisms.

In this context, the strategy recommends public and private support for setting up organizational mechanisms (Dairy Farmer Field Schools, for example) for developing innovation capacity among producers, and linking them with formal knowledge organizations (such as universities and research institutions), milk processors and producer groups. Adequate support also needs to be provided for realistic and cost-effective systems for (i) continuous monitoring of input use, generation of output and recovery and loss of nutrients, and (ii) establishing a learning feedback mechanism. This requires the government and non-government agencies to establish a dedicated extension service delivery system equipped with requisite human and other resources for delivering need-based and timely information. Creation of linkages between dairy entrepreneurs and all relevant stakeholders would be another important part of the extension service delivery system.

2. Promote fair and efficient markets, including institutional structures to integrate small-scale producers in the modern value chain

As noted above, despite broad-based upscaling trends, a large proportion of milk in Asia is produced by smallholders. The existence of a vibrant smallholder dairy sector combined with a favourable medium-term market outlook for the dairy sector is, potentially, good news since the poor in general have a higher stake in smallholder dairy production than in crop production. Furthermore, animals are typically more equitability distributed than land in many of these areas and dairying is also more labour-intensive than crop production and provides a remunerative outlet for family labour. These characteristics imply that growth in the smallholder dairy sector could emerge as an instrument of inclusive economic development with concomitant nutrition-related benefits.

At the same time, there is ongoing debate in the region about the ability of smallholder dairy producers to respond to a growing market that demands higher quality and consistent and diverse products. Some observers argue that the scope of technology infusion on small farms is limited and hence the region must strive towards building and promoting larger dairy farms. Others however argue that small farmers can meet the demands of market but need public policy and organizational support that builds capacity and facilitates access to services, finance and technology. In some cases, there may be trade-offs between a policy aimed for increased national dairy self-sufficiency through more intensive production with policy objectives of inclusive rural development through smallholder production. There is some evidence that there are few economies of scale in dairy production when labour costs are low. Notwithstanding this debate, investment in the further development of both smallholder- and industrial scale dairy in the region continues apace.

Various forms of collective action have long been a central mechanism for improving the market access and productivity of smallholder producers. These platforms aim to enhance the bargaining power of small producers in the markets, create new opportunities for them by improving their management skills and facilitate access to higher quality and more reliable inputs and services. In the context of the smallholder dairy sector, the Asia region has rich experience with collective models supported both by public and the private sectors, although not always with consistently positive or successful outcomes. In addition, the region has good experience with a number of diverse and commercially competitive smallholder dairy chain models that can serve as an important source of lessons in the design of future programmes and strategies. At a fundamental level, policy mechanisms in support of the smallholder dairy sector need to aim at mitigating the downside risk to increase smallholder capacity to raise the returns to their enterprises. Due care must be exercised in this context, however, to ensure that the diversity of local markets and peoples’ choices in maintaining diversified livelihoods are not compromised.

There is also a need to better recognize the new kinds of organizational structures and forms for linking smallholders

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to markets. The classic models of collective action such as cooperatives and producer groups remain important, but new more business-oriented models have emerged such as producer companies and dairy hubs,\(^9\) and there is a continuing need for public support for these models in terms of finance, credit, capacity building and mechanisms to reduce risks. A closer understanding of newer initiatives and models can also help to discover new opportunities for involving smallholders through innovative public-private partnerships and for refocusing pure public support measures to areas which may not yet be sufficiently attractive for private investors.

In this context, it is also important to recognize that not all smallholders will be able to benefit from the opportunities offered by this growth as different people may face different risks and opportunities. It is therefore important for countries to sometimes use scarce public resources, not in fighting insuperable forces of change, but rather in helping smallholders adapt to change in ways that produce better social outcomes. Specific gender-sensitive policy interventions can effectively support the needs of different types of smallholder farmers and households. Some smallholders are competitive in the changing economic environment and can remain so if they receive the right kind of policy, financial and institutional support. This is best accomplished through facilitating institutional innovations to overcome the higher transaction costs associated with being small operators. The producer institutions can help them gain access to inputs on more favourable terms and provide a go-between with large-scale consolidators and retailers to overcome barriers that block smallholders’ access to growing markets. Policy support should promote productivity growth and market access for smallholders (FAO, 2009).

the strategy recommends identifying and promoting ways and means to support institutions and policies that (i) enhance the bargaining power and market access of small farmers; (ii) strengthen the incentives to deliver quality milk; (iii) create fair and transparent pricing systems; and (iv) reduce losses in the dairy chain. But approaches and interventions should be tailored to the local context while at the same time being cautious of not promoting smallholder dairy in areas where smallholders are not competitive, where markets are not lucrative or where the enabling conditions do not favour investments in smallholder operations. The strategy also recommends enhanced investment in targeted awareness building and advocacy efforts to build further support for the smallholder dairy sector and analytical support to identify policies and institutional measures for backstopping an enabling environment for smallholder dairy development.

In some parts of Asia, the milk market is dominated by an informal sector. In some countries, despite strong government support to the formal sector (organized production, procurement, processing and marketing of milk), the total market share of the formal sector is limited to only about 20-22 percent. Despite the potential risks and limitations of the informal milk market, policy-makers should recognize that it is driven by proximity of farms to consumer markets, consumer preference and price, and that market forces will maintain it until these factors change. Proactive approaches to upgrade such markets may enhance positive change towards upgraded practices, standards and product quality. Such approaches may include capacity building of milk agents and a policy for monitoring, certification and licensing of informal milk market actors to enhance and regulate the informal milk business.

Finally, now that Asia encompasses the largest milk-producing region in the world in South Asia, as well as the fastest growing dairy region in the world in East and Southeast Asia, trade opportunities need to be further exploited. Although growing quickly, East Asia remains a significant importer of dairy products as shown in Table 1, much of which are supplied by New Zealand and Australia, among other countries outside the region. The Association of Southeast Asian Nations has undertaken steps that will in 2015 create a single market, but barriers remain to intra-regional trade between South and East. While South Asia continues to improve into comparative advantage in milk production and export, trade policies need to be reviewed that would increase intra-Asian trade in dairy products.

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\(^9\) Dairy hub mainly refers to a collection of services around a milk chilling plant. Such hubs provide services such as bulk ing, chilling, market access, transportation, veterinary services, advisory services, financial services and input supply to dairy farmers.
3. Improve dairy food quality and safety

Encouraged by the continuing surge in demand, a number of governments in the region have prioritized the dairy sector for public and private investment in their quest to reduce dependence on imports. However, the region continues to face a number of challenges with respect to milk quality, safety and postharvest losses along the dairy value chain. Support is needed to improve the management and operations of milk collection and processing centres including cost-efficient measures to improve milk quality and safety, particularly in the context of increasing public demand for higher standards both in traditional markets and in modern product processing markets. This requires investment in enhancing human capacity and promoting hygienic practices along the entire dairy value chain (starting from the feed provided to dairy animals); reputation building through labelling or branding programmes; establishing effective quality assurance; milk testing and incentive producer payment schemes; development and harmonization of food quality and safety standards where they do not exist; improvement in laboratory infrastructure; establishing a mechanism for promoting and certifying Good Agricultural Practices (GAP) and Good Manufacturing Practices (GMP); and improving access to information with respect to pricing and product quality. However, care must be taken to facilitate such quality and standard changes in ways that match consumer preference and market signals, to avoid adding costs to products without increasing market value commensurately. Policies and programmes in this context must also recognize differential demand for traditional and modern products and promote both categories of products using updated methods and standards.

With respect to strengthening human capacity along the dairy chain, the strategy recommends expanding opportunities to provide vocational training for small- and medium-size dairy operators (milk producers, service providers and milk traders, collectors, processors and distributors, etc.) by strengthening dairy training centres, dairy research centres and other relevant knowledge institutions in the public and private sectors. In Asia women play an important role in day-to-day management of dairy animals. Provision of training to build the capacity of women must be given high priority.

4. Enhance consumer education to enable more informed choices, including emphasis on publicly-supported school milk programmes linked to local dairy operations

Good nutrition is the foundation for human health and well-being, physical and cognitive development, and economic productivity. Poor nutrition among children results in poor physical growth, lowered cognitive development and reduced labour productivity. Overweight and obesity lead to lower labour productivity and higher medical costs arising from associated non-communicable chronic diseases. Deficiencies in micronutrients can slow intellectual and physical growth among children, reduce adult labour productivity and lead to disease, premature death and increased maternal mortality (UNICEF and The Micronutrient Initiative 2004).

Although the Asia Pacific region has achieved substantial improvements in nutritional levels, the region still houses more undernourished people than any other region. According to FAO estimates, 578 of the world’s 925 million hungry live in this region, equivalent to 62 percent of the total.

Serious child undernutrition within the region is another insidious problem that must receive strategic attention and urgent and sustained action. There are also large disparities regarding underweight prevalence among urban and rural children throughout the region.

While progress in addressing deficiencies in nutrient intake is supported by the provision of basic services and initiatives that inform and empower communities and families (particularly women), the implementation of school milk programmes in most countries has demonstrated benefits in improving the nutritional intake of children as well as providing a much needed outlet for subsistence farmers who have dairy cows.

Consumer choices have their own influence on nutritional outcomes. Emphasis on consumer education with the ultimate goal of influencing choices in favour of healthier
choices in terms of more nutritious diets may be effective. Thus the strategy recommends (i) support, guidance and enhanced public investment towards linking the development of school milk programmes with local dairy development, and (ii) strengthening consumer education with respect to milk and milk products with support from the knowledge networks, media information campaigns and public outreach efforts, including greater coverage and visibility of nutrition issues.

5. **Strengthen stakeholder capacity to cope with production and market risks and for innovation**

Reducing risks and mitigating their effect on the poor is another prerequisite for sustainable development. With growing commercialization and increased frequency of extreme weather events, the poor are particularly vulnerable to increasing production-, market- and climate-related risks because of their limited assets. Public services in the region almost invariably lack the capacity to plan for such risks, or to respond in a timely manner. Building up such response capacity of communities and institutions is important and needs to be an integral part of the development strategy. Some elements of the mechanism to enhance such capacity would include coordinated delivery of services, training of farmers on dairy husbandry, effective health care delivery and cattle insurance through community groups, producer institutions and public agencies. Experience also suggests that bilateral public and private cooperation, supported by appropriate research, can facilitate public action so as to reduce vulnerability in the wake of growing production and market risks. The strategy recommends strengthening institutional mechanisms for improving regional harmonization and collaboration to promoting more resilient dairy-related livelihoods.

6. **Minimize the environmental footprint of the dairy sector and improve mitigation/adaptation measures to climate change impacts**

The main environmental issues associated with dairy production concern water and air pollution, biodiversity, and climate change. Water pollution arises from the inappropriate disposal of manure and the application of fertilisers for forage production. Nutrients, principally nitrogen and phosphorous, if emitted in high concentrations, can be a significant component of pollution from agriculture to surface water, groundwater and marine waters, damaging ecosystems through eutrophication and degrading. Water bodies can also be affected by organic effluents and pathogens contained in manure.

**Water footprint:** Although, at a global level, on a per unit of nutritional value the water footprint of milk compares favourably with other animal source foods (Table 2) there are many milk producing areas across Asia that are under severe water stress. Research on the water footprint in the context of various dairy production systems in the region is limited at best and the implications and strategies for better optimization of the water footprint are not so well understood. The strategy recommends targeted research on better understanding the implications of growing dairy sector on Asia’s water resources and ways and means to better optimize the water footprint of the Asian dairy sector. In this context it is further recommended to adopt a standard water footprint methodology which would allow benchmarking and consistent comparisons across time and across countries and regions of the world.
### Table 2. The global average water footprint of crop and animal products

<table>
<thead>
<tr>
<th>Food item</th>
<th>Water footprint per unit of weight (L/kg)</th>
<th>Water footprint per unit of nutritional value</th>
<th>Calories L/Kcal</th>
<th>Protein L/g of protein</th>
<th>Fat L/g of fat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Green</td>
<td>Blue</td>
<td>Grey</td>
<td>Total</td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>194</td>
<td>43</td>
<td>85</td>
<td>322</td>
<td>1.34</td>
</tr>
<tr>
<td>Fruits</td>
<td>726</td>
<td>16</td>
<td>43</td>
<td>962</td>
<td>2.09</td>
</tr>
<tr>
<td>Milk</td>
<td>863</td>
<td>86</td>
<td>72</td>
<td>1 020</td>
<td>1.82</td>
</tr>
<tr>
<td>Cereals</td>
<td>1 232</td>
<td>228</td>
<td>184</td>
<td>1 644</td>
<td>.51</td>
</tr>
<tr>
<td>Oil crops</td>
<td>2 023</td>
<td>220</td>
<td>121</td>
<td>2 824</td>
<td>.81</td>
</tr>
<tr>
<td>Eggs</td>
<td>2 592</td>
<td>244</td>
<td>429</td>
<td>3 265</td>
<td>2.29</td>
</tr>
<tr>
<td>Pulses</td>
<td>3 180</td>
<td>141</td>
<td>734</td>
<td>4 055</td>
<td>1.19</td>
</tr>
<tr>
<td>Chicken meat</td>
<td>3 545</td>
<td>313</td>
<td>467</td>
<td>4 325</td>
<td>3.00</td>
</tr>
<tr>
<td>Pig meat</td>
<td>4 907</td>
<td>459</td>
<td>622</td>
<td>5 988</td>
<td>2.15</td>
</tr>
<tr>
<td>Sheep/goat meat</td>
<td>8 253</td>
<td>457</td>
<td>53</td>
<td>8 763</td>
<td>4.25</td>
</tr>
<tr>
<td>Bovine meat</td>
<td>14 414</td>
<td>550</td>
<td>451</td>
<td>15 415</td>
<td>10.19</td>
</tr>
</tbody>
</table>


**Manure management:** Dairy cow manure is a nutrient-rich fertilizer; when used appropriately it can make significant contributions towards improved crop/fish pond productivity and replacement of chemical fertilizers. However, if not managed carefully, it can become a source of soil and water pollution, biodiversity loss and other economic losses.

Global experiences have shown that land application of livestock manure for the fertilization of crops and grasslands and for improvement and/or maintenance of soil fertility is one of the most appropriate methods of manure utilization. Traditionally pastoral and smallholder mixed systems in Asia have used nutrient and organic matter in manure as input to agriculture or as household fuel. However, with recent ongoing structural changes, scaling up and emergence of large dairy farms in some countries, manure production may exceed local land recycling capacities to the extent that negative environmental impacts related to manure management are likely to grow. Use of available assays for faecal phosphorus and milk urea nitrogen can be used to generate data for the region to assess ‘sustainable animal diets’, manure nutrients and environmental loss. There is a need to better understand appropriate stocking rates and the relationships between the proximity of lands for feed production and manure land spreading and the options available for surplus manure production.

There are technical options to recover nutrients and energy from manure and the region also has reasonable levels of technical expertise to disseminate these technologies. However, policies and programmes related to manure management are either absent or generally ineffective. Policies are based on a limited assessment of current practices and a poor understanding of the cost implications of adoption of mitigation options for different categories of farmers. Further, the social and equity implications of environmental regulations are not adequately understood. The key to making progress for reducing nutrient loss is to have good farm-level data so as to find ways of recovering nutrients from waste and to turn the waste into income.

This would require substantial investment in data collection, analysis and feedback systems.

The strategy recommends (i) undertaking strategic analysis (including policy and institutional analyses, cost effectiveness of manure management practices and preparation of investment guidelines) of manure management practices; (ii) enhanced public and private investment in farm-level data collection, analysis and feedback systems; (iii) scoping, documentation and dissemination of good practices of manure management; (iv) promoting good legislation to prevent discharge of dairy farm manure (including liquids) to surface waters; (v) facilitating enhanced coordination among scientists from various fields to encourage the integration of animal, soil and plant components; (vi) development of pilot/demonstration farms (incorporating appropriate levels of technology); and (vii) designing and implementing appropriate training courses on nutrient budgets and improved manure management practices.

**Greenhouse gases:** Dairy farms are a source of greenhouse gas (GHG) emissions, mainly from enteric fermentation (methane) and manure management (methane and nitrous oxide); improving the carbon footprint of the dairy sector is an essential element of sustainable milk production. According to FAO estimates, in 2007, the
global dairy sector contributed 4.0 percent to total global anthropogenic GHG emissions. This figure included emissions associated with milk production, processing and transportation, as well as the emissions from meat production from dairy-related culled and fattened animals. Considering the emissions associated with milk production, processing and transportation of milk and milk products only, the overall contribution of global milk production, processing and transportation to total anthropogenic emissions is estimated at 2.7 percent.

Recent studies have pointed out the positive relationship between milk yields and reduction in GHG emissions. This presents a potential win-win opportunity for the region but the relationship between emission intensity and milk yields must be examined within the context of food-feed competition and use of grains in dairy cow rations. While recommending to adopt feeding and management practices with the twin objectives of reducing GHG emissions and improving milk yields, the strategy proposes sharp focus on enhanced use of local feed resources and balancing dairy cow rations. Overall, the environmental performance of the dairy sector can be affected by technological developments (e.g. improved housing facilities; manure storage, spreading and treatment systems; altering feed composition to improve digestibility of phosphorus and nitrogen using more digestible feed materials or by improving the digestibility of locally-produced feed materials). Further, with anaerobic manure digester technology, farms can recover methane gas for use as renewable energy. The strategy also recommends public support for promotion of biodigesters so as to provide communities with a renewable energy source with opportunities to sell the energy for additional revenue.

Overall, it is essential to improve the governance of the sector to ensure that its development is sustainable. As noted above, natural resources such as land, air, water and biodiversity are under pressure and corrective action is needed to encourage the provision of public goods. This will involve addressing policy and market failures, and developing and applying appropriate incentives and penalties. Adoption of improved technologies, encouraged by appropriate economic incentives, can improve the environmental performance of the sector. A key policy focus in this context should be on correcting market distortions and policy failures that encourage environmental degradation. For example, subsidies that directly or indirectly promote overgrazing, land degradation, deforestation, overuse of water or GHG emissions should be reduced or eliminated and market-based rewards and punishment systems that incentivize use of more environmentally friendly practices should be instituted. Payments from public or private sources for ecosystem services can also be an effective means to promote better environmental outcomes, including soil conservation, conservation of landscapes and carbon sequestration.

The sector has enormous potential to contribute to climate change mitigation. Realizing this potential will require new and extensive initiatives at national and international levels, including: the promotion of research on and development of new mitigation technologies; effective and enhanced means for financing livestock activities; deploying, diffusing and transferring technologies to mitigate GHG emissions; and enhanced capacities to monitor, report and verify emissions from livestock production.

Finally, addressing environmental issues would require provision of on-farm technical assistance and extension services to farmers. The aim should be to achieve environmental results at least cost to individual farmers. In some countries regulations on large producers would be necessary and such regulations must become an integral part of dairy development policies and strategies while at the same time being embedded in the overall environmental strategies at the country level. Equally important would be to undertake and promote research and development on adaptation to ongoing climatic changes; for example, identification of animal breeds and feed crops that perform well in future environments of higher temperatures and water deprivation. The long-term productivity and resilience of cross-bred animals in the environment in which they are reared should be the basis for their selection for future use.


11 For example, the ration balancing programme initiated by the NDDB of India to improve productivity and reduce feeding cost has already reported considerable reduction in enteric methane emission per kilogram of milk yield in lactating cows and buffaloes. A study conducted to evaluate the efficiency of utilization of dietary protein for milk production in lactating animals showed that on feeding a balanced ration, the average percent dietary protein secreted into milk of the total protein intake increased from 19.2 to 23.5 in lactating animals, indicating significant improvement in efficiency of utilization of dietary protein for milk production. The average N excretion in lactating animals was 81 percent of the total N intake before ration balancing, which was reduced to 77 percent on feeding a balanced ration. Reduction in N excretion through dung and urine could be an effective method of reducing ammonia and nitrous oxide emission in the environment and improving the efficiency of dietary N utilization for milk production, through balanced feeding. For more information, see Garg, M.R., Sherasia, P.L., Bhandari, B.M., Phontuba, B.T., Shelke, S.K. & Makkar, H.P.S. 2013. Effects of feeding nutritionally balanced rations on animal productivity, feed conversion efficiency, feed nitrogen use efficiency, rumen microbial protein supply, parasitic load, immunity and enteric methane emissions of milking animals under field conditions. *Animal Feed Science and Technology*, 179: 24-35.
THE WAY FORWARD

The vision and the strategic objectives outlined in this document need to be translated into specific actions and measurable targets and implementation plans. While the action will remain local and fall within the ambit of national development plans and policies, national decision-makers would benefit from experiences in other countries. In order to make progress, multistakeholder action at regional, national and subnational levels would need to focus on facilitating practice change, enhancing the understanding of risk profiles and mechanisms to minimize risk, promoting good practices along the value chain, enhancing stakeholder information and education, pooling opportunities for research and cross-country learning, development, extension and education, and finally monitoring, evaluating and continuously improving sustainability performance.

The road ahead is increasingly challenging. The sector not only needs to supply growing amounts of safe food and support rural livelihoods, it must also deal with growing resource scarcity and reduce its environmental footprint. From intensive dairy to dry land pastoralism, livestock systems face highly diverse challenges that require different responses. The complexity of the task is further compounded by the fact that different countries and societies would prioritize objectives differently, depending on factors such as income levels, the relative role of smallholders in the sector, the importance of and prospects for exports, and degree of pressure on and degradation of natural resources. In general, the objectives will tend to be prioritized differently according to the country’s stage of economic development. Countries at low levels of economic development and smallholder-oriented production systems will typically emphasize the role of the dairy sector in economic and social development and design policies to enhance its contribution to income, employment and insurance against risks for poor population groups, including managing animal diseases in support of sustainable livelihoods. At subsequent stages of development, the emphasis may shift towards other objectives such as ensuring adequate supplies for populations while ensuring decent product quality and public health outcomes and protecting the environment and natural resources. In more advanced economies, the focus might shift heavily towards public goods such as human health, food safety and the environment.

It is important to recognize the legitimacy of such differences in prioritization and to ensure that institutional and governance mechanisms reflect that diversity. At the same time, it is also important to recognize that dealing with these challenges would need coordinated joint action among all the key stakeholders at various levels. No single entity is in a position to carry out its task in isolation and hence such an action could benefit from the establishment of a multistakeholder platform to facilitate regional cooperation, knowledge exchange, policy dialogue and catalytic action. This requires identification of willing partners agreeing on a common minimum agenda, putting in place an organizational structure, commitment of resources and a monitoring and accountability mechanism. This should be an open, voluntary and iterative process and such a coalition should be given time to evolve and establish credibility among stakeholders.

The strategy recommends full support from stakeholders towards formation of a Dairy Asia platform that can capitalize on the unique and complementary strengths of different actors. Further, the platform should be supported by structures and processes to (i) promote dialogue towards enhancing common understanding of development issues, (ii) build consensus on the role of dairy towards sustainable food security and nutrition and (iii) catalyse stakeholder commitments to action and on-the-ground improvements. The platform partnership must also be open, voluntary, inclusive and knowledge-based to catalyse coherent and collective practice change.

Finally, it is important to recognize that sustainability is a process of continuous practice change that addresses social, economic and environmental objectives simultaneously. The Dairy Asia platform must strive towards supporting this process by supporting/implementing joint analyses and assessments, facilitating multistakeholder dialogue and cooperation at international and local levels, identifying and providing necessary tools and guidance, and supporting/promoting innovation for local practice change.
Recognizing the central role of smallholder producers in Asian dairy landscape and the potential of smallholder dairy in generating inclusive economic growth, food security and nutrition, the Animal Production and Health Commission of Asia and the Pacific (APHCA), the Food and Agriculture Organization of the United Nations (FAO), and the Common Fund for Commodities (CFC), initiated a stakeholder consultation process in 2007 to distil lessons from Asian experiences and to outline elements of a regional strategy for future development. This involved meetings and workshops with participants from over 17 counties representing national government agencies, cooperatives, dairy industry groups, independent research institutions, private companies and dairy producers. The consultative process culminated in a regional dairy strategy and investment plan for smallholder dairy development and elaborated a strategic vision for smallholder dairy development – Asian milk for health and prosperity, known as the Chiang Mai Declaration. The strategy outlined following strategic objectives

1. A glass of Asian milk a day for every Asian child.
2. Regional self-reliance and enhanced dairy food security.
3. Smallholders better linked to markets and enabled to become commercial dairy entrepreneurs.
4. More efficient, productive, profitable and responsible (socially and environmentally) dairy chain
5. Regional and national recognition of the multiple benefits of smallholder dairy

Strategic pillars

In order to addresses the challenges and objectives, the strategy identified strategic interventions under four mutually reinforcing pillars (Figure 1).

Figure 1: The strategic pillars of smallholder dairy development in Asia

Pillar 1: Human resource development and knowledge management

Investing in people is essential for sustainable development. The region has considerable human resource development experience in the region, including experience with hands-on, knowledge-based, vocational training. There are also good examples of farmer-to-farmer learning. Building on the availability of such experiences, the strategy identified following major interventions and activities under the human resource development and knowledge management pillar:

1. Preparing an inventory of dairy training institutions and materials in the region, identifying those most suitable for smallholder dairy development (SDD).
2. Developing state-of-the-art, vocational training courses for SDD best practices and models, including course materials and practicals, which are sustainable and provide incentives for trainers and trainees.
3. Establishing a regional SDD-focused capacity building programme at the vocational Dairy Training Centre in Chiang Mai, Thailand.
4. Setting up the DairyAsia Knowledge and Information Network hosted initially by APHCA.
5. Sponsoring enterprise-to-enterprise exchanges that would allow detailed comparison of practices and operating results among participants.
6. Developing a coaching program that would include a pool of successful smallholder dairy entrepreneurs and plant managers who can be tapped as trainers or visiting coaches for promising smallholder dairy enterprises.
7. Increasing the number of qualified plant managers, quality control and product development officers and AI technicians to be made available to growing enterprises.

Pillar 2: Improving the productivity and competitiveness of smallholder milk producers

To gain profitable access to markets, smallholders must produce milk efficiently. In the past, most of the private sector smallholder business models focussed on the off-farm links in the dairy chain, thus neglecting farm level constraints. On the other hand, some successful smallholder dairy development models, especially the cooperative model, incorporated elements such as input services, loans, animal insurance schemes, milk collection systems, remunerative pricing, daily or weekly milk payments etc to reduce risks for dairy operators. However, the investment needed to scale up the farms beyond one or two cow units often exceeded the capacity of most poor rural households. SDD strategy therefore focused on incorporating innovative financing packages, including livestock insurance to mitigate risk. The focus in the strategy was on increasing milk yields, quality and profitability through making productivity enhancing inputs...
and services (feed, stock, animal health, management skills) readily accessible and affordable and facilitating the sourcing of appropriate technology, equipment and supplies among dairy enterprises in the region.

The major activities under this pillar included, inter alia:

1. Describing in detail and publishing a “menu of options” (catalogue) of the best SDD dairying practices and models focused on improved returns for smallholders.
2. Selecting the dairy development models most appropriate for local conditions.
3. Advocacy for the smallholder dairy sector to sustainably compete for resources and finance.
4. Assisting the smallholder sector to compete in product markets, in particular through creative linkages with private sector which result in fair and remunerative returns.
5. Increasing milk yields, quality and profitability through making productivity enhancing input services (feed, stock, animal health, management skills) readily accessible and affordable and reducing milk chain losses.
6. Facilitating the sourcing of appropriate technology, equipment and supplies among dairy enterprises in the region.

Pillar 3: Strengthening the linkages between farmers and consumers to deliver a quality product at a fair price

The strategy noted that over 80 percent of the milk and dairy products sold in the region were marketed through informal channels, although processed (formal market) milk and dairy products have been gaining ground rapidly in transforming countries such as China, India, and Thailand. Informal channels generally keep transaction costs low, and service nearby lower-income consumers. Many countries in the region produce a wealth of traditional products, which often command very high prices. Some countries have turned traditional products into high added-value niche products. However, urban consumers invariably become more discerning in terms of quality and safety and aspire to western style products and quality standards, purchased from western style supermarkets.

The major activities under this pillar included, inter alia:

1. Improving farmer access to marketing channels, formal and informal.
2. Increasing opportunities for smallholders to access the formal sector.
3. Creating competitive supply chain conditions.
4. Creating fair and transparent pricing systems with incentives to deliver quality milk.
5. Diversifying the range of dairy products on offer.
6. Educating consumers on the nutritional benefits of local dairy produce.
7. Stimulating consumer demand in those countries with very low per capita milk consumption levels.
8. Reducing losses (qualitative and quantitative) in the dairy chain.
9. Designing and establishing common facilities and networks of resources at national and regional level that would enhance quality control and product development, with potential cost sharing by smallholder enterprises.

Pillar 4: Enhancing the enabling environment

The strategy recognized that smallholder dairy development can be successful under a wide range of situations, but the approach and interventions need to be tailored to the local situation. It has to be recognized that in some cases certain systems, or in fact SDD systems in general, may not be feasible. Key success factors are linked to the nature of risk inherent to dairying. The risks and opportunities (differentiated by market demand, production practice, geography, and access to markets, inputs and services) are also influenced by more macro or broader issues such as trade regulations, government agriculture and investment policies, and institutional support.

The main aims of Pillar 4 were to identify and promote institutions and policies that are critical to enhancing the bargaining power, market access, and incomes of small farmers. The major activities under this pillar included, inter alia:

1. Articulating a smallholder inclusive policy framework.
2. Identifying and supporting conducive legal and regulatory frameworks.
3. Advocating for a favourable macro-economic framework.
4. Developing a plan of action and advocacy support for ensuring an enabling environment for SDD.
5. Creating a platform for identifying and mobilizing the necessary financial services and supportive infrastructure.
6. Linking government nutrition programs to smallholder dairy producers as suppliers.

Beneficiaries

The strategy was designed with the explicit objective of transforming smallholder milk producers in rural communities. Potential direct beneficiaries included some 200 million smallholder families, or nearly 1 billion people including women dairy operators. Within the target group, the strategy placed special emphasis on the empowerment of women by ensuring they have equal opportunities under all the strategy pillars.