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Vincent PORPHYRE, Nguyen Que Coi

The agricultural province of Thai Binh has based its development strategy principally on agriculture and livestock intensification. Decision makers have promoted large-scale industrialised models, especially in pig production, but may face environmental issues without proper policies to protect water resources and human health in villages.

The Red River Delta (RRD) is the hub of all economic activity in Northern Vietnam, where the majority of the region's population is concentrated. It is under threat due to its strategic position and unchecked population growth that is putting an increasing strain on resources. Population densities exceed 1,200 inhabitants per square kilometre in Northern Vietnam. Water pollution is a grave risk in this delta area. As replenishment is provided mainly by the river system, rainfall and irrigation water, water quality is greatly affected by human economic activities. Pollution due to industrial activity and agriculture – crops and livestock – are consequently a major issue. It is felt all the more keenly since the 1.8 million inhabitants of Thai Binh province depend directly on the water resources of the Delta, as do the 18 million people living in the whole RRD.

Thai Binh province and its ambitious agricultural development plans for 2010

Thai Binh province is located in the RRD, 150 kilometres southeast of Hanoi. Fuelled by an increasing population, rising incomes and urbanization, demand for livestock products in Hanoi is growing at a dramatically high rate. Intensification of livestock production, and particularly pig production, is therefore bringing RRD authorities and producers together to meet the challenges of the coming decades, often defined as the Livestock Revolution (1). This initiative will be better able to respond to the animal protein demands of a wealthier population as well as locating international export markets. Between 1990 and 2001, annual growth in Vietnamese pork meat production was 7%, virtually identical to that of consumption. In 2010, the production of pork carcasses should reach 2 million metric tons, compared with 1.5 million in 2001.

At the provincial level, Thai Binh agricultural services have been named as project managers of the national development plans, and most especially the National Programme for Lean Meat Pig Development, which has clear quantitative goals. In the Red River Delta area, pig production development objectives call for 8,500,000 pigs and 500,000 metric tons of animals to be slaughtered per year. Centralized policy trends favour investment in animal husbandry infrastructure, concentrated feed production commodity chains, slaughtering facilities and in the introduction of breeds with high growth potential.

Private smallholders' initiatives and investments will also add to this development towards intensification. In order to support these objectives, the province is already moving away from its low-income rice production (1,050,000 metric tons/year) to increase maize and soya bean production (20,000 metric tons and 6,500 metric tons/year respectively) for animal feed.

Even if the existing farming systems are based mainly on livestock-crop integration, decision makers are

determined to increase the number of lowland industrial large-scale models. It is to be feared that new intensive breeding methods may damage the soil and the water table. The transfer and well-balanced distribution of pig waste will remain critical for sustaining soil fertility while converting a pollutant into a fertilizing product.

The environmental and economic challenges to be faced

In 2002, Le Coq and Jésus (2) analysed the various development factors in the pork commodity chain in the Red River Delta. They emphasise that stakeholders wish to increase productivity, by boosting the quality and organisation of the commodity chain. Principal developmental perspectives adopted notably include gearing production to respond to market demands, reducing production costs and developing markets. In addition to these aspects, however, observations reveal that the stakeholders involved are themselves worried about damage to the environment.

Causes of pollution linked to intensified pig farming are well known. Pigs excrete 70 to 90% of the nitrogen, minerals (phosphorus, potassium, magnesium, etc.) and heavy metals they ingest while feeding. These substances are concentrated in effluents from livestock farming. Their accumulation in surface water or in the ground can involve risks for the environment. The eutrophication of surface water, i.e. ponds and watercourses, is caused by an excess of organic matter and minerals disposed of when livestock farm effluents are evacuated, escape or overflow into bodies of surface water; the pollution of such waters endangers fish production and its suitability for drinking. Leaching of nitrates has in particular an effect on the quality of drinking water; ground water becomes polluted by seepage from storage facilities or from the fields when doses of organic fertilizers are too high. Accumulation of heavy metals and minerals in the ground has an effect on soil fertility. This organic pollution also promotes the spread of diseases and pathogens poten-

tially dangerous to humans and to farmed animals; it causes ammonia to be released into the air from buildings for livestock and from open-air storage pits or during spreading.

In Vietnam, pig production has long been considered as necessary to maintaining soil fertility for cultivation; it provides the organic fertilizer vital to sustaining high levels of production in a very intensive agricultural system. Farmers have established efficient production methods, suited to the local context, based on fertility transfers between the various kinds of farming practised. The system integrating livestock farming, ponds and vegetable production (the VAC system) is an illustration of this. But while there is movement towards large-scale industrialisation, it may legitimately be wondered what the consequences would be of a significant increase in production capacities of pig farming, which has long been limited to small-scale operations. The European example has shown that an intensive development of livestock farming has dramatic consequences on the environment without appropriate management of animal waste. Thai Binh province's avowed intention of developing the pork commodity chain begs the question of environmental impact as a negative externality to be considered urgently and regulated appropriately.

It may be wondered how these changes affect the traditional "integration" of the various kinds of farming practised. The wishes of politicians will have an undeniable impact on such developments, particularly on the location of large-scale production units through control of real estate, given that land use is strictly regulated. As the pig population rises, the District People's Committees plan to consolidate farms in specific areas

to simplify supply of inputs, disease control and marketing of produce. A specialization plan for communes has been set up, making provision for the development of 5 to 10 hectares set aside for livestock production in each commune by 2006. While the official texts advocate the VAC system and coupling livestock with fish farming, it can nonetheless be wondered what the impact will be of these consolidations on future systems of production and on the management of associated animal waste. Vital information is crucially lacking concerning the limits of modifications.

Many demanding stakeholders and their active involvement in agricultural production

The 1.8 million inhabitants of Thai Binh province are heavily dependent for water supply on natural water resources; this issue is equally of great importance to all 18 million inhabitants of the provinces that make up the Red River Delta.

The pig farmers and farm households are naturally involved in the national development projects. An association of commercial pig farmers has been newly created in Thai Binh and embodies the provincial initiative to bring stakeholders together and organize production. 60% of the existing producers are women (with an average age lower than 45 years). Every farmer involved in the process of intensifying pig, fish or crop production through individual initiatives now expects technical support and advice. They all demand a better dialogue with policy makers and official services, collectively seeking to ease their main constraints (economic, technical, veterinary and environmental).

Policy makers, farmers and producers' organizations have therefore become highly concerned by environmental pollution through their development strategies towards intensification, and similarly with infectious diseases that threaten human life.

The provincial services in Thai Binh are considered as policy makers responsible for the provincial agricultural development plans, investments and regulations. Both the Provincial Department of Agriculture and Rural Development and the Provincial Department of Natural Resources and the Environment are involved. They are responsible for creating wealth, e.g. rural employment and poverty alleviation, and for protecting public assets, including water and the environment in general. The former SOE Provincial Livestock Production Company has played a major role here; this organization has implemented development activities within



MARD's national pig development project, as the provincial executive office, and manages farmers' training and general organization of production with relation to District Agriculture Offices and Extension Centres.

Farmers and decision makers must therefore solve three-part equations comprising quantity, quality and sustainability as variables (3): increased quantity of overall production would allow general development of the commodity chain; increased quality of products would open the door to export and urban markets; sustainability entails environmental protection, social equity and economic profitability. Balancing development and the environment – and most especially water resources – is therefore of prime concern. An adequacy is therefore expected in producers' development strategies by identifying alternative options and investment specifications and thus protects their environment to promote and implement economically-but-environmentally sustainable production systems.

An innovative approach in Northern Vietnam

No existing survey of the province or the Delta makes it possible to give an opinion on the current state of pollution caused by farm waste in Thai Binh. However, these dangers are vital factors to be taken into consideration with a view to sustainable development of animal produce commodity chains.

The CIRAD and six partners in Vietnam (NIAH, VTGEO, NISF, HAU), Thailand (AIT) and Spain (AIDA) decided jointly to initiate a multidisciplinary programme funded by the ASIAPROECO programme of the European Commission. The 12-month E3P Project, acronym for Environmental Protection and Pig Production, aimed to establish baseline work for designing and implementing a geographical information system; as a diagnostic tool, it has been dedicated to pig production development in order to assess the surpluses of animal waste, the nutrient needs of crops and fishponds, and to define the most reliable animal waste management and technological options. This area-wide diagnosis seeks to support agricultural production intensification as an income-generating activity in rural areas and to protect threatened environment and natural water resources in deltaic areas.

A province-wide baseline reference study focused on livestock, agricultural and environmental interactions and outlined the main indicators to be taken into account for a sustainable development of the agricul-

tural sector, through i) a full analysis of the official statistical census; ii) a pro-active analysis of stakeholders' perceptions of the environmental impact of animal production and their possible role in problem solving; iii) an economic analysis of pig manure considered as a commodity; iv) on-farm quantification of waste water flows and manure composition, taking local conditions into account; and v) an update on practices in organic fertilization of crops and fish feeding management.

A geographical and technical appraisal of the supply and demand of crops and fish farming for animal waste nutrients in the province; illustration of the various scenarios according to agricultural development schemes, farming practices, technical options and provincial regulations.

A preliminary geographical information system was designed then as a tool to appraise the pollution sources due to pig production development and needs/lack of nutrients on the part of crop and fish farmers with the help of a geographical interpretation; Satellite images and spatial analysis has highlighted the main changes in the water, urban and vegetation index and identified the main land-use patterns to be considered. Such a geographical approach was supposed to identify existing, expected and possible manure management and technological options at the regional level, and their impact on global economic performances of farmers concerned.

A large proportion of unknown factors

Until now, very little research has been done on this subject (4). The particularity of the region, linked to high population density, small-scale farming and rapidly developing livestock production, makes the situation complex at the communal level. Many unknowns remain concerning the issue of effluents in Thai Binh province, which justifies the regional diagnosis presented by the E3P Project.

At the farm level, little is yet known about effluent management strategies; the following questions may therefore be asked: how diverse is the range of effluent management practices? What are its determining factors? What relationship exists between the users (crops, ponds) and the producers of effluents? Which pig farms are "high-risk"? What is the definition of a "high-risk" farm? How do practices change with intensification, with the specialization of these units towards one kind of livestock production, or even the establishment of specialised areas backed by the district?



This is an especially delicate problem to tackle given the diversity of production units found in Thai Binh province, both in terms of activity and size of production systems.

At communal and district levels, the question arises of the relationship between effluents produced in the districts and the capacity of the land there to absorb these substances without harming the quality of natural resources. It appears necessary to go beyond the intuitive assessment made by the district authorities, which seems to indicate an overall deficit of organic crop fertilizers. Questions also arise concerning the disparity in situations within one and the same district: are the communes in the same situation? What possible solutions exist should some communes prove to have excess quantities?

From an environmental point of view, the local capacity to recycle effluents will enable or prevent the development of livestock commodity chains. The existing dynamic within these commodity chains justifies some reflection on the development of the situation in the years to come. This development will be accompanied by changes in land use (conversion of plots of rice farmland into ponds, concentration of livestock farms into specialized communes, etc.) that must be taken into account.

On a scientific level, very few references to livestock farming effluents appear to be available or to have been validated, concerning the production, storage and use of effluents in Vietnam. The only existing general work is the "Fertilizers Guide" by the agronomist Le Van Can, published in 1975 (5). The facts that the RRD

provinces show a shortfall in farm fertilizer and the subsidized use of chemical fertilizers would explain the dearth of investment in this field. While animal production develops and takes the factory farming road, and the price of nitrogen rises on the world markets, such references seem useful for agronomic management and for suitable economic development of this organic matter of animal origin.

Conclusion

The aim of the work contained in this publication is therefore to provide some elements of an answer at the communal level to the series of questions asked above. The purpose is to enlighten political decision makers as to the current and future situation of their constituencies with regard to production and use of livestock effluents, while attempting to make this approach into a diagnostic tool, usable for other districts in the province.

Considering the lack of available data and previous agronomical studies, our diagnosis is based on numerous strong hypotheses; one thousand interviews, field surveys and specific studies have provided us with the necessary information to create a general conceptual model that shows a simplified representation of reality. Our results have thus to be considered as a framework for decision and not as an exhaustive description of a complex situation.

Readers may find in this present publication the implemented methodologies and our main results after 12 months of multidisciplinary work; to clarify our results, this work has been divided into 10 specific chapters:

1. The general context of a dynamic agricultural sector in the Red River Delta, presenting the main features of the agronomical and social situation;
2. A spatial and temporal analysis of the biogeographical evolution of the province, mainly based on spatial modelling and satellite images, analysing the land-use change pattern;
3. An analysis of the stakeholders' perception of pig manure management highlights the social perception of people, their experiences, constraints to modification of their farming system, their proposals and opinions concerning solutions in terms of organization or technology;
4. A classification of pig farmers regarding environmental risks describes their use of pig manure and their possible evolutions according to the various situations encountered in the province;

5. Fish production and integrated feeding practices are evaluated as a major contributory activity in the consumption of animal waste;
6. Determining the composition of animal manure and by-products provides analytical references within the Vietnamese context;
7. Farmers' practices are defined concerning their use of organic and inorganic fertilizers on crops, trees and vegetables;
8. The agronomical balance in nitrogen and organic matter identifies the current situation at communal and district level; the possible scenarios and perspectives for 2010;
9. An economic appraisal of animal manure considering pig waste as a commodity and giving key references to promote a sustainable commodity chain;
10. The Outlook for an Integrated Sustainable Development of Pig Production in the Red River Delta is finally discussed, considering the changes necessary at local and national levels.

After all this discussion and analysis, we hope that policy makers, researchers and experts in rural development will find useful references and key scenarios

in these pages to inform their own decisions and regulations. The great challenge will then be to continue the work and convince the various actors involved in the agricultural sector to take into account their potential role in favour of a better environment.

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