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LIVESTOCK AND SUSTAINABLE DEVELOPMENT: FROM RESEARCH TO INNOVATION

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INTRODUCTION

A farming system is defined as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate (Dixon et al, 2001). In our studies the analysis of farming systems is based on the problem orientation of the researcher. The research questions can be derived through participatory modes, action research, scientific discourse and literature sources. The definition of the farming system, the boundaries, the components and interactions, the flows within and into and out of the system are determined by the system of study and the research questions. The context of the farming system has become equally important to determine driving forces for development. These may consist of a diversity of external opportunities and constraints ranging from watershed management to markets to credit facilities to human health services and education. The farm system may respond to these driving forces individually, but general patterns of evolution can be found which are useful for creating supportive policies for development.

Agricultural research has over a long period of time produced encouraging results to enhance productivity of livestock. All of us know the experience of dairy cows producing 6000 kg milk on station versus the 3000 kg farmers produce on farm. The key issue was the question how to transfer our station technology to the farmer. We assumed a linear model with researchers handing over results to extension agents to deliver to the often resource-poor farmers. We now realise that this simple model is not fit for the real and complex world of farmers. Farmers are aware of risk, of competing labour needs, of cost of inputs, of policies and of market opportunities or lack of these. Determinants in their context like resources, technology, markets, policies, institutions and public goods, and information interact with the farming system. Farming households develop different management strategies for their farm: intensification, diversification, scaling up, off-farm income and exit from farming. They utilise mixes of these strategies in response to internal and external changes.

The recognition of failure of the linear model has inspired scientists like Barnett (2004) to formulate the innovation systems approach. A successful innovation system taps into the stock of existing knowledge and enables farmers to use it. The innovation systems approach requires a focus on the interplay of actors: researchers, extensionists, farmers, policymakers, traders and processors. Innovation is not so much about new inventions, but about new combinations of production , processing, marketing and services offering new perspectives for farmers.

Results of analysis of two farming systems in Indonesia and Vietnam will be presented. What is the contribution of farming systems analysis for innovation? What is the benefit of assessment of sustainability for innovation?

Dynamics of small ruminant production in Central Java, Indonesia

In this study the behaviour of sheep and goat production systems was analysed to understand the prospects for development. Research sites of three agro-ecological zones were selected: lowlands, middle zone and uplands. Market access and infrastructure were favourable in the lowlands and least developed in the uplands. The dynamics were studied using primary and secondary data and by interviewing farmers and groups, field observations, monitoring feeding practices, air and water quality and animal performance, and observing marketing strategies. In the period 2001-2003 150 small ruminant farmers, 71 neighbouring farmers and 30 key persons contributed to the study. Also quantitative data were collected at 10 markets, 44 mosques and 42 roadside sellers.

The role of small ruminants has stayed the same in the last century, but numbers have increased, the type of animals kept and the farmers' management. At national level population growth, economic and political crises and the policies for intensification of crop production have effected sheep and goat production. At regional level local government promoted group housing and goat milking, which were not adopted. Farmers did adopt slatted floors, shared male goats and joined farmers groups because these programmes took into account the perceptions of farmers and their possibilities and constraints. The local government paid more attention to goats than to sheep. Promotion of Etawah-grade goats resulted in dominance of this crossbred. In the lowlands farmers are crossing again with the Kacang goat resulting in the smaller Bligon goat. Farmers themselves replaced the thin-tailed sheep with fat-tailed sheep preferred by consumers. Farmers responded differently in the research sites, dependent on agro-ecology and on socio-economic situation. Access to credit and labour were important determinants for keeping small ruminants. Small numbers, 4-6, of small ruminants were owned by older farmers. Small ruminants were secondary to crop production. Grazing was no longer an important component of the system contrary to common perception. Field grass is fed in all zones, in confinement too. In the lowlands cassava peels favoured the production of sheep and in the middle zone and uplands leaves favoured goats. Goats here produced more offspring and grew faster. Economic benefits from goats were higher in the uplands.

Farmers did not receive a cash income from small ruminants. The returns per unit of labour were below the regional minimum wage level. Farmers kept small ruminants as a saving for security. A second reason was that the manure has a high quality for fertilization of paddy fields and fruit trees. Farmers did not profit much from rising demand and prices before the feast of sacrifice, Idul Adha. The flock sizes are too small to manage on time the preferred weights of 25 kg or more for rams. The marketing system involved many actors and farmers were not in a position to control prices as they do not sell directly at the markets. In the lowlands prices remained stable during the year. In the middle zone and uplands prices dropped at time of land preparation and school fee payments.

Small ruminants effected their environment by causing high faecal coliform bacteria levels in groundwater. Sheep and goats were housed close to family quarters

and water became contaminated with manure. Air pollution was not a problem except for hydrocarbons in the middle zone. This was probably caused by manure storage in the house.

Small ruminants are not likely to become a major income earner. Where sufficient labour is available, breeding of Etawah-grade goats is becoming attractive. Farmers can also direct their efforts to improve the marketing by direct selling to mosques at Idul Adha festivities and by cooperating in farmers groups. For some sheep farmers fattening directed at the attractive market before Idul Adha could be profitable.

The uplands are the poorest regions of Central Java. They depopulate contrary to government policy to limit urbanisation. The opportunities for cash income and security by Etawah-grade goat breeding and production are supported by ample availability of tree leaves and sales and export. Governmental policy should be directed at infrastructure, and credit facilities if private initiatives or farmers'groups fail. Farmers' organizations should provide better marketing opportunities from small farmers and mobile phone communication more transparency and action in the marketing system. In the lowlands sheep production occurs in a developed environment with good infrastructure and access to credit. Governments' role is limited to maintaining this support and providing farmers with new knowledge through education and participative on farm research. Marketing systems can also be improved by farmers' organizations.

Dynamics of integrated agriculture-aquaculture systems in the Vietnamese Mekong delta

In the Vietnamese Mekong delta integrated aquaculture-agriculture farmers (IAA) are changing in response to national policy like Doi Moi reform (return to market economy and land ownership by households), international markets and access to knowledge and technology. In our study farm household information with 90 structured questionnaires was collected from three districts. Farms varied with regard to the intensity of the fish input of the farming system and marketing opportunities. The districts are not subjected to high levels of flooding. Most farmers belong to the medium size farm group: .3-1 ha. Very poor farmers have no farming land. In all categories off-farm and non-farm activities were common. Data were collected in 2002 and 2004. The farms consisted of five components: rice, orchard, cash crops, livestock (pigs and poultry) and fishpond.

Stable components of the system were rice, orchard and cash crops. Significant increases were found in livestock and even more so in fish production, measured as LUI land use intensity (in %), the ratio between the land use of each component and the total agricultural area.

Rice was produced one to three times every year. Fish ponds were common in two villages, in the third village fish was produced in ditches. Poultry was kept for family consumption and pigs for sale. Intensified orchards were common in one village and mixed orchards were found in the other two. The rice field is the traditional source of food and feed and mulch for vegetables and mushrooms. Pig manure is applied in orchards and fish ponds. Poultry are free ranging. Orchards offer weeds and wastes as feed for pigs, poultry and fish. Fishponds supply water for fruit trees and feed like water spinach, snails and crabs for pigs and poultry.

Farm gross return increased considerably in 2004 and so did off- and non-farm income in two districts. Over the two years gross margins were highest for rice,

followed by orchard, fish, pig, cash crops and was negative for poultry caused by the AI outbreaks in 2003 and 2004. The farm management differences can be explained by three factors: first the distance of farm to the district market, second the land use intensity of products like rice, fruit, cash crops and fish and third the opportunity for off- and non-farm labour income.

The changes in the IAA systems were strongly related to opportunities outside the farming systems in terms of employment and marketing. The farmers responded with intensification of the aquaculture component and pig production. There is also a trend towards fewer components: specialization. Nevertheless farmers continued with rice production and orchards, hard to change activities in the short term. The consequences of these changes are important for natural resource management which is efficient relative to specialized farming systems with large external inputs.

The IAA system shows that it has great flexibility in adaptation to national and international market development. In the long term this may lead to further specialization in fish, pigs, poultry production or cash crops and to greater risks for income security. Land use is very much determined by its agro-ecological status and by food security concerns. Rice production will therefore continue and changes in orchard land use will depend on competition with other components, especially fish production. Fish production integrates with pig and poultry production in the medium intensity fish production ponds.

Important policy issues for farm management are technology development in pig, poultry and fish production and cash crops, efficient management of natural resources and provision of knowledge and transparency in the national and international marketing chains. The regional government has to consider infrastructural works for better access to markets. As off-farm and non- farm employment increases education becomes more important and educational opportunities for children in the poorer segment of society have to be created.

Assessment of sustainable development

As changes occur over time from a variety of sources affecting farming systems, it is not easy to assess sustainability. Assessment is linked to a fixed point in time in a particular setting. When a study is finished the results may have to be interpreted in the light of even more recent changes. It is important to be aware of the major and critical issues that affect systems and cause changes. See Bell and Morse(2003).

In order to select issues of concern it is important to establish a basic and well defined concept of the system and the context of the society being studied. The boundaries of the farming system being studied have to be established and understood for later interpretation of the results. Some issues will be internal to and important to the farming system itself, other issues are external with large influence on the viability of the system. Before any research can start, or participatory workshops organised for issue identification and selection, the farming system and its boundaries have to be defined and understood and agreed by the participants.

The next step in the process will be the identification of sustainability issues. For participatory approaches a stakeholder analysis is required and representatives of the stakeholder groups have to be invited. There is always a risk that not all stakeholders are represented, let alone that they can equitably express their views well. The process and outcomes of a participatory workshop will vary. This is the reason why a study of

secondary data and literature can substantiate the results of the participatory workshop. If needed primary data can also be collected and analysed, this will markedly slow down the process and may cause loss of dynamics in the participatory traject. Issues that can be expected are related to income, costs of inputs and prices of products, labour productivity and labour income, land prices, environmental impacts, labour availability and health as the farmers are aging, animal health control and productivity, governmental policies and regulations, subsidies and export opportunities.

When the identification and definition of relevant economic, ecological and societal issues has been completed selection and quantification of suitable sustainability indicators (SI) follows. These indicators have to be a) relevant, i.e. they have to express something about the issue, b) simple, i.e. they have to be understandable for users, c) sensitive and reliable, i.e. they have to react to changes in the system, and different measurements must lead to the same outcome, d) it must be possible to determine a target value or trend and e) data have to be accessible. The search for indicators is sometimes difficult, but for many issues creative and satisfactory solutions can be found. Economic issues are often expressed as labour income, for environmental impact nutrient balances or Life Cycle Assessment methods are used for eutrophication and acidification and global warming. Animal welfare is usually a conglomerate of parameters including health.

When data have been collected on farms, showing also the variation between SI's, the scores for the indicators have to be utilised separately or jointly. From single indicator scores and their variability already the key problems and potential pathways to improvement become visible. This result can be linked to the original result on the issues important for the farming system.

Once SI's have been collected the next step becomes the judgment of the level of the indicators. Which reference values are acceptable? Reference values may come from different sources. For some reference values legal or regulation minimum/maximum are available. Others have to be found in scientific literature, for example for the Animal Needs Index presenting the issue animal welfare. For labour income minimum wages can be used. But for some indicators, an average value or a value linked to a reference year, may be the only solution. It should be understood, that the choice of reference value can have distinct effects on the final outcome of the indicator.

Overall assessment requires aggregation of the value of single SI's, weighting of these indicators and considering practical usefulness of an overall judgment. There are neither uniform approaches to aggregation nor to compensation. Threshold values can also be applied resulting in systems becoming unacceptable. This will may meet the agreed standard reference level.depend on the user of the information and for what purpose. In our studies of farming systems we usually work with single indicators or groupings of indicators to better understand the trade offs and the potential for improvement of the farming system. The acceptation of compensation or threshold values will change the relationship between the SI's. In this evaluation the dynamics are important as the context is changing over time. Mollenhorst (2005) presented the consequences of decisions regarding SI's for welfare and labour income for different egg layer housing systems. The battery cage becomes easily the worst performing system in a situation where welfare has to meet a minimum level, while all other indicators may meet the agreed standard reference level.

CONCLUSIONS

Systems analysis can provide scenario's for of future development of farming systems when the analysis concerns the system and the context. The goat and sheep production systems in Central Java are, except for imports of breeds for crossbreds, hardly affected by international markets. But the education of the children is quite dependent on ownership of goats and sheep. The security and savings function of small ruminants therefore determines the future opportunities of children in areas like the uplands, where poverty is a large problem. The analysis also showed that with focused policies like infrastructural improvement, marketing transparency and organization, credit facilities and economic extension, farmers can earn a reasonable income from goats and do not need to relocate to urban centres.

The IAA farms in the Vietnamese Mekong delta are participating in the national and international markets for rice, fruit and fish. The farmers are responding with specialization and employment off-farm. The IAA farmers require extension support for understanding the marketing opportunities, for technical expertise for the components of intensification, for risk management and maintaining efficiency of resource management. Infrastructural improvements will remove constraints for farmers to sell for cash income.

Farmers' organizations can play an important role in development. This aspect has not been highlighted in these studies.

The study of small ruminant production systems was not designed to evaluate sustainability following a formal assessment process. The study of sustainability of mixed systems in the Mekong delta is about halfway. The process for assessment of sustainability depends very much on inputs from the end users of the results: farmers. Researchers provide scientifically based information of their mixed farming systems. Feedback, comparison of results and exchange between farmers can all assist in identification of production techniques, services like credit provision, infrastructure, market information that can yield higher prices, less cost, less risk or better resource use. Researchers can offer other knowledge within this context, that can be utilised in this interactive process.

System analysis of the mixed crop-livestock system and its context provides important insights for potential development by identification of opportunities and constraints. Although rice production has maintained first priority for food security in Indonesia and in Vietnam the extra opportunities for cash income and security originate in livestock, fish and cash crops. Households profit with more cash income and livestock sales for education of their children. Government staff should take regional, national and international information and farmers'perceptions as the basis for their development policies. Market integration, risk assesment and environmental management have to be included in both the farm management and in the government policies. Interactive processes involving farmers, policy makers and systems researchers can result in innovative development.

Animal scientists are generally trained in disciplinary areas like nutrition, breeding and genetics, reproduction, animal welfare. Animal production systems specialists have the advantage of understanding the different disciplines, the farming system with its economic, ecological and social perspective, the food production chain

and the context. They have knowledge of hard and soft systems approaches for field work. This unique combination of expertises makes system researchers potential contributors, as partners and as scientists, to innovation systems.

REFERENCES

Barnett,A. (2004). From 'research' to poverty reducing 'innovation'. A policy brief from SRA Ltd. http://www.cphp.uk.com/

Bell,S. and S.Morse (2003). Measuring sustainability. Earthscan Publications Ltd. London. 189 pp.

Dixon, J., A.Gulliver and D.Gibbon (2001). Farming systems and poverty: Improving farmers' livelihoods in a changing world. Editor M. Hall. FAO and World Bank, Rome and Washington D.C.. 412 pp.

Budisatria, I.G.S. (20060. Dynamics of small ruminant development in Central Java, Indonesia. PhD Thesis, Animal Production Systems Group, Wageningen University. Ponsen and Looijen BV, Wageningen. 144 pp.

Le Thanh Phong, H.M.J.Udo, M.E.F. van Mensfoort, R.H. Bosma, Le Quang Tri, Dang Kieu Nanh and A.J. van der Zijpp (2006). Oral communication INREF POND project: Changes in integrated agriculture-aquaculture systems. What is the balance in sustainability? Wageningen University.

Mollenhorst, H. (2005). How to house a hen: assessing sustainable devslopment of egg production sytems. Thesis Wageningen University. 135 pp.

Zijpp, A.J. van der (2001).Animal Production Systems: on integration and diversity. Inaugural address, October 18,2001 Wageningen University. 66 pp.