Livestock Waste Management in East Asia

Abstract: The population growth and increasing wealth and urbanization taking place in East Asia are driving one of the world’s fastest growing demands for animal products. The livestock sector is responding effectively to this demand surge, mostly through the emergence of large-scale intensive pig and poultry production, but supply growth has been associated with serious environmental issues, mostly related to manure management. The 5-year (July 2006-December 2011) Livestock Waste Management in East Asia Project (LWMEAP) was designed to finance the incremental costs of moving from the business-as-usual approach of ineffectively addressing environmental problems to a strategic framework for livestock production development which is not only economically but also environmentally sustainable.

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Livestock Waste Management in East Asia

Experience of the GEF - sponsored

GEF/FAO: Livestock Waste Management in East Asia Project
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PROJECT DESCRIPTION

The project’s development objective was to reduce the major negative environmental and health impacts of rapidly increasing concentrated livestock production on water bodies and thus on the people in three countries of the East Asia region: China (Guangdong Province), Thailand and Viet Nam. Its global environment objective was to reduce livestock-induced pollution and environmental degradation of the South China Sea. The project contributed towards the goals of the World Bank’s Country Assistance Strategy for China (CAS 25141-CN), for Thailand (CAS 25077-TH) and for Viet Nam (CAS 27659-VN) through investment in selected livestock farms and development of replication strategies to promote environmentally sustainable growth.

The project’s approach contributed to regional Global Environment Facility (GEF) Action Programmes by: involving three of the region’s most important countries in terms of livestock production and waste pollution; emphasizing their common interests in protecting South China Sea ecosystems; and introducing the possibility of replicating project demonstration experience throughout the region.

The project had six main expected outcomes:
- demonstration of LWM practices in participating farms/villages;
- reduction in surface water pollution due to livestock production in project areas;
- development of replication strategy and other policy measures for LWM, and their local and national (provincial) adoption and enforcement;
- development of plans and programmes to achieve spatial distribution of livestock production better aligned with environmental and health objectives;
- reduction in risks to human health through improved management of pathogens, antibiotics and virus transmission from livestock to humans;
- increase in public awareness and regional exchange of information on pollution threats and health problems from livestock waste.

PROJECT ACTIVITIES

The project was divided into four components:

- Livestock Waste Management Technology Demonstration (including training and extension activities) – to demonstrate solutions to diminish critical livestock waste pollution by reducing excess nutrients and risks to human health.
- Policy and Replication Strategy Development (including awareness raising activities) – to put in place a policy and regulatory framework for environmentally sustainable livestock production in each country that will encourage farmers to adopt improved manure management practices.
- Project Management and Monitoring – to support the establishment of efficient project management and monitoring structures.
- Regional Support Services (including capacity building, coordination and facilitation) – to respond to participating countries’ need for capacity building support and regional coordination and facilitation support to achieve cross-country synergies and regional replication.

The project focused on pig farms because pigs are the dominant type of livestock in the participating countries and because expansion of this livestock industry represents the largest single environmental impact on river water quality. All three countries recognise the negative effects of industrial livestock production on the environment, and of pig production in particular.

PROJECT TOOLS

Project teams in all three locations were able to draw on three major FAO instruments for decision support: COSIMO, STRAW and GIS-based spatial planning.

The COSIMO (Cost of Compliance Simulation Model) instrument provides guidelines, standards and approaches for the design of a policy framework to reduce land and water
pollution from livestock production while acknowledging other objectives such as poverty reduction, public health improvement, economic growth and animal disease control.

The STRAW (Support for the Treatment and Recycling of Animal Waste) program offers a software application for identifying and selecting manure management options for confined pig production in rapidly growing economies.

Spatial Planning based on Geographic Information System (GIS) technology and multiple criteria evaluation supports the planning of livestock production at national and local levels.

THE EXPERIENCE

ISSUE
At the beginning of the 21st century, China, Thailand and Viet Nam alone accounted for more than half the pigs and one-third of the chickens throughout the world and the concentration of pig and poultry production in the coastal areas of these three countries is emerging as a major source of nutrient pollution of the South China Sea. Along much of the densely populated coast, pig density often exceeds 100 animals per square kilometer and agricultural lands are overloaded with huge nutrient surpluses. Run-off is severely degrading seawater and sediment quality in one of the world's most biologically diverse shallow water marine areas, causing “red tides” and threatening fragile coastal, marine habitats including mangroves, coral reefs and sea grasses.

ADDRESSING THE ISSUE
Pollutants from all three countries threaten the South China Sea. But the nature of livestock operations differs markedly among the countries. In China (Guangdong province) half of the pigs are still produced in operations with fewer than 100 animals, although large-scale industrial operations are growing rapidly; almost one quarter of the pigs in Guangdong are produced on farms with more than 3,000 animals. In Thailand, three-quarters of pigs are now produced on large, industrial farms with more than 500 animals, while in Viet Nam very small producers with just three or four pigs account for 95 percent of production. Nevertheless, because the issue of waste management is common to all three, and because all three share a coastline with the South China Sea, the project developed a set of common activities. Potential synergies and cost savings were also foreseen in the common development of tools and methods to address the waste management issue.

The early Area-wide integration (AWI) pilot projects carried out by the Livestock, Environment and Development Initiative (LEAD) have shown that as pig production moves towards larger, specialized, confined production in peri-urban areas, increased amounts of manure are often improperly discharged, leading to surface water and other environmental problems. As a result, Component 1 of this project (Livestock Waste Management Technology Demonstration) demonstrated workable solutions to reduce regionally-critical livestock waste pollution caused by industrial or concentrated livestock production. These livestock waste management solutions focused on recycling the nutrients present in pig manure for other agricultural activities such as cropping and fish farming, as well as on reducing excess nutrients in manure, in particular nitrates and phosphates, through a combination of settling and storage or incorporation into biomass. The component also demonstrated the environmental effectiveness of bio-digestion as a way to reduce organic matter content of effluents and generate renewable energy, i.e. biogas.

Because enforcement of existing regulations on waste management is generally ineffective, Component 2 (Policy and Replication Strategy Development) supported the setting up of a policy and regulatory framework for environmentally sustainable development of livestock production in each country to encourage farmers to adopt improved manure management practices. It also developed and tested strategies for widespread replication of manure management practices in relation to farm scale, affordability, operational capacity, material availability, public health risk reduction and compatibility with the waste handling methods of local communities.

Under Component 3 (Project Management and Monitoring), the project supported the establishment of national project management structures in Thailand and Viet Nam, and a provincial structure in Guangdong, with a mandate to ensure that all aspects of project design and implementation were well documented and easily and publicly available. This component included monitoring of the manure management practices developed under
Component 2 and assessment of their potential for replication. In particular, at the farm and community levels, the monitoring process focused on the effect of project manure management interventions on public and animal health, including end-of-pipe and critical downstream discharges of nitrate, phosphate, BOD (biological oxygen demand), COD (chemical oxygen demand) and E. coli bacteria. Growing awareness of environmental and public health issues associated with livestock waste management is often not translated into action because of lack of knowledge and experience; at the same time, many of the tools and approaches required to address the issue of waste management would be the same or similar in the three participating countries.

As a consequence, Component 4 of the project (Regional Support Services) developed common tools, technical standards and methodologies for technology selection, policy design and environmental monitoring; these were tailored to local conditions while maintaining harmonization across provincial and country boundaries.

RESULTS AND LEARNING

OVERALL ACHIEVEMENTS

1. Introduction of a regional approach, which permitted, among others:
   • collaboration;
   • comparison of results and experiences on waste management and policy elements;
   • exchange and transfer of technology and approaches;
   • environmental awareness-raising among farmers (demonstration of practical options such as value of manure as fertilizer and renewable source of energy) and government staff.

2. Development of waste management technology and improvement of environmental performance through, for example:
   • demonstrated feasibility of biogasification;
   • introduction of new technologies and development of new designs for large and medium farms, accounting for a total of approximately 500,000 pig places;
   • access to international expertise.

3. Institutional development, such as:
   • Collaboration between government and farmers-private sector;
   • Collaboration between line ministries (Agriculture, Environment, Public Health, Interior);
   • Capacity building on waste management and international experience;
   • Collaboration between decision-makers, financial institutions, academia, research institutes and farmers.

4. Incorporation of the greenhouse gas (GHG) emission mitigation objective and coupling with financing under the Clean Development Mechanism (CDM), one of the carbon finance mechanisms defined in the Kyoto Protocol.

5. Positive effect on beneficiary incomes.

6. Enhanced public participation and fewer complaints against farmers.

7. Improved long-term sustainability (social, economic, environmental) of the sector for farmers.

PROJECT COMPONENT BENEFITS

The LWMEAP project outlined policies at both the national and local levels. At the national level, the project stressed the need for inter-agency cooperation to develop effective and realistic regulations on environmental protection and discharge standards and to undertake spatial planning for the location of future livestock development to create the conditions for better recycling of effluents. As a key tool for shaping and implementing policy at the local level, LWMEAP provided detailed templates for three different Codes of Conduct. Each of the proposed Codes has been tailored to address specific farming practices and environmental challenges that are representative of most pig production in the region.

In particular, the project produced beneficial outcomes at both local and global levels for each component:

Livestock Waste Management Technology Demonstration

• Improved sustainability of intensive pig production through adoption of proven manure storage, treatment and recycling technologies.
• Reduction in local environmental hazards and nuisance factors.
• Increased on-farm investment in livestock waste management, leading to improved nutrient balances and quality of domestic waterways, as well as public health benefits.
• Increased availability and knowledge of innovative technologies for mitigating the environmental impact of intensive livestock waste and private and public capacity to implement such technologies.
• Contribution to long-term cost-effective reduction of nutrient losses and waste discharge into water systems draining into the South China Sea.

**Policy and Replication Strategy Development**
• Development and adoption of a replication strategy and other integrated policies and standards for improving the management of livestock waste and its discharge into the environment.
• Increased public and producer awareness.
• Improved capacity for training and enforcing policies.
• Improved capacity for establishing data infrastructures
• Replication of improved LWM practices throughout the region, leading to enhanced long-term sustainability of pig production in areas surrounding the South China Sea.

**Project Management and Monitoring**
• Improved institutional capabilities for supporting livestock waste management.

**Regional Support Services**
• National agencies for livestock better able to regulate, support and monitor a more environmentally-sustainable intensive livestock production industry that meets national economic and environmental needs.
• Countries bordering the South China Sea apply common tools and guidelines for LWM, resulting in better effectiveness at regional level of their efforts to reduce pollution of the South China Sea caused by intensive livestock production.
• Decision support tool for LWM technology selection (Sustainable Treatment and Recycling of Animal Waste – STRAW) and for policy design (Cost of Compliance Simulation Model - COSIMO) made globally available.

**SHORTCOMINGS**

Despite its significant achievements, the project revealed a number of shortcomings related to design and implementation that follow-up or replication should rectify.

Project design was marked by a low level of investment subsidy to farmers (Component 1) which constrained participation; limited emphasis on demonstrating technologies for small farms compared with larger production units, and limited targeting of project participants during preparation.

In terms of implementation, experience demonstrated inadequate emphasis on policy development (which takes time and political will outside project teams); high transaction costs and an administration burden related to administration procedures; delay in the development of DST reducing their adoption during project cycle; limited demonstration of technologies for recycling of manure (liquid) and biogas effluents on crops; and lack of adoption of an harmonized monitoring methodology and consistent data collection that have limited the possibility for the Regional Facilitation Office to carry out regional assessments and comparisons.

**FOLLOW-UP AND REPLICATION**

**Follow-up**
Follow-up projects should draw on strong government and farmer support/responsibility, should continue international technical support through the same team of experts, and should design the level of support to farmers carefully. In this context, experience shows that an investment subsidy level of 30-40 percent would appear to be more appropriate than the 25 percent called for in the project design.

**Replication**
The aim of the project’s replication is the eventual integration of the project’s successful demonstrations and policy work into each country’s overall livestock waste management strategy and their scaling up. Through regional dissemination activities targeting primarily the three participating countries but eventually also other countries draining into the South China Sea, other countries in the region could benefit from the knowledge and experience gained under the project. The project also provides valuable experiences beyond the East Asia region.

The project was designed to maximize replicability beyond its immediate impact areas. Indeed, a noticeable pollution reduction in the South China Sea catchment areas could only be achieved through replication of the demonstrated livestock waste management practices throughout the participating countries and in other countries bordering the South China Sea.
Specific project activities for replication of improved livestock waste management approaches would include: (a) the development and implementation of targeted policies; (b) specialized training, exchange visits and other forms of technology and experience sharing; (c) engaging farmer groups, local communities, non-governmental organizations (NGOs), government agencies and other stakeholders; (d) support for local pressure through public-awareness building; and (e) the dissemination of demonstration results through training, targeted workshops and development of an internet portal for in-country and regional learning and replication.

Initial successes will be critical, and efforts will be needed to monitor and evaluate progress towards relatively short-term outcomes, one of which should be establishing effective partnerships. Initial successes of the proposed cost-shares to improve manure handling and storage could have additive effects. Success can only be achieved through very careful implementation and persistent follow-up, and continuation of the management counseling often required during the adoption period.

Close cooperation with other international livestock management projects and assistance agencies would ensure that a successful project approach can be replicated in other regions that face similar environmental problems from industrial livestock production.

Replication challenges would include:
- Design and implement targeted and phased measures to address LWM issues in an effective and socially acceptable manner (new versus existing farms, large versus small farms, peri-urban versus rural areas).
- Design and demonstrate effective technology options for liquid waste management, which is the most challenging environmental issue.
- Develop cross-country coordination and avoid a leakage effect (i.e. production moving to areas/countries with low environmental regulation).

**SIGNIFICANCE**

This project is the first GEF IW project to address the issue of the environmental problems that are being created in the East Asia region by rapidly increasing large-scale livestock production units and to test and consolidate a strategic framework for livestock production development which is economically and environmentally sustainable.

Simultaneously, the project represents the first time the issue of LWM has been addressed from both a policy and technical standpoint, and within an approach focused on regional collaboration.

The results of the project, which was designed with replicability in mind, are relevant to other pig production areas in tropical environments: Southeast Asia (e.g. Cambodia, Indonesia, Malaysia, Philippines and Chinese provinces other than Guangdong); Latin America (Brazil, and Mexico); and the Pacific Islands.

**REFERENCES**

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