

Providing technical assistance for sustainable livestock waste management in South East Asia

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Past studies have shown that the livestock sector is causing progressive soil and water pollution across East Asia. Public awareness about impacts on the natural environment and of public health issues is growing but this is rarely translated into action because of a lack of knowledge and experience among public organisations, NGOs and livestock producers. Even if expertise in policy and technology development is actually available among academia and research centres in the region, it is often not consolidated, validated or visible enough to guide intervention on a broad scale. The same expertise could effectively address issues of a similar nature in the whole region. This gap in knowledge transfer is being addressed within the framework of the "Livestock Waste Management in East Asia (LWMEA)" project, launched in 2006 with participation of groups in Thailand, Vietnam and Guangdong Province of China. The primary aim of this project is to support the introduction of sustainable livestock manure management practices in order to reduce pollution fluxes reaching the South China Sea. In supporting the project implementation, the Livestock, Environment and Development initiative (LEAD), which is part of the FAO, has undertaken the development of a set of software packages (known as decision support tools or DST's) to address main aspects of animal waste management. The development programme draws on cross-country synergies, local expertise and the economies of scale. Four such decision support tools have been identified to meet the capacity building needs in the three LWMEA participating countries and more generally, in the region as a whole.

Introduction – environmental issues associated with manure management in South East Asia

Fuelled by a growing population, rising income and urbanisation, demand for animal products in the developing world is expected to rise over the next decades: in the developing world, per capita consumption of meat rose from 14 kg in 1983 to 21 kg in 1993, and is expected to reach 30 kg by 2020. Among the developing countries, Asia has the fastest developing livestock sector (annual growth rate for meat production over the same period was 8.4% in China and 5.7 percent in Southeast Asia), as a consequence of faster growth in human population, economy and urbanisation. Recent analysis predicts that this trend will endure over the next 20 years, although the pace of growth may dwindle. Over the 1997 to 2020 period, annual growth of consumption is predicted to average 3.0 percent in China, 3.3 percent in Southeast Asia and 2.8 percent for the developing world.

The livestock sector is responding to this surge in demand for livestock products with some drastic transformations that impact the type of manure produced as well as its management practices. This in turns has substantial environmental consequences, especially in terms of eutrophication, acidification, waterborne diseases and climate change.

The Livestock Waste Management In East Asia Project

Against the above background, the Livestock Waste Management In East Asia (LWMEA) project's objective (The World Bank, 2006) is to reduce the major negative environmental and health impacts of rapidly increasing concentrated livestock production on the open waters of and thus on the people of Southeast Asia. Its global environment objective is to reduce livestock induced, land-based pollution and environmental degradation of the South China Sea and Gulf of Thailand.

The project takes a comprehensive approach to integrate technological solutions, regulatory enforcement, capacity building, and regional synergy for achievement of the Project objectives. It is integrated into the Governments' mainstream programs and based on existing institutional mechanisms. The project will support activities under the four components briefly introduced below, to be implemented in Thailand, Vietnam and Guangdong Province of China, over a period of five years:

Component 1: Livestock Waste Management Technology Demonstration. This component is to demonstrate technically, geographically, economically and institutionally workable solutions to reduce livestock waste pollution. Farmers participating in the project are supported through matching grant schemes whereby the investment costs are supported by the project, the national government and the farmers at the level of 25, 25 and 50 percent, respectively. The livestock waste management strategies promoted under this component focus on reducing excess nutrients (nitrates and phosphates in particular) and human health risks.

Component 2: Policy and Replication Strategy Development. This component supports the development of a policy and regulatory framework for environmentally sustainable development of livestock production in each country that will induce further policy reforms and encourage farmers to adopt improved manure management practices.

Component 3: Project Management and Monitoring. This component deals with project management and project monitoring and evaluation.

Component 4: Regional Support Services. This component provides capacity building support to strengthen the participating countries' institutional capacity and regional coordination and facilitation support to ensure regional coordination and achieve cross-country synergies, and regional replication.

The first three components are implemented at national level by central or provincial project management units, while the fourth component is implemented by FAO's regional office in Bangkok.

Rationale for the common development of decision support systems

In each of the participating countries it is evident that a growing awareness of environmental and public health issues associated with livestock waste management is often not translated into action because of a lack of knowledge and experience about how to deal with the issue. On the other hand, many of the policies and technologies required to effectively address the issue would be similar in Thailand, Vietnam and Guangdong province, as well as in other countries and provinces bordering the South China Sea. It therefore makes sense to draw on cross-country synergies, skills and economies of scale in pursuing the achievement of the project's objectives. In addition, the development of harmonised approaches provides an organizing framework and necessary analytical support to permit the project to constructively evaluate its own performance and to identify opportunities for replication and strategies for scaling-up of the project's results.

Overview of decision support tools prepared in the framework of the LWMEA project

Four decision support tools (DST) have been identified to meet the capacity building needs in the three LWMEA participating countries and more generally, in the region as a whole. These tools and related training modules will initially be developed in English, and later translated into national languages. Each tool, tailored to local conditions while maintaining harmonization across provincial and country boundaries, will be delivered in the form of handbooks, calculation sheets and software.

Tool for spatial planning of livestock development

During the project preparation, the participating countries expressed their need for a more sustainable spatial planning of future livestock production, and identified Geographical Information Systems (GIS) as a supporting tool for policy enforcement with regard to the spatial location of future livestock production. The use of GIS as a decision support system for spatial planning should support the adoption of zoning policies and regulations for the spatial planning of future livestock production.

Rationale. While mitigation of environmental pollution by animal waste can be tackled by improving waste management practices at farm level, the spatial planning of the livestock production is an approach to prevent environmental impacts from future livestock production. With spatial analysis one can identify areas that are sensitive to environmental pollution by pig farms, and by zoning and buffering prevent some negative environmental impacts, such as odour pollution in residential areas. If mitigation measures at the farm level are (partly) failing, a proper spatial allocation will also prevent other environmental impacts, such as soil and (ground) water pollution by nutrients, occurring near very sensitive areas, such as nature reserves. However, the development of zoning policies and regulations will be required for a successful implementation and enforcement of the output of the spatial DST.

Users. A tentative identification of potential users was worked out during project preparation in the three countries, and will be validated during implementation. Among users, we differentiate users of the DSS tools and the users of the output (resulting maps) of the tools. Therefore, the decision making process on the spatial planning of future livestock production needs to be identified first for each of the participating countries, since these decision makers will be the most important beneficiaries of the results of the DSS tools.

Approach. Suitability of areas for future intensive animal farming will be assessed for national and provincial level spatial decision and policy making. The method, relying on Geographical Information Systems and participatory multiple criteria decision making was described by Gerber et al. (2008). Criteria for identifying unsuitable and restricted areas may include:

- (i) maximisation of economic profitability of pig production,
- (ii) minimisation of environmental impacts,
- (iii) protection of public and animal health, and (iv) rural development and poverty reduction.

Decision support tool for the selection and evaluation of manure management options

This tool is introduced by Burton et al. (2008). In brief, the DST targets users among farmers, extensionists (government, companies, farmers' associations) and technocrats and intends to fulfil three function:

- (i) Support for the design of new manure management systems based of specific farm's parameters and context;

- ii) Support for the assessment of environmental impacts caused by a given farm, as described by the user;
- iii) Guidance and good practices on animal waste management, from collection to recycling/discharge (pre-designed leaflets or printed material from the software). The DST will include a computer-based module and printed material. Technical designs and environmental impacts will be assessed against the following environmental parameters - by decreasing order of importance: i) main water pollutants (nitrogen-N, phosphorus -P, **dissolved organic carbon - DOC**; ii) main greenhouse gases -GHG (methane -CH₄, nitrous oxide-N₂O); iii) secondary water and soil pollutants (copper - Cu, zinc -Zn, pathogens and drug residues).

Tools for monitoring environmental, public health and socio-economic impacts of intensive livestock production

Monitoring is an internal and inherent project activity and consists of watching the progress vis-a-vis planned activities and collection of some specific observations which could help understand if desired results are likely to be achieved. It also comprises some diagnostic analysis of ongoing activities which could help the authorities in project countries to locate gaps and act to carry out mid-term correction if any needed. Monitoring is also required in the long run, beyond project's span, to measure actual enforcement and effectiveness of policies and adapt policy frameworks accordingly.

Rationale. There are numerous and complex issues associated with waste management of industrial livestock production, including environmental, public health, economic, and social issues. If these issues are usually known in the participating countries, quantitative information is generally missing, and standardised approaches for its gathering often not available, especially in Government Offices. In particular, none of the three countries is currently equipped with adequate approaches, methodologies and guidelines to handle public and animal health risk monitoring, analysis and/or mitigation. The tool will be developed to support monitoring of environmental, public health and socio-economic impacts of intensive livestock production during project span and beyond.

Users. The targeted users are Government staff at central and local level. Especially staff from Ministry of Agriculture, Ministry of Natural Resources, Ministry of Public Health, Ministry of Planning and Ministry of Finance; Pig producers and producers organizations; and NGOs and civil society.

Expected content. The decision support tool will gather selected indicators and related methodologies for their collection. It shall also propose a structure for data management and analysis. In line with the project preparation findings, the following aspects shall be covered: surface water quality, groundwater quality, soil quality, public health and zoonotic diseases, system performance, social monitoring.

Tools to support the ex ante assessment of policy changes

The project preparation identified a clear need for policies and techniques that can re-orient the livestock sector growth on a sustainable path. The project preparation work also identified constraints to an effective change towards less harmful production, including: (i) little public or institutional understanding or concern over the direct environmental damages or risks posed by intensive livestock operations; (ii) lack of capacities and methods to address such issues; (iii) strong incentives for public servants to promote economic development even at the expense of the environment; and (iv) little or no consultation with stakeholders by the regulatory or enforcement agencies.

Rational. Because enforcement of new policies is often sensitive, and because environmental regulations can have wider effect than the strict environmental issue they

intend to tackle, there is a need to test their consequences. In particular, environmental policies will affect farmers income and labour demand, with some consequences on rural development. Particularly in the context of the three countries, environmental policies also require thorough stakeholder involvement to ensure effective implementation.

Users. Government staff at central and local level would be the main users of the DST, and especially staff from Ministries involved in the project and members of the National Steering Committees: Ministry of Agriculture, Ministry of Natural Resources, Ministry of Public Health, Ministry of Planning and Ministry of Finance. Pig producers, producers organizations, NGOs and civil society would also benefit from the tool, which will allow them to better voice their concerns and suggestions in the policy making process.

Expected content. The decision support tool will support users in the process of identifying, assessing and negotiating environmental policy measures for intensive animal production. It will also provide methodological support for their implementation and monitoring. Three thematic areas were suggested by the countries. First, the control of environmental issues on new farms: development of compulsory Environmental Impact Assessment (EIA) prior to construction and licensing schemes for new farms. Enforcing environmental policies on new farms was perceived to be a particularly efficient approach to achieving pollution reduction. Given the rapidly growing and changing livestock sector, this approach will also achieve substantial impact. The support will include the setup of the (EIA) and licensing institutional framework, the development of criteria to be included in the EIA / licensing protocol (water pollution, gaseous emissions); and the capacity building among accreditation and control agencies. Second, the economic analysis of waste management, at farm level (cost effectiveness) and sector level (impacts on competitiveness). Third, the collection of environmental data to guide policy making process, e.g. current manure management practices.

Perspectives

The four Decision Support Tools are not at the same stage of preparation and will require different types and intensity of input for their completion. The monitoring guidelines are drafted and the final version should be available within the coming months, in the form of a printed manual. The DST for the selection and evaluation of manure management options requires a substantial development work, both on the conceptualisation, data collection and programming fronts. Its preparation is however well engaged and its delivery is planned for spring 2009. The methodology for developing the spatial planning DST is well developed but the design interface and database management are to be fully developed. Finally, preparation work for the policy support DST was only recently initiated.

The development of these four DST relies on an international network of experts, drawing from academia, civil servants and farmers in Europe and Asia. Providing a comprehensive support to partners in Southeast Asia that aim at improving manure management requires calling on an array of expertise and support. The development of sound DST requires technical expertise but the actual effectiveness of DST in actually supporting decision making depends on the process through which they are developed and on the ownership that is gained among decision makers.

References

- Burton, C.H., Menzi, H., Thorne, P.J., Gerber, P., 2008. *A computer-based Expert system to support the selection and implementation of systems for sustainable livestock waste management in South-East Asia. This volume.*
- Gerber, P., Carsjens, G.J. Pak-uthai, T., Robinson, T.P., 2008. *Decision support for spatially targeted livestock policies: Diverse examples from Uganda and Thailand. Agricultural Systems 96 (2008) 37–51.*
- The World Bank, 2006. *Project appraisal document on a proposed grant from the global environment facility trust fund in the amount of us\$7 million to the kingdom of Thailand, the people's republic of china, the socialist republic of Vietnam, and the food and agriculture organization of the United Nations for a livestock waste management in East Asia project.*