regional perspective

Asian Livestock benefiting from innovation

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Introduction

The concept of innovation often generates thoughts of high-technology interventions, with sophisticated scientific discoveries applied to solve sometimes generations-old problems. This article demonstrates that in the smallholder livestock sector of Asia, innovation from low-technology approaches and new ways of thinking about problems plays as important a role as advanced science. The examples described here show that more efficient and more profitable ways of raising livestock can be found using low level technology and low costs, and can also be generated from creative thinking about the use of established tools and technology.

Innovation is the introduction of something new such as an idea, method, process, or device, which is used in solving a problem. High-technology innovations might include the use of new computer assisted solutions to generate faster and more accurate results to a question or problem involving information management. There is no shortage of such hi-tech solutions applied to small scale livestock problems in Asia. For example, in India, small scale enterprises (SMEs) have been developing computer access points in remote area communities to provide farmers with access to market prices for grains and other crops, complete with training and other needed support. New and cheaper vaccines and the use of inexpensive feed additives to promote feed efficiency or reduce parasite burden are other high-tech examples of innovation, although the practicality of such interventions for the typical small scale system may be open to question.

In contrast to these high-tech approaches, decidedly low-tech innovative solutions extend access for small scale farmers to improved production techniques which increase household profits. This increases the likelihood of adoption and sustainability. Furthermore, low-tech solutions tend to favour the use of renewable resources while promoting integrated farming techniques amenable to community led decision making. Examples of low-tech innovation in the livestock sector can be found in situations as diverse as smallholder dairy production in South Asia, community managed solutions addressing the use of micro-credit and animal health, indigenous and appropriate low input types of livestock in Bali and Bangladesh, and innovative fodder techniques in Vietnam.

Yet another form of innovation is creative thinking to use existing and well known technology and tools in a new way. One topical example in Asia is the concept of compartmentalisation, which classifies livestock systems by management system and scale of production to help fight avian influenza in the region.

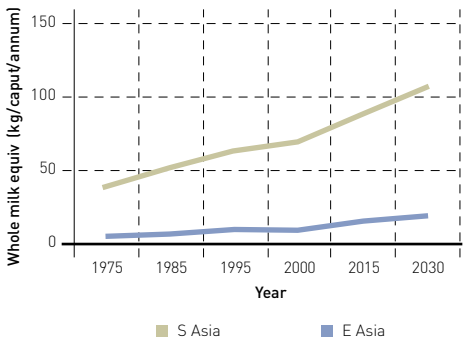
Community managed solutions

Dairy communities

Communities are playing an ever greater role in managing innovative solutions to livestock production. This is particularly so for dairy production in Asia, which has grown significantly in the last two decades. Consumption of milk and dairy products in many countries in Asia has risen tremendously since the 1980s following increased incomes and populations and changes in tastes and preferences, prompting a rise in the number of dairy cattle. Despite increases in production, demand is increasing at such a rate that imports of powdered milk are expected to continue in all countries in Asia for the next twenty years.

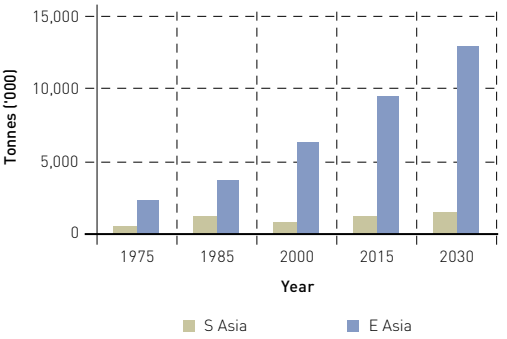
Much of the success of small scale dairying has been due to the presence of dairy co-operatives, often based on the success of Operation Flood in

MILK CONSUMED IN ASIA (KG/CAPUT/ANNUM)



Source: FAOSTAT (2005)

NET IMPORTS OF DAIRY PRODUCTS IN ASIA



Source: FAOSTAT (2005)

Gujarat, India, which set an example for further success stories in countries such as Thailand. Benefits that have been well documented include a system of regular collection and distribution, and a reliable price for milk produced. But more recently, communities have developed innovative approaches to expanding milk sales and increasing profit margins.

In South Asia, communities have modified the concept of milk producers' marketing co-operatives to increase access to vertically integrated markets. Rather than relying on sales of fluid milk alone, much of which is purchased for further processing by local co-operatives, farmers have developed community networks of input and output suppliers and processors with the end purpose of generating greater sales of processed dairy products such as yoghurt and soft cheeses. Even modest small scale processing of milk into yoghurt can significantly increase the value of the product sold, generating extra income for producers. Model small scale community dairy processing plants have been set up in several communities in Bangladesh, India, and Pakistan, demonstrating to local farmers how milk can be transformed into yoghurt and soft cheeses for sale locally and at nearby markets. A few such small scale processing plants are now fully operational, typically serving up to several hundred producers. The innovation introduced is not so much the methodology used, which has been available for many years, but the concept that local communities can take charge of collection and processing of their milk with support from co-operatives. Profits are directly absorbed by the producers as they are paid for their milk on arrival at milk collection centres which double as processing centres.

Small scale dairy farm communities have also become more integrated with other farming systems. Reliance on dairy as a sole means of income is risky, as for any farm product. More farm villages in South Asia are integrating activities to spread risk and to increase efficiency of production systems. In Bangladesh, the Community Livestock and Dairy Development Project (Mitra, 2005), a UNDP funded project with technical assistance from FAO, has demonstrated that by developing opportunities for community managed decision making in mixed crop-fisheries-livestock production systems, communities can help themselves to reduce poverty and enhance livelihoods. Based around village micro-credit and investment in agriculture, the innovative features of the CLDDP project that could be emulated elsewhere include: emphasis on diversified community activities with household specialization; integration of complementary agricultural

activities such as dairy cattle and forage crops; and, creation of special development and insurance funds to reduce start up costs and minimize financial risk of failure. The CLDDP project also has an emphasis on the enhancement of development opportunities for women.

Community animal health workers

Another example of innovative community managed approaches to livestock production has been practiced in Myanmar, Nepal, and the Philippines, where women are trained as part-time community animal health workers (CAHWs). Women who participate in training as CAHWs in such programs are not encouraged to rely on animal health work as their sole activity, but rather to act as resource persons with potential for earning extra income from animal health work. Furthermore, unlike previous CAHW programs, women enrolled in newer programs are encouraged to remain within their communities and act as resource points, attend to local concerns rather than national programs, and engage in joint analysis of problems and solutions. This encourages two fundamental but essential elements of the new approach to training CAHWs. Firstly, CAHWs should be members of the community who are also dependent on livestock for their income and who understand the local nature of livestock production constraints and problems. Secondly, CAHWs are not a replacement for technical services but provide a stop-gap particularly in areas where veterinarians or extension workers rarely travel. The innovative approach here has been to reject the notion that the only successful model of an extension worker is a university educated individual based in a provincial office serving many communities; instead, CAHWs have shown that locally recruited and trained individuals with basic education can prevent 15-25% of herd losses annually (McCorkle, 2003), providing a needed service to communities that public veterinary service either cannot or will not provide.

Management of animal waste

In many countries the trend in livestock production over the last 15-20 years has been for increasing numbers of large scale operations, an increase in the concentration of production, and a reduction in the amount of land and water available for treatment of animal waste. Backyard and small scale producers of pigs and poultry now regard pollution from livestock as a serious concern, particularly in peri-urban settings and areas where water is a scarce resource. In the Philippines this concern has slowed the rate of intensification of livestock production systems in areas already intensifying (Rola *et al.*, 2003), following the trend of larger scale producers to either maintain or reduce the number of livestock raised. One response has been to establish lagoons for waste collection, while another has been to adjust feed formulae in order to minimize waste odours from livestock farms. But these measures have not by themselves been sufficient to allow farm expansion while meeting the requirements of new environmental laws and regulations, many of which are enforced with increasing frequency.

The concern for proper management of animal waste has led producers in South Asia and China to develop innovative ways of storing and removing animal waste. Biogas production units are being re-investigated on small to large scale farms as waste disposal presents increasing problems. Bio-solids broken down in underground fermentation units produce gas for cooking, lighting, and as an energy source for on-farm activities. Modelled after larger scale units on commercial farms, small scale units suitable to smallholder production systems can serve the energy needs of two or more houses while recycling poultry, dairy, and pig waste. Solids broken down in fermentation units are used as fertilizer for crop production, sometimes being sold for cash. The innovative changes in designing specific bio-gas units for small-scale and large-scale production as well as the rising cost of fuels has made bio-

gas units more cost effective while providing a method for handling livestock waste.

Small scale producers are also being brought into discussions regarding planning and policy formulation as it pertains to local environmental guidelines and regulations for waste management. Issues such as zoning, bans on discharge, manure and manure product marketing, nature of storage, use of taxes and subsidies to enforce and encourage waste management, and appropriate mix of crops and livestock to facilitate waste management are important to small holders as well as larger scale producers. Further efforts to encourage small scale farmers to use innovative techniques for waste management are being encouraged. For example, in the Philippines small scale farmers are joining larger scale producers in learning of ways to evaluate and adopt practical techniques that reflect nutrient mass balance calculations and evaluation of environmental mitigation efforts on a per kg of output basis. Recent studies have shown that small scale farmers in fact spend more in environmental mitigation per unit of output than do large scale producers, indicating that small scale farmers have a less negative impact on the environment than do large farms (Catelo, 2004).

Appropriate breeds of livestock

In the area of livestock genetics, attitudes to indigenous breeds are slowly changing. While the offtake (milk, meat, etc.) from indigenous livestock is usually less than that of imported breeds, local types of livestock fare better under systems of minimal input typical of small scale production. Indigenous animals tend to be hardier and more disease resistant, and less demanding of high energy/protein diets for metabolic and reproductive functions.

While there is much room for improvement in the preservation of indigenous breeds in Asia through breeding programs and breed promotion, there are good examples of the preferred use of indigenous livestock. In Bali, Indonesia, for example, the primary breed of cattle is the *Bos javanicus* (also erroneously known as *Bos banteng*), a banteng type of cattle that is listed by the International Union for Conservation of Nature and Natural Resources (IUCN) as endangered. The Bali Banteng is preferred for its ability to graze on minimal roughage sources such as roadsides, areas under palm and other trees, and unimproved pasture. Used primarily for meat, the Bali Banteng is also used to produce small amounts of milk and for traction. Regrettably, the purity of the genepool of Bali Banteng cattle has decreased considerably due to cross breeding programs throughout South-East Asia. Aware of the threat of extinction of the breed, the island of Bali has taken the innovative step of banning other cattle types on the island in order to conserve the purity of the Bali Banteng (NRC, 1991), confirmed by recent informal discussion with veterinary officers from Bali. Until greater efforts are made to secure the biodiversity of indigenous livestock such strict and innovative breed preservation measures may be necessary to ensure that breeds such as the Bali Banteng do not disappear forever.

While the Bali Banteng is an example of a locally preserved indigenous breed, a different approach to innovation in breeding has been adopted in Bangaldesh, where crossbreeding has been used to produce a low input chicken for small scale farming. Egyptian Fayoumi cockerels from imported stock are crossed with Rhode Island Red hens on government farms to produce a local bird known as Sonali, suitable for semi-scavenging production (Rahman *et al.*, 2004). The Sonali is extremely popular with small holders and the meat and eggs fetch a premium in local markets. The birds require little supplementation and lay large numbers of eggs per year (up to 200 per annum), three to four times higher than local hens. Although not a native bird to Bangladesh, the innovative use of a low input indigenous breed from Egypt in a native cross-breeding program has worked extremely well for Bangladeshi poultry farmers. In contrast to more expensive

PHOTO: D. HALL

Sonali type birds are extremely popular in Bangladesh for their hardiness and high egg laying ability.

imported poultry such as the white leghorn which requires high feed and management inputs, the Sonali breed has proved a hardy semi-scavenging type of bird that has generated cash, meat, and eggs for millions of Bangladeshi rural families.

Forages

Typically one thinks of grasses and shrubs as a source of fodder for small ruminants and monogastrics, but it is now common to see the use of food industry by-products such as rejected parts and residues of pineapple and baby corn crops. In Vietnam and China, innovative ideas regarding sources of roughage are leading researchers to develop methods of preparing and feeding alternative crops to livestock that are already in use for human food, such as cassava and rice. For example, cassava is an essential tuber crop grown in China and Vietnam; in Vietnam it is second in use to rice as a cash crop for small scale farmers (Khang *et al.*, 2000). As a roughage source, fresh cassava leaves have been used with varying results in ruminants, and one hectare of cassava can yield 3000 kg of protein.

Part of the constraint to greater use has been potential cyanide toxicity and unfavourable tannin content of the leaves, reducing palatability. To overcome these problems, researchers in Vietnam (Ly and Ngoan, 2005) have shown that by wilting cassava leaves in a simple manner following a prescribed process, the cyanic acid content of the leaves not only had reduced to negligible levels but the addition of small amounts of rice bran or cassava root meal resulted in good quality silage that reduced feed costs. Cassava leaves have also been shown to have good potential as bypass ruminant protein for use in dairy cow rations (Khang *et al.*, 2000). Other examples include further processing of tofu waste to avoid spoilage for duck feed and ensiling of fish by-products for protein supplementation in fattening pigs.

Compartmentalization and controlling livestock disease

In the last two years the outbreaks of bird flu in Asia, or avian influenza as it is properly termed, has caused the deaths of more than 65 humans, the deaths of birds, and billions of dollars in direct economic damage and lost trade. It has been recognised that eradicating the disease from entire countries, or even geographic zones, is a major challenge.

Recently countries in the region have begun discussing details of an innovative approach to containing and defeating avian influenza which is adaptable to other livestock diseases as well. The premise of the new approach, called compartmentalization, is to identify "compartments" of farms or processing units based on the scale of production and other shared characteristics in order that approaches to controlling disease are geared to compartments rather than the entire poultry industry. For example, farms with low input low output management such as households rearing backyard native chickens could be classed in a completely separate compartment to that of a high bio-secure intensive operation raising thousands of broilers for international markets. The grouping is not based directly on geographic location but rather on characteristics such as scale of production and inputs, and particularly on a common bio-security system within a compartment, and degree of traceability of animals and products along the market chain.

Compartmentalisation can only be effective when seen as part of a well designed national disease control strategy, requiring surveillance and monitoring activities, stamping out of outbreaks and on-farm biosecurity, and protection for the compartment from incursion of disease agents. In this respect, it shares common features with progressive zoning. The valuable innovation that it offers, however, is the possibility that the geographic space occupied by a compartment need not be continuous, provided that biosecurity is maintained. All of the operations within one vertically integrated poultry market chain might be considered a compartment, even if they are physically separated.

Under a compartmentalization system, if avian influenza breaks out in an isolated area and is confined to small holder backyard farms, disease control efforts could be focused on that compartment rather than the entire sub-sector or a geographic zone. Large scale highly bio-secure units could continue production of chicks, meat, and eggs, and exports could continue subject to trading partner agreements. Resources currently directed to the entire sub-sector could be focused on problem elements that are most at risk for entry and spread of the avian influenza virus, increasing the efficiency of response and containment.

If compartmentalization is adopted, it is almost certain that there will be changes in the management systems of the various potential compartments. Producers of small scale backyard flocks will likely come under pressure to contain their birds with netting or fencing, and techniques such as vaccination may or may not be mandatory depending on the nature of confinement and housing used.

The World Organisation for Animal Health (OIE) recently included the use of compartments in its guidelines on avian influenza control (OIE, 2005). It has been stressed that compartmentalization is a strategy that needs to be adopted by countries with particular attention to country level production characteristics and features. Furthermore, trade agreements between countries that use or do not use compartmentalization will be worked out between those trading countries, as has always been the case in bilateral trading agreements.

Conclusions

Innovation in the livestock sub-sector does not have to rely on new high-tech inputs in order to be successful. The examples presented in this article demonstrate that simple local application of innovative ideas can result in cost savings with increased output and reduced disease and environmental risk. Furthermore, low-tech innovations can be a part of sustainable community-led mixed crop-livestock production systems. For farmers with limited access to financial and other resources, low-tech innovation provides small scale farmers with advanced applications in animal production and health, increasing the role of livestock in providing household nutrition and financial security. For problems on a larger scale, new ways of applying existing technology may provide effective solutions where previous approaches have failed.

References

Catelo, A.O. (2004). Implications of environmental externalities in livestock industrialization. Presented at the workshop "Structural Change in the Livestock Sector – Social, Health, and Environmental Implications for Policy Making". Bangkok, January 27-29, 2004.

FAOSTAT (2005). http://faostat.fao.org/

Khang, D.N., N.V. Man, and H. Wiktorsson. (2000). Substitution of cotton seed meal with cassava leaf meal in Napier grass (Pennisetum purpureum) diets for dairy cows. Paper presented at the workshop "Making better use of local feed resources". SAREC-UAF, January, 2000.

McCorkle, C. (2003). Chapter 2: Community-based animal health care, participation, and policy: where are we now? In: *Community-based Animal Health Workers: Threat or Opportunity?* The IDL Group. Crewkerne, Somerset, UK.

Mitra, B.K. (2005). Community Livestock and Dairy Development GMPF/UNDP/FAO Project, BGD/98/009. Yearly Progress Report, 2004. CLDDP, Joysagar, Bangladesh.

National Research Council. (1991). *Microlivestock: Little-Known Small Animals with a Promising Economic Future.* Chapter , page 29. NRC Office of International Affairs. National Academies Press, Washington, D.C.

Ly, N.T.H. and L.D. Ngoan. (2005). Evaluation of the economical efficiency of using cassava leaves (variety KM 94) in diets for pigs in Central Vietnam. Paper presented at workshop "Making better use of local feed resources". Cantho, Vietnam, May 23-25, 2005. Article #24. Retrieved October 1, 2005 from http://www.mekarn.org/proctu/ba24.htm

OIE (2005) *Terrestrial Animal Health Code.* Chapter 1.3.5 Zoning and Compartmentalization http://www.oie.int/eng/normes/mcode/en_chapitre_1.3.5.htm and Chapter 2.7.12 Avian Influenza http://www.oie.int/eng/normes/mcode/en_chapitre_2.7.12.htm

Rahman M.M., M.A. Baqui, and M.A.R. Howlider. (2004). Egg production performance of RIR x Fayoumi and Fayoumi x RIR crossbreed chicken under intensive management in Bangladesh. *Livestock Research for Rural Development.* 16, Art. #92. Retrieved October 1, 2005, from http://www.cipav.org.co/lrrd/lrrd16/11/rahm16092.htm.

Rola, A., W. Rola, M. Tiongco, and C. Delgado. (2003). Livestock intensification and smallholders: a rapid reconnaissance of the Philippines hog and poultry sectors. International Food Policy Research Institute; Markets, Trade, and Institutions Division Discussion Paper 59. IFPRI, Washington, D.C.