

Nagaland's pig subsector

Current status, constraints and opportunities



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Project Report

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Foreword

This report presents the results of a study which appraised the pig sub-sectors of three selected districts in Nagaland state, Northeast India. It synthesizes the results from the three districts – Dimapur, Mon and Phek – and a market study in Kohima, draws conclusions and makes recommendations for research and development (R&D) interventions. To ensure consistency and comparable results, the same methodology was used in each of the district appraisals in Nagaland and in a similar study carried out in five districts of Assam and in Guwahati, Assam’s capital.

Acknowledgements

The series of appraisal studies was jointly conducted by the Nagaland Empowerment of People through Economic Development (NEPED), State Veterinary and Animal Husbandry Department (VAHD), School of Agricultural Science and Rural Development (SASARD)-Nagaland University (NU) and the International Livestock Research Institute (ILRI).

However, the views expressed in this report are those of the individual scientists and do not necessarily reflect the views of NEPED, VAHD, SASARD or ILRI.

The study would not have been possible without the participation of many individuals and organizations. The oversight and review provided by Dr Y.Y. Lotha (Director, VAHD), Dr I.P. Khala (Assistant Director, VAHD), Dr V. Rutsa of NEPED and Dr C. Rutsa of SASARD were indispensable to the design of the study and interpretation of the results. We are also indebted to the executives of village councils, pig producers and their families, pig traders and pork retailers who shared their knowledge, experiences and insights with us. We are also grateful to the field officials of VAHD, Rural Development Department, Agriculture Department and municipal councils in the three districts and Kohima town for their guidance and for the benefit of their expertise and experiences. We also thank Dr Savio and Dr Bocto for research assistance and Dr Monjul Islam for preparing the map. Finally, the series of studies would not have been possible without the support of Mr Temjen Toy, Team Leader, Commissioner and Secretary to the Government of Nagaland, to whom we express our gratitude.

Executive summary

The Northeastern region (NER) of India is characterized by a high proportion of tribal people for whom pig keeping is integral to their way of life. Over a quarter of India's pigs are in the NER. Nagaland state in the NER has the highest density of pigs per 1000 people; its pig population is about 700,000 and its human population was 2 million in 2001. Increasing demand for animal-source foods in the NER, and in India generally, matched with the current low productivity of the regional pig population, suggests that well-targeted interventions to improve pig production could deliver significant livelihood benefits for tribal and other marginalized groups in the region. This context led to the present study which appraised the pig sub-sector of Nagaland to build a comprehensive understanding of the pig systems in the state and to identify entry points for effective public- and private-sector interventions to improve livelihoods and generate employment in the pig sub-sector.

By its very nature, an appraisal does not set out to provide definitive answers but rather to identify key issues that are likely to respond to development interventions or that require research to fill the gaps in knowledge. Therefore, the appraisal applied two complementary methods: a review of secondary information from or relevant to Nagaland and the collection of primary data through semi-structured interviews. The interviews were carried out in May and June 2007 at district, village and household levels with consumers, market agents, producer households and district- and village-level key informants in Dimapur, Mon and Phek districts. Dimapur district includes Dimapur town, the largest urban and commercial centre in Nagaland. A quick market survey was also carried out in Kohima, the state capital. The three districts (out of the state's eleven) and Kohima captured the variation observed in Nagaland for pig production and marketing. Three clusters per district were selected for the village and household interviews, and included the main areas of pig production and their expected variation for ethnic group, production and cropping systems and market opportunities. Stakeholder meetings held before and after collecting the primary data helped guide the appraisal to identify issues and interpret the results. This report synthesizes and draws conclusions from the results and presents recommendations at the state level and, where appropriate, for a specific district.

The consultations with pig producers, pork consumers, pig traders, input suppliers and the organizations mandated to serve them gave an overview of Nagaland's pig sub-sector. Consistent with expectations, pig production is invariably a small-scale, backyard activity that serves to fulfil socio-cultural obligations, generate income and accumulate capital. It is an integral part of the livelihoods of the various ethnic groups. Between 80% and 90% of households in the three clusters of Dimapur and Phek district and 60% in Mon kept pigs. Households generally kept 1–3 indigenous or crossbred pigs in low external input systems and depend upon family labour and other local inputs, particularly feed, that are of no or low opportunity cost. As a result, levels of production are low with slow growth rates and poor reproductive performance. Well-targeted technical interventions in these production systems and the associated cropping systems can significantly improve the productivity and profitability of pig keeping.

Traditional management practices continue to dominate production with two exceptions; in most areas, scavenging systems have given way to penning and many indigenous pigs have been replaced by crossbreeds. It is only in remote areas where scavenging indigenous pigs are the majority. Only 2% of pig-keeping households in Dimapur and Mon and 20% in Phek allow their animals to scavenge. There are very few indigenous pigs in Dimapur district. In Phek district, 30–40% of households still keep indigenous pigs while in Mon district, 20% of households in Tizit cluster and 80% in Mon and Wakching clusters keep indigenous pigs. Production systems (housing and feeding practices) and their objectives (breeding, fattening or both) vary amongst ethnic groups, locations and cropping systems, the latter because of the dependence on local feed resources. The most common production objective was fattening to slaughter of purchased pigs; 60% or more of pig-keeping households in each cluster kept fattening pigs only. Therefore, to be successful, efforts towards improving pig production should be specific to a household's production objective, location and ethnic or social group.

The dependence on locally available feed resources and traditional feeding practices limited pig performance. Low-grade crossbred pigs being fed for slaughter reached 30–40 kg live weight at 10 months of age and high-grade crosses 80–90 kg, with the lower weights more prevalent. A major factor that contributed to the low growth rate of crossbred pigs was the low nutrient density and low protein content of the pig feeds, which were

mainly the by-products of the household's rice and maize crops, starchy roots, vegetables and collected forages. Nevertheless, because these and other local feed resources were of low or no opportunity cost and family labour was used to care for the pigs, backyard pig production was an attractive, profitable way of earning income and fulfilling socio-cultural obligations. In contrast, few small-scale producers in or near Dimapur and Kohima towns have adopted intensive systems of pig production (stall-feeding using purchased concentrate feed) being promoted by central government agencies. However, some producers regularly bought milling by-products and planted crops specifically for use as pig feed.

The current lack of scaling up and intensification of pig production may be a contributory factor to the observed large deficit of slaughter pigs, particularly in Dimapur and Kohima towns. For many years, this deficit has been filled through the procurement of large numbers of pigs from outside the NER and particularly from UP. However, rising demand for pigs outside the NER is reducing the profit margins on these imported pigs. Along with concerns about disease control and attempts to stimulate local production, this is likely to further reduce the numbers that are imported in future.

There are too few weaned piglets and young growing pigs produced in the three surveyed districts to satisfy demand from local households that want to fatten pigs. These deficits are filled through young pigs traded from Assam, Manipur and Myanmar. Of the young pigs purchased for fattening, 10% in Mon, 20% in Dimapur and 30% in Phek were imported. Between 1000 and 1500 young pigs were imported each month from Manipur to Phek and neighbouring districts and another 300 to 500 were procured from Myanmar.

Despite these imports, the market for young and slaughter pigs of local producers was good; over the last ten years the real price of pork (adjusted for inflation) had increased by an estimated 8% in Mon, 17% in Dimapur and 46% in Phek. Further price rises were predicted with pig traders and pork retailers pressurizing the authorities to increase the price of pork. These market pressures suggest that demand is outstripping supply and that there is considerable potential to increase the productivity and profitability of local pig production.

Given the prevailing market conditions, it was not surprising that in all three surveyed districts pig producers were happy with the income they generated. However, they also said that they were unable to increase the number of pigs they kept because of the labour-demanding nature of feed collection and preparation. Aversion to risk is an important factor that inhibits change in these low-external-input, low-output activities of resource-poor households. Hence the conundrum: the market continues to demand more pigs but the input constraints faced by most resource-poor producers limit their capacity to respond.

Given this structure of pig production and the demand and supply scenario, what **specific recommendations** can be given to overcome the constraints faced by the pig sub-sector in Nagaland and thereby to exploit the potential to increase the scale of pig production and improve its productivity and profitability for these resource-poor households?

Some guiding principles will be critical for the success of interventions in the pig sub-sector:

- Improved efficiency and profitability of production should be achieved by incremental changes to better utilize existing resources through innovative community-based programs implemented by client-oriented staff.
- Participatory methods to identify and target priority problems and to develop and test interventions for specific locations will be essential to ensuring ownership and acceptability among the communities.
- A key element will be to identify and promote current best practices of the most successful community members.

Allied to these principles, mechanisms for institutional sustainability should be established by

- having a strong component of capacity building in participatory methods for local institutions and the target producer groups through hands-on training and exposure visits;
- ensuring that services are on a paid-for basis;
- avoiding program components that are free or highly subsidized and ensuring that any subsidy is reduced in a phased manner over a short period; and

- ensuring that public interventions have built-in staff incentives and effective monitoring and evaluation processes.

A participatory, action research approach will ensure that the interactive, iterative process of identifying constraints, evaluating options to resolve the constraints and assessing the benefits meets the needs of the pig-producing households and groups to improve their husbandry while increasing their capacity for innovation. Through continuous information sharing within their communities and groups and with their R&D partners, the base of locally relevant knowledge is increased. The process also facilitates the strengthening of institutional linkages and effectiveness amongst the R&D organizations including the agencies giving credit, the provision of which may play a key role in supporting the adoption of technical innovations.

Within that developmental context, what are the specific technical, institutional and policy constraints amenable to interventions?

Production constraints and opportunities

Producers lacked knowledge about feeding, health care and breeding practices that could improve their pig production. Required are needs-based, client-oriented programs using participatory methods and action research to improve the capacity of pig producers to make more effective use of available feed resources, to maintain their pigs in good health and to breed productive crosses. The programs should be designed with the aim of improving production through incremental steps achievable within the limits of current household resources, especially feed and labour. Particular attention should be given to learning from the current best practices of successful low-external input producers and overcoming feed constraints.

Recommendation 1

Through location-specific programs for ethnic and social groups, apply participatory methods and action research to improve the feeding management of pigs.

For the programs aiming to identify feeding practices that give faster growth rates and better reproduction, a key opportunity results from the most commonly used feed sources

being rich in energy but deficient in protein. This constraint that can be offset by three complementary interventions: (i) participatory testing of non-conventional protein-rich feed resources like rice bean, legume forages and soybean; (ii) participatory testing of improved varieties of crops such as tapioca/cassava, *Colocasia/taro*, quality protein maize (QPM) and sweet potato and (iii) testing the profitability for pig producers and feed suppliers of a protein-rich feed supplement. The third intervention is likely to be relevant only where producers have good access to cash markets for the sale of their pigs, whereas the first two can be developed even with communities in remote areas.

Each of these feed interventions conforms to the principle of providing pig producers (whether individual households or church groups) with information and technological options that allow them to combine feeds optimally in relation to their local conditions, the cost of production (including family labour) and the contribution of each feed to meeting the nutrient requirements of their pigs for profitable performance. These feed interventions should be complemented by technical support, drawing on the lessons from local best-practices to improve the housing conditions of pigs.

The same participatory process should also be applied to evaluate the impacts of pig diseases and their threats to the viability of small-scale herds, particularly in relation to designing effective prevention and control systems for swine fever and foot and mouth disease (FMD). Current systems for vaccine delivery do not work. Thus, alternatives are required through community-based training in the early clinical diagnosis of these viral diseases and the collective actions required to prevent the spread of infection. These community-based schemes would include veterinary assistants paid by the community or a group of communities to supply a variety of services including castration, vaccination and first aid.

Recommendation 2

- 2.1 *Through participatory methods, develop innovative community-based systems for the early clinical diagnosis and control of swine fever and FMD.*
- 2.2 *Support the training of fee-earning technicians for the provision of veterinary services in the community-based schemes.*

Another technical constraint to increased production was the lack of quality breeding stock and weaners and the absence of systematic breeding programs. Current government breeding programs need to be re-assessed and innovative community-based systems developed and supported by a needs-based training program on the care and management of breeding stock. If a business plan using realistic production coefficients and market prices for a local breeding scheme looks promising, investments by private-sector individuals could be encouraged. Key elements will be expanding the stock of the preferred type (Large Black/Burma cross²) and making available quality crossbred boars for sale to breeders for use in fee-paying mating systems. To sustain crossbreeding, which is integral to increased productivity, breeding stock of the indigenous pigs of Nagaland needs to be made available. *In situ* conservation programs developed through community-based breeding schemes with appropriate incentives are the probable solution.

Recommendation 3

- 3.1 *Government breeding programs should include the Large Black/Burma cross 'breed' preferred by most producers and produce quality crossbred boars for sale to villagers for use in fee-paying mating systems.*
- 3.2 *Through participatory methods, develop innovative community-based systems for sustaining crossbred pig populations and in situ conservation of indigenous pig breeds.*

Marketing and consumption constraints and opportunities

The food safety of pork needed improvement. With rising pork consumption and an increasing number of market participants between producer and consumer, the public health risks from unhygienic practices are growing. Currently there is little or no routine ante and post mortem inspection of slaughter pigs in urban areas where significant numbers of pigs are slaughtered and their pork sold. These deficiencies in public health measures should be addressed through a risk assessment along the production-to-consumption value chain to systematically analyze the practices of pig producers, pig traders and pork retailers and identify intervention points for improving hygiene and food

² The most popular and prevalent cross-bred pig available in Nagaland is known as Large Black/Burma cross/Bilati as it is understood to have originated from Myanmar (formerly Burma).

safety. The evaluation should assess the requirements for improved infrastructure and inspection (manpower and physical resources) and for training in meat hygiene and food safety based upon consumers' needs, perceptions and willingness to pay. Given that producers in Nagaland sell a high proportion of pork directly to consumers, an assessment of local slaughter practices will be central to the risk analysis. In addition, the risk assessment will include the market chains from Assam and Manipur, the states outside the NER (especially UP) and Myanmar. The result would be a quality assurance program that incorporates training and certification.

Recommendation 4

- 4.1 *Carry out a risk assessment along the pork production-to-consumption value chain to identify critical intervention points for improving meat hygiene and food safety.*
- 4.2 *Support training for a quality assurance program to address the deficiencies in the management of pigs, their slaughter and the handling of pork in order to improve meat hygiene and food safety.*
- 4.3 *For training of trainers, the courses given by the Animal Products Development Centre in the Philippines are an option that should be considered (http://www.aphca.org/reference/apdc_ph/apdc_index.html).*

A study of consumer preferences showed that there was no price differential between lean and fat pork and that pork from indigenous pigs was more expensive than that from crossbreeds, reflecting consumer preferences based on taste. There is need to better define and quantify consumer perceptions of pork quality – including aspects of taste, appearance and composition – to inform government planning and possible private-sector investment. This will indicate how the market is developing, the type of pigs that should be kept, how they should be managed and how their meat should be presented to consumers. Integral to the study will be the documentation of the traits preferred by households and ethnic groups for the many pigs slaughtered at social and religious functions.

Recommendation 5

Carry out a study of consumer preferences and perceptions of pork quality – including aspects of taste, appearance and composition – to inform private investment and public planning.

Policy and institutional constraints and opportunities

Principal amongst the constraints faced by current and potential pig producers was their lack of access to technical information, reflecting the absence of effective production and veterinary extension services. Public funding is required for innovative, community-based programs using participatory methods implemented by staff oriented towards the needs of their clients. This approach will require a mindset change by government officials, an increased role by non-governmental organizations (NGOs) and building upon local social infrastructure, e.g. church groups. Two complementary institutional mechanisms are recommended to achieve this.

Recommendation 6

- 6.1 *Support a program of capacity building in participatory and action research methods.*
- 6.2 *Establish a planning and coordination group as a platform to catalyze the process of mindset change and prepare a policy on pig sub-sector development.*

To be effective the planning and coordination group will have to overcome the current inadequate coordination among the varied R&D stakeholders like the Indian Council of Agricultural Research-North Eastern Hill (ICAR-NEH), the National Research Centre on Pig (NRCP), NU, VAHD, NEPED, NGOs, commercial banks and insurance companies. This can be addressed within the overall policy on pig sub-sector development and the pro-poor strategy for its implementation. For capacity building in participatory approaches, the principles, methods and manuals of Jain and Polman (2003) apply (http://www.fao.org/world/regional/rap/susdev_rural_devt_regional.asp). For capacity building in action research methods, options include the courses on 'Participatory action research for rural development' and 'Participatory innovation development: a training of facilitators' by the Regional Centre for Asia of the International Institute of Rural Reconstruction (IIRR) in the Philippines (<http://www.iirr.org>).

Given the widespread poverty in Nagaland, it was expected that lack of operating capital and limited credit facilities would constrain the development of pig production. Few households currently borrow money and even then, the loans are used for consumption

not production. The loans are generally from friends and family rather than bank sources or local money-lenders (credit agents); most of these money-lenders are poor and supply only a very small proportion of all credit. Micro-credit schemes managed by NGOs may be a viable way forward so that credit could be made available for individual households to achieve incremental improvements in their production systems. Capacity building of existing NGOs on project appraisal and financial management would be a first step towards their playing an intermediate role in money-lending. Technical extension should be integrated with provision of credit to achieve increased scale and productivity of backyard pig production.

Recommendation 7

Support the training of local NGOs in credit lending and financial management to facilitate provision of micro-credit to small-scale pig producers and traders.

Through the appraisal of Nagaland's pig sub-sector it has been possible to arrive at a good understanding of who consumes pork, how pigs and pork are marketed and how pigs are produced. As a result, specific actions have been identified through which it will be possible to improve the pig sub-sector's contribution to livelihoods in Nagaland and to accrue significant benefits for resource-poor households. As has been emphasized, for these proposed interventions to be successful, substantial capacity building will be required to achieve the shift in the R&D paradigm to client-oriented, needs-based programs. The recommendation for capacity building in participatory and action-research methods is therefore central to the proposed plan of action.

Another part of that paradigm shift will be to ensure that policies and publicly funded programs are even-handed in support of small-scale production with its important social equity contribution and its counterpart, the possible emergence of more intensive peri-urban production units using purchased feeds, such as those developing in Dimapur. Monitoring and evaluating these changes in the structure of the pig sub-sector in Nagaland and in the nature of public support will be an important responsibility for the proposed planning and coordination group.

1. Introduction

1.1. *Background to the study*

Identifying development opportunities for India's NER, and particularly for its tribal and other marginalized communities, is a priority for India's central and NER state governments (Government of India 2003). The NER is characterized by a high proportion of tribal people for whom pig keeping is integral to their way of life; over a quarter of all India's pigs are in the NER. The increasing demand for animal-source foods in the NER and in India generally, matched with the current low level of production of the NER pig population, suggests that well-targeted interventions to improve the efficiency of pig production and increase its scale could deliver significant livelihood benefits for tribal and other marginalized groups in the region.

ILRI carries out pig systems R&D to alleviate poverty and improve rural livelihoods in Southeast Asia and sub-Saharan Africa. After various meetings and field visits in the NER beginning in 2004 and culminating in consultations with and at the request of its partners in 2006, ILRI committed to work with them to appraise the pig sub-sector (pig production and marketing) in Assam and Nagaland. Logistical and budgetary factors resulted in the Assam appraisal being carried out during September and December 2006 (Deka et al. 2007) and the Nagaland appraisal in May and June 2007.

As in Assam, the discussions about the appraisal design in Nagaland focused on how to support the state government in its efforts to develop an effective program for the pro-poor development of pig production and marketing. The aim was to identify ways to improve the livelihoods of the rural Naga population by generating income and employment through development of pig production and marketing. Central to the process was the need to build a shared understanding amongst key public- and private-sector stakeholders about current pig production and marketing systems, their constraints and the opportunities for improvement. NEPED agreed to co-sponsor the implementation of the appraisal. It was also expected that useful mutual lessons would be learnt from the Nagaland and Assam appraisal studies.

1.2. Objectives

From the discussions during the planning of the appraisal, it was agreed that the objectives were twofold:

1. Build a comprehensive understanding of the pig systems in Nagaland through a participatory process involving key stakeholders and, from that information,
2. Identify entry points for effective public- and private-sector interventions for developing the pig sub-sector within a pro-poor market-oriented strategy to improve livelihoods and generate employment.

1.3. Approach and methods

The approach taken during the development of the appraisal work program was to consult with key stakeholders drawn primarily from the public sector but also involving the private sector. The consultations included a stakeholder meeting hosted by NEPED, VAHD and ILRI in Kohima on 4 May 2007. The consultations were followed by detailed discussions with the key partners working in Nagaland on pig systems R&D and rapid appraisal methodologies. It was agreed that two complementary methods would be applied to implement the appraisal: a review of secondary information and the collection of primary data through semi-structured interviews at district, village and household levels.

Through discussions with key informants and, where necessary, by visits to the relevant institutions – ICAR-NEH, NU, SASARD, VAHD, the Indian Institute of Bank Management and the National Institute of Rural Development-North Eastern Regional Centre – it was confirmed that there was a lack of reliable secondary information related to pig production and marketing in Nagaland. Consequently, most references (especially technical) cited in this report are drawn from Assam and other NER states; these are complemented by international reports relevant to pig production R&D in Nagaland and the NER generally.

Given the lack of secondary information, it was particularly important that the collection of primary data covered the whole market value chain, that a broad range of informants were interviewed and that the field surveys covered areas of pig production, marketing and

consumption that would give a representative picture of the variation within the pig sub-sector in the state and the factors explaining the variation.

Therefore, knowledge of the key local partners about the major supply-side and demand-side factors influencing the variability of pig systems in the state was the guiding force in selecting the districts to be surveyed. From the state's eleven districts, three contrasting yet complementary ones were selected – Dimapur, Mon and Phek – based on variation for ethnic groups, geographical location, pig populations, production systems and market opportunities. Dimapur district includes Dimapur town, the largest urban and commercial centre in Nagaland and, therefore, the major consumption centre. In addition, the pork market in Kohima town, the state capital and second-largest urban centre, was studied in order to assess its demand for slaughter pigs and pork and their marketing. Table 1 summarizes the distinctive features of the three surveyed districts.

Table 1: Distinctive features of Dimapur, Mon and Phek districts

Feature	Dimapur District	Mon District	Phek District
Geographic location	Foothills and plain valleys bordering Assam	Low hills and mountains in far NE Nagaland bordering Arunachal Pradesh and Myanmar	High hills and mountains in South Nagaland bordering Manipur and Myanmar
Ethnic groups	Rural: mostly the Sumi and Angami communities Urban: most ethnic groups	Mostly the Konkyak community	Mostly the Kezha, Pochuries and Chokri communities
Key economic feature	Dimapur town is the major urban and business centre of the state	Extensive poverty	Relatively less poverty than in Mon
Accessibility	Good accessibility by road, rail and air	Very poor accessibility and only by road	Poor accessibility and only by road
Main system of cultivation	Plain valleys with irrigation	<i>Jhum</i> (shifting) cultivation	Terraces
Major crops	Rice	Maize, millet rice and taro	Rice and maize
Pig production system	Major pork-consuming district; relatively better pig production and marketing systems	Poor pork-consuming district; low-input-output production system	Trying to be self-sufficient; ban on import of slaughter pigs

Source: key informants

Three cluster areas were identified within each of the sample districts and in consultation with the district veterinary officials. Figure 1 shows the three selected areas in each district where the semi-structured interviews were carried out at village and household levels.

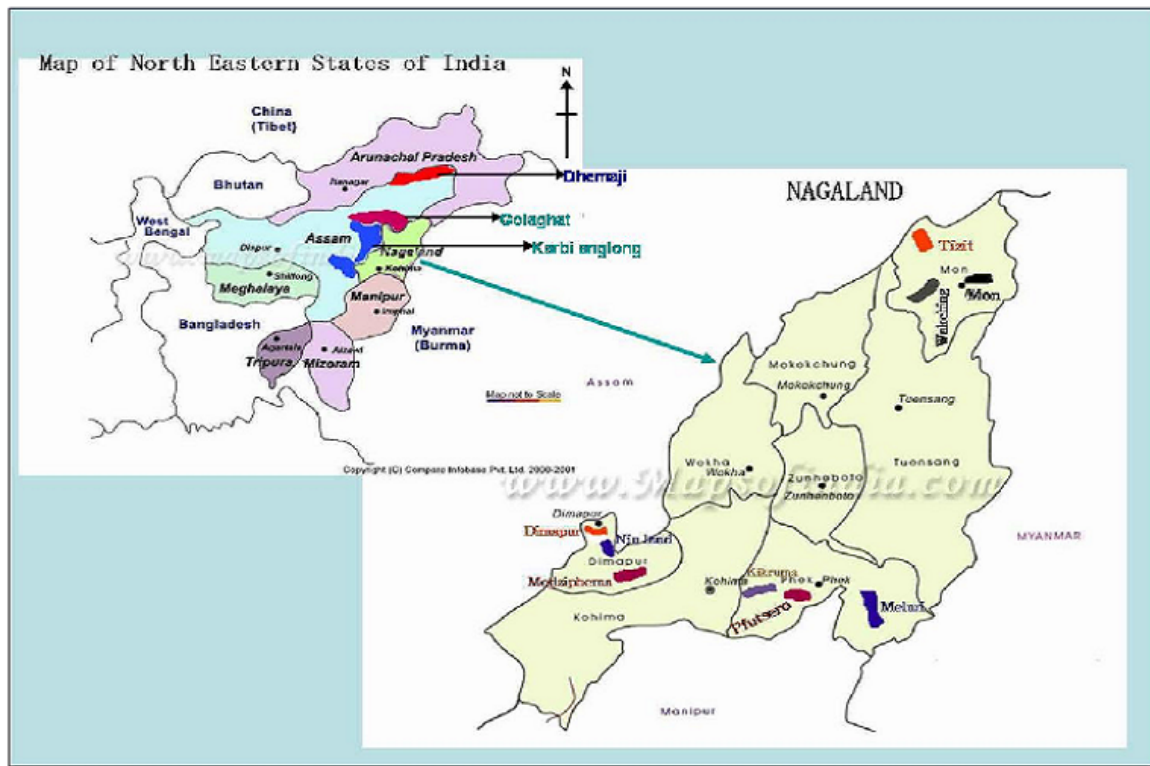


Figure 1: Map of Nagaland showing Dimapur, Mon and Phek districts and the cluster areas where the field surveys were carried out in May and June 2007.

In each cluster, interviews were carried out in two villages and three households in each village. One cluster was chosen 5–10 km from the district headquarters or major town and the other two clusters chosen from 30–70 km away. Efforts were also made to include the areas thought to have the most potential for increasing pig production and that showed variation for ethnic groups, production systems and market opportunities. The villages in each cluster were identified after detailed discussion with the district veterinary officials about the demographic and livelihood patterns, the roles of agriculture and livestock in farming systems, concentration of pig population, variation in ethnic groups and marketing systems and how these factors were thought to influence the variability of pig systems in the state. Households were visited during May and June 2007 to collect primary information from producers, consumers, market agents, input suppliers, district officials

working on pig systems, and other key stakeholders in pig production and marketing. Table 2 lists the surveyed districts, clusters, villages and local daily or weekly markets.

Table 2: Surveyed districts, clusters, villages and markets

District	Cluster	Village	Market
Dimapur	Dimapur	Burma camp	Burma camp, Dimapur town
		Chaberang colony	Chumukedima town
	Niuland	New Layir Shuba	
		Nikhekhu	
	Medizephema	Piphema	Medizephema
Mon	Tizit	Siethekie	
		Phuktong	
	Mon	Numsa	Tizit weekly market
		Mon	Mon town
		Totok	
Phek	Wakching	Wakching	
		Shiyong	
	Kikruma	Kikruma	
		Kezo Basa	
	Pfutsero	Jhavame	Pfutsero town
		Losami	
	Meluri	Kutsapo	Phek town
		Khumiaslu	

The interviews drew on check-lists prepared for consumers, market agents and producer households and for district- and village-level key informants. In summary, the field-based interviews gathered information on the populations and income groups practising pig production and marketing, the relative importance of pig production and marketing in livelihood strategies, production practices (feeds, breeds, disease control and reproduction), pig production and profitability, marketing chains and the actors involved, consumer demand and preferences, support services (e.g. veterinary clinics), an approximate timeline for the dynamics of the systems and the interviewees' perspectives on constraints and opportunities, i.e. the scope for improving the scale, productivity and profitability of pig systems.

By its very nature an appraisal does not set out to provide definitive answers but rather, to identify key issues that are likely to be responsive to development interventions or that require research to fill the gaps in knowledge. To achieve these objectives, this report draws together the field data collected in the three districts and the secondary information available from R&D organizations and literature review. It describes the pig systems in Nagaland state and analyzes the constraints to, and opportunities for, increasing their contribution towards improving livelihoods and generating employment opportunities.

1.4. Expected outputs

Based on the plans for the appraisal drawn up prior to its implementation, the expected outputs were:

- A better understanding of current pig production and marketing systems in Nagaland and the constraints to, and the opportunities for, improving systems productivity and profitability.
- Specific recommendations to overcome technical, institutional and policy constraints and exploit the opportunities for improving productivity and profitability.
- A sound basis for the development of a new program or project by the relevant government departments, other public bodies and NGOs for interventions in support of improved livelihoods through pig production and marketing.
- A basis for others to develop needs-based projects and/or commercial ventures.

These outputs are derived in the context of Nagaland's current economy and resources (Section 2), its pig marketing (Section 3) and production (Section 4) systems and the related policy and institutional issues (Section 5). Finally, Section 6 presents the report's conclusions and recommendations.

2. Nagaland, livelihoods and the pig sub-sector

2.1. Overview of Nagaland

Hundreds of years ago, the Naga people migrated in several waves from China and Southeast Asia through Myanmar although the exact date of their entry to the Naga Hills is not known. After India's independence in 1947, the Naga area became a part of the State of Assam until the State of Nagaland Act (1962) converted the Naga Hills Tuensang Area into a separate state and Nagaland came into being on 1 December 1963. Nagaland borders its sister states Arunachal Pradesh to the north, Manipur to the south, Myanmar to the east and Assam to the west respectively (Figure 1) and has 11 districts. Kohima is the state capital and Dimapur the major commercial centre.

The Naga society has a unique social structure for the administration of its villages. With the introduction of the Nagaland Village and Area Council Act (1978) the state made a big step forward in the process of decentralized development (Haloi 2002). Rural areas, especially in Mon district, still have a king (locally called *angh*) who is the chief of several villages and is responsible for resolving disputes in the villages under his jurisdiction. In other ethnic groups like the Sema, power is held by the village chief whose post is hereditary. Each village has a formal administrative body (village council), headed by a chairperson, and a Village Development Board (VDB). The VDB prepares the five-year village action plan and manages government development funds. No development activity in the village can be undertaken without authorization of the village council and/or VDB. In addition, there are other village committees (e.g. Village Education, Joint Forest Management and Watershed Committees) which oversee the activities of the relevant departments and organizations.

The 2001 census put the state population at 1.99 million (Government of Nagaland 2004) of which about 90% is rural. There are only nine towns; their populations range from 114,000 in Dimapur to 13,000 in Phek. The other towns are Kohima, Chumukedima, Mokokchung, Mon, Tuensang, Wokha and Zunheboto. The majority of Nagaland's people are Christian though there are some Hindus and Muslims. Nearly 90% of the population (Haloi 2002) belongs to the Scheduled Tribe (ST); most of the remainder belong to the

General Community and come from outside the state. There are about 84 tribes of which 17 are considered major (Haloi 2002): Angami, Ao, Chakhesang, Chang, Khiamuniungan, Kuki, Konyak, Kachari, Lotha, Phom, Pochury, Rengma, Sumi, Sangtam, Yinchungru, Zeliang and Langsimnyi. Each tribe has its own culture and dialect; Nagamese (a broken form of Assamese language) is the inter-tribal medium of speech. The major urban centres like Dimapur and Kohima are home to almost all the ethnic groups. In Dimapur district, the Niuland area is dominated by the Sumi community while Medizephema area is dominated by the Angami community. The only major ethnic group residing throughout Mon district is Konyak. Phek district is mainly populated by the Kezha, Pochury and Chokri communities. The Chokri community resides predominantly in Kikruma, the Khezha in Pftusero, and the Pochury in Meluri.

The state has a pleasant sub-alpine climate. It is generally cool in winter and warm in summer; average monthly temperatures range from 4°C to 31°C. Most rain falls from May to September with an average of 200–250 cm. During February–March, there are strong winds that damage to crops and trees and in March–April there are hailstorms.

Table 3: Land use in Nagaland state and in the three surveyed districts

District	Reporting area for land utilization	Total cropped area*	Net sown area	Fallow	Forest and misc. trees	Others
Dimapur	239	89	67 (28)	14 (6)	132 (55)	26 (11)
Mon	160	33	25 (16)	21 (13)	105 (66)	9 (5)
Phek	193	45	38 (20)	17 (9)	125 (64)	13 (7)
Nagaland	1582	386	309 (20)	158 (10)	983 (62)	132 (8)

Land area in '000 hectares

Percentages in parentheses

* Total cropped area is constituted of net sown area and area sown more than once out of the net sown area. So total cropped area is not calculated under the total area

Source: Directorate of Agriculture, Government of Nagaland

Except for some small plain areas towards Assam, the state's geography is dominated by hills and mountains. Saramati is the highest peak (3841 metres). Of the towns, Pftusero in Phek district is situated at the highest altitude (2133 metres). All rivers flow either into the Brahmaputra in Assam or the Chindwin in Myanmar. Rail, road and air connectivity is poor due to the hilly terrain and uneven topography. The railway and scheduled flights

only serve Dimapur. The network of national highway, state highway and district roads is about 13,000 km of which only half is surfaced road. Electricity and telecommunication networks are similarly limited. Physically, the state is triangular in shape (Figure 1) and covers some 16,527 km² of which about two-thirds is forested (Table 3). The net cultivable area is about 20%. Table 4 presents descriptive statistics for the state and the three surveyed districts. Dimapur is more highly populated and urbanized than Mon and Phek, while Phek is notable for its relatively slow population growth and Mon for its illiteracy. Rural poverty is endemic. The 1999–2000 poverty statistics show that nearly a third of Nagaland’s people lived below the poverty line, well above the national average of 26.1%. The poverty and slow economic growth is exacerbated by a long-running insurgency against the central government.

Table 4: Key statistics for Nagaland and Dimapur, Mon and Phek districts

Particulars	Dimapur	Mon	Phek	Nagaland
District headquarters (m)	260	898	1524	
Number of villages	219	111	104	1317
Number of towns	2	1	1	9
Total population ('000)	308,382	259,604	148,246	1,988,636
Urban population (%)	35	6	9	10
Area (km ²)	927	1,786	2,026	16,579
Population density (per km ²)	333	145	73	120
Sex ratio (females per 1000 males)	854	881	923	909
Decadal population growth (%)	73.30	73.42	45.12	64.41
Literacy rate (%)	78.15	42.25	71.35	67.11

Source: Statistical Handbook of Nagaland (2004)

2.2. Rural economy and the role of pigs

The economy of Nagaland is dominated by rural households that practise rain-fed crop agriculture in two major systems: terrace and *jhum* (shifting) cultivation (NEPED 2006). Within the areas covered by this study, wet (irrigated) cultivation was practised only in the plain valleys of Dimapur district and a small part of Mon district. In Mon and the hilly areas of Dimapur, *jhum* is practised on about 80% of the cultivable land, while terrace cultivation prevails in 80% of cultivable land in Phek district. The farming systems are ‘low-input, low-output’ with high dependency on family labour but few purchased inputs,

e.g. the use of chemical fertilizer is negligible. Rice is the major crop, comprising about 75% of the total food grain production³ in the plain valleys and on the terrace fields. In the *jhum* areas, rice, maize, millet, taro, tapioca and pumpkin are the major crops. In *jhum* fields, about 20–30 crops are cultivated at a time on the same plot of land to meet the household's food requirement. Soybean, rice bean, squash, potato, mustard, banana, turmeric, ginger, pineapple and vegetables are grown on both terrace and *jhum* fields. Although rice is the staple food, yields from the *jhum* fields are low and poor families may depend on taro (*Colocasia*) and tapioca as their staple for 3–4 months of the year. Farm production is supplemented by food and other products gathered from common property resources (CPR) and especially from the extensive forest areas which are integral to the land-use systems (NEPED and IIRR 1999).

Although most land is owned by individuals, 20% is under community ownership. Relative to the national average, land holdings are large in Nagaland; households with semi-medium (1–2 ha) and medium (over 2 ha) land holdings are the majority (Table 5). In part, this reflects the prevalent *jhum* cultivation in which the land holding is divided into plots for cultivation over a period of years and then left fallow for several years. However, with increased population and decreased holding sizes, the *jhum* cycle has lessened significantly and now the same plot of land may be re-cultivated after 3–4 years, resulting in poor soil fertility and low yields. Thus, households may only produce enough paddy to meet their needs for 4–5 months of the year. As the cash incomes of many families are low, purchasing rice may not be possible and so taro or cassava becomes the staple.

Table 5: Number of farm families by size of landholding in Nagaland and the surveyed districts

Area	Marginal	Small	Semi- medium	Medium	Large	Total
Dimapur	4428 (11)	9022 (22)	12,452 (31)	11,692 (28)	3188 (8)	40,782
Mon	1312 (6)	3392 (16)	7692 (36)	7271 (35)	1572 (7)	21,239
Phek	1184 (7)	3508 (21)	5146 (31)	5896 (36)	812 (5)	16546
Nagaland	9396 (6)	20,794 (14)	40,466 (27)	64,095 (43)	14,420 (10)	149,171

Number in '000; percentages in parentheses

Source: Agricultural census, 1995-96, Directorate of Agriculture, Nagaland

³ Department of Agriculture, Government of Nagaland (<http://agringl.nic.in>)

In Dimapur, because of its large plain valleys, almost all privately-owned land can be cultivated every year. As a result, the district is considered the rice bowl of Nagaland. Similarly, the predominant terrace cultivation in Phek means that most land holdings can be cultivated almost every year resulting in higher production and relatively better economic status than in Mon. Terrace cultivation is practised mainly in Kohima, Phek and Wokha districts while *jhum* cultivation is observed throughout the state. Except in parts of Dimapur district (e.g. Niuland area), homestead crops and vegetables are not common in Nagaland mainly because of the small land within the homestead.

Along with crop agriculture, backyard pig and poultry rearing is integral to the livelihoods of these farm families and symbolizes the health and wealth of families. In addition, pond fishery is popular in some parts of Dimapur district while paddy-cum-fish on terrace fields is practised in Phek district. CPR like roadsides and school and church fields are not generally used for grazing, possibly because of the instruction made by the village council. Except for a small number of peri-urban dairies especially in Dimapur district, dairy farming is not generally practised by Naga households. Milk consumption and the use of draught animals are not traditional to Naga communities. Within the state, the limited dairy production is generally by the Bihari, Bengali and Nepali communities.

In contrast, pig keeping is traditional and very common amongst Naga households; it serves to meet socio-religious obligations and brings additional income to rural and urban families. Most rear between one and three pigs although some households (especially in Dimapur district) rear up to 15 pigs. Pig feed is mainly the by-products of paddy, maize, taro, vegetables and gathered forages. Pigs therefore serve to convert existing resources and waste crop by-products of low value into high-value animal source foods for home consumption and/or sale. Keeping the pigs helps rural households to diversify their risks, serves as a source of cash for day-to-day household expenses (repairs, school fees or medical treatment). In addition, some households donate to the Church small sums of cash from the income generated through pig-keeping.

Rural households in Dimapur, Mon and Phek keep over 90% of the districts' pigs (Table 6). Of the three districts surveyed for this report, government statistics (2003) indicated that Dimapur had the highest density of pigs per 1000 people (471) and Mon the lowest (143).

Despite the apparent importance of pig keeping to rural livelihoods in Nagaland, statistics show that fewer pigs were kept in 2003 (316 per 1000 people) than in 1992 (414 per 1000 people). Therefore, the current contribution of pig production and marketing to rural livelihoods in Nagaland and the potential to increase that contribution need to be clarified.

Table 6: Numbers of pigs, the percentage in rural areas and the pig density in Nagaland and in the three surveyed districts

Area	Rural	Urban	Total	% rural	Pig density per 1000 people
Dimapur	131,422	13,854	145,276	90	471
Mon	36,495	679	37,174	98	143
Phek	60,737	524	61,261	99	413
Nagaland	518,821	125,393	644,214	80	316

Source: 17th Livestock Census (2003); VAHD, Government of Nagaland

In addition to farming and extracting products from CPR, many households earn cash income through daily labour. For example in Mon, a large majority work as daily-wage labourers or crush stones in quarries for cash. A male labourer is paid INR 40 (with food) per day while women are paid INR 30. In Dimapur district, men are paid INR 100 per day and women INR 70, while in Phek there is no difference in the wage rate for men and women (INR 100). The lower wage in Mon reflects the higher intensity of daily-wage labour and lower employment avenues in other sectors. Other sources of income include weaving of bamboo baskets (practised by almost every household); sale of bamboo shoots, fruits and vegetables by women; blacksmithing; carpentry; pottery and wood carving. Of the organized industries, the sugar mill in Dimapur, the plywood factory in Mon and the Wazeho Mini Cement Plant in Phek are the most notable in the three districts. The work participation rate in Nagaland is reported to be 45%; this is higher than that in Assam (36%) and other states of NER as most family members are involved in crop farming or other income-generating activities. This perhaps influences the dependency ratio which in Nagaland (76%) is the lowest amongst the NE states⁴.

In summary, Nagaland's rural economy is primarily agriculture-based but has other non-farm sources of livelihood security and income. Pig production and marketing is an

⁴ East India Human Development Report, National Council of Applied Economics, New Delhi (2004)

integral part of the livelihood strategies of about 80% of households among Nagaland's varied ethnic groups. However, it was not clear from the secondary information what the importance of pig production is relative to the other non-crop components of tribal household livelihoods. It was also not obvious whether the economic importance of pig keeping for Naga people is increasing or declining.

2.3. Hypotheses on the contribution of the pig sub-sector to livelihoods

Prior to the field surveys to assess the current status of pig production in the three districts, hypotheses were formulated about the role of the pig sub-sector in the economy of Nagaland, its contribution to rural livelihoods and the factors that may change its structure. These hypotheses included:

1. In Nagaland, the production of pigs is a small-scale backyard enterprise that is practised by all Naga ethnic groups.
2. Pig production by the Naga people serves several livelihood objectives that include meeting socio-cultural obligations, generating income, accumulating capital and providing the most preferred source of meat.
3. Current systems of production can be characterized as 'low-input, low-output' and depend upon family labour and on other local inputs (particularly feed) that are of no or low cost relative to the value of the pig being reared.
4. Local feed resources currently define the scale of pig production. Therefore, improved feed resources and feeding practices will be key interventions to increase the scale, productivity and profitability of pig production.
5. Some traditional management practices are changing, especially in respect to breeding and rearing; indigenous pigs are being replaced by crossbreeds and the scavenging system of rearing by penning.
6. Nagaland has a deficit of piglets, growers and slaughter pigs and depends on external supplies to meet the deficit.
7. In Nagaland, pork consumption is traditional for all ethnic groups. Consumers differentiate between pork from indigenous breeds and their crosses reared traditionally and pork from exotic crossbreeds procured from outside the state.

8. Current practices for slaughtering pigs and selling pork are unhygienic and pose a risk to public health, particularly in urban areas.
9. The scale, productivity and profitability of backyard pig production are constrained by lack of public interventions using participatory methods to improve the access of producers to technical knowledge and veterinary services.

In addition to the hypotheses listed above, it was expected that others would result from the findings of the field surveys and the related discussions.

3. Marketing of pigs and consumption of pork

If sustained improvements in livelihoods in Nagaland are to result from improvements in the efficiency of pig production and increasing scale of production, the changes will probably be driven by demand for more pork. Therefore, understanding who consumes pork and how pork and pigs are marketed were the first steps in the appraisal process.

3.1. Consumption of pork

Nagas are traditionally meat-eaters and although pork is the preferred meat type, the list of non-vegetarian foods that are consumed is long; it includes chicken, beef, chevon, dog, fish, egg, wild birds, crab, frog, snail and ants. Some of these are gathered (wild birds and crabs) while others are home-produced (pork and chicken) or purchased (beef and chevon). Of the meats produced by livestock, demand was reportedly highest for pork followed by chicken and beef, while demand for chevon was much lower.

Table 7: Prices of meat in May–June 2007 in the three surveyed districts

Item	Dimapur	Mon	Phek
Beef	55	40–50	50–60
Pork	85–90	80–100	80–90
Broiler chicken	80	100	100
Indigenous chicken	120	130	120–130
Dog meat	100	70	90
Chevon	130–140		120
<i>Mithun</i> meat		150	

Prices in INR per kilogram of meat

Source: Field surveys

3.1.1. Prices of pork and factors affecting demand

Table 7 presents the prices of fresh meats (sold as live birds in the case of chicken) available for sale in Dimapur, Mon and Phek during the field surveys in May and June 2007. Price variation reflects the relative demand and supply of the various meats. Of those most readily available for purchase in the markets, beef was significantly cheaper.

Pork was marginally cheaper than broiler chicken (except in Dimapur) while indigenous chicken was more expensive than broiler chicken and similar in price to chevon.

Consumers said that although the price of pork was similar to that of broiler chicken and lower than that of indigenous chicken, taste rather than price was the prime criterion for purchasing pork. Nevertheless, in Mon district where recurring insecurity has reduced incomes, price was a major factor affecting which type of meat was bought. Broiler chickens were readily available in Dimapur and Kohima but not in Mon and Phek, resulting in higher prices for indigenous chicken.

Availability was an important factor affecting the consumption of pork; in the surveyed rural areas, people usually consumed pork on the day when producers slaughtered a pig. As a result, in these rural areas and small towns like Mon, pork was not available for purchase every day. In Dimapur and Kohima towns, pork was generally consumed one to three times a week by most households, reflecting its daily availability and the purchasing power of these urban households. In other areas, pork was eaten once or twice in a month. Whenever pork was purchased, any excess fresh meat was preserved by smoking.

Processed pork products like ham, sausages, bacon and salami were available in a few stores in prime locations of Dimapur and Kohima towns; the products were supplied from outside the state and especially from Kolkata, Delhi, Haryana and Shillong. The target customers are mostly upper middle-class families. Interviews with some store owners revealed that demand for these processed products has been increasing over the years but sales were still very low such that they were insignificant relative to the sales of fresh pork in Dimapur and Kohima towns.

When buying fresh pork, preference for fat or lean meat varied depending on individual choice (mostly guided by age and health status of the consumer and taste of the particular portion of pork) though there was no price difference between fat and lean pork. However, the price of pork from indigenous pigs (which have less fat) was slightly higher (INR 90 to 100 per kg) than that from crossbred pigs (INR 80 to 90 per kg). Offal, head, legs and blood were also sold; the price of offal, head and legs was the same while blood cost INR 5 per half-litre cup.

Demand for pork was slightly higher during winter and markedly so during local ethnic festivals and on Christmas, Good Friday and New Year's Day holidays. In Phek, demand was also high in the summer because villagers work hard in their fields and eat more pork to sustain their energy. They also consume pork when celebrating the first and last days of cultivation, the completion of harvesting and the eve of the new season's cultivation. Conversely, demand for pork was much lower on Sundays than other days because most people were busy with church activities.

3.1.2. Price trends

Village and municipal councils and town committees control the price of pork at wet markets. The price did not usually vary by season but when it increased, often during the festival season, it remained unchanged for at least another year. Within the past ten years, the prices of pork have risen by about 60% in Dimapur and Mon but have doubled in Phek (Table 8). When adjusted for inflation, the respective price increases are about 12% and nearly 50%, presumably a reflection of changing balances in supply and demand.

Table 8: Average pork prices and percentage changes in the three surveyed districts

Item	Dimapur	Mon	Phek
Ten years ago (A)	50	60	40
Five years ago	60	70	60
Current (B)	90	100	90
B/A actual (%)	+60	+66	+125
B/A adjusted for inflation (%)	+17	+8	+46

Prices in INR per kg

*Adjusted by the All India Consumer Price Index <http://indiabudget.nic.in>

Source: key informants during market survey

3.1.3. Level of consumption

In Dimapur district (including Dimapur and Kohima towns), richer households ate pork almost every day and total consumption was 10–20 kg per month. Poor, rural consumers (who are the majority) could afford to consume only 1–2 kg of pork. Market agents and consumers opined that the average monthly consumption of pork per household in the

district might be 4–5 kg. In Mon district, due to the poverty of most households, 60% of households could not afford to consume pork even once in a month while the remainder procured only 0.5–3 kg of pork per month. Traders and executives of village councils estimated that the average monthly pork consumption per household would be about 0.75 kg. In comparison, about 60% of households in Phek consumed 0.5–1 kg of pork once a month and remainder consumed 2–5 kg of pork.

These informal estimates of current consumption can be compared with published estimates from government sources. The annual collection of household consumption data by the National Sample Survey Organization (NSSO) provides state- and district-level estimates of per capita consumption of meat and other foods (Government of India 2003). The NSSO results in Table 9 confirm that the consumption of pork in Nagaland is markedly higher than in Assam or Meghalaya, reflecting the high proportion of tribal people in the state and their tradition for eating pork. Pork is considered the first choice of meat by almost all households in Nagaland; NSSO statistics indicate that 88% of Nagaland's population eat pork.

Table 9: Per capita consumption of pork in urban and rural areas and for rural social groups in three northeastern states

State	Urban	Rural	ST*	SC*	OBC*	Others
Assam	0.09	0.61	2.26	0.44	0.49	0.21
Meghalaya	3.26	2.04	2.14	0.00	2.26	0.15
Nagaland	9.54	7.18	7.45	1.61	4.14	1.80

Per capita pork consumption in kilograms per annum

* ST: Scheduled Tribe group; SC: Scheduled Caste group; OBC: Other Backward Classes

Source: Government of India (2003)

The NSSO estimates in Table 9 also confirm that pork consumption is higher in urban and peri-urban areas, e.g. Dimapur and Kohima towns, probably a reflection of the variation in purchasing power. According to other NSSO estimates, Assam's rural and urban populations incur only 9% and 1%, respectively, of their total meat expenditure on pork while the rural and urban estimates in Nagaland are over 30%. Nationally, the percentage spent on pork in Nagaland is the highest of any state. In contrast, despite having the highest number of pigs (2.32 million), UP has a per capita pork consumption of less than

0.2 kg and less than 2% of its population eat pork; this partly explains why UP has been a major supplier of pigs to Nagaland.

Table 10: Per capita consumption of pork in urban and rural areas of Nagaland and in selected districts

District	Rural	Urban
Kohima*	7.97	10.54
Mon	7.87	0.00
Phek	6.97	6.33
Nagaland	7.18	9.54

Per capita pork consumption in kilograms per annum

*Including Dimapur

Source: Government of India (2003)

NSSO estimates presented in Table 10 suggest that there is low variation of pork consumption in rural areas in the surveyed districts. These estimates show that Kohima district (including Dimapur) had the highest consumption of pork. In Dimapur and Kohima, the ready availability of pork (mainly from imported pigs) and the relatively high purchasing power of many urban residents are probable factors explaining these differences. On the other hand, the urban NSSO estimate for Mon district shown in Table 8 does not reflect the reality found during our surveys. The error is probably a result of the small sample sizes on which some NSSO district-level estimates (like Mon) are based.

It is also noteworthy that the rural estimates published by NSSO (Table 10), which show fairly similar levels of rural pork consumption in the three districts (7–8 kg), contrast with estimates from the key informants in our field surveys (2 kg in Mon, 4 kg in Phek and 10 kg in Dimapur/Kohima); the relative values of the field estimates seem to be consistent with the variation in pig density and purchasing power in the districts. Further study is required to provide reliable estimates of current and projected levels of pork consumption and to identify the key factors affecting the demand and supply of pork.

3.1.4. Future demand

Pork consumption is likely to increase in the foreseeable future, provided there is adequate supply. Population growth (reported to be the highest in India) and the resulting economic

growth and improved purchasing power may also contribute to increased demand for pork. However, purchasing power may be threatened by renewed insurgency, particularly in Mon district and other afflicted areas. If there is political stability and an adequate supply of pigs, current trends suggest that both the quantity and frequency of pork consumption can be expected to increase among current consumers in urban and rural households and in urban fast-food outlets and hotels. Consequently, the growth of pork consumption will be faster in urban than in rural areas. It was against this backdrop of widespread pork consumption and some optimism for an increasing demand for pork that the field surveys examined the current marketing of pigs and of pork.

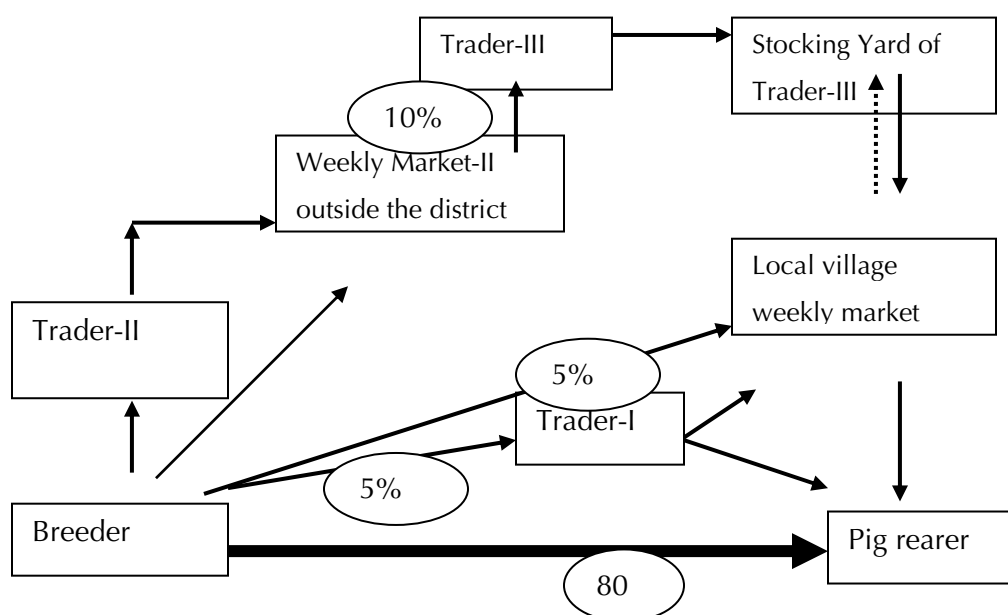
3.2. Current supply chain of pigs and pork

3.2.1. Output market (piglets, slaughter pigs and pork)

There are three principal products from Nagaland's piggery: weaner piglets and growers (depending on the age at sale); slaughter pigs and fresh pork. Weaner piglets and growers are the first product in the supply chain. They are produced by households or pig units that keep breeding sows. In Nagaland, almost all breeders were small-scale backyard pig keepers, some of whom retained piglets for rearing to slaughter.

Supply chain for piglets

Piglets (including growers) were marketed in one of several ways, the simplest and most prevalent of which was direct sale by breeders to pig rearers (Figure 2), partly because there are few weekly markets or piglet traders unlike in Assam. Only 5% of piglets were sold through traders. The information from field survey suggests that in all three districts local supply of piglets was 10-30% lower than demand (Table 11). At the time of the survey, Dimapur district met its deficit from Assam and Manipur, Mon district from Assam and Phek district from Manipur and Myanmar (Figure 1).



Trader-I: Procure piglets from local breeders to sell in local village weekly markets

Trader-II: Traders from the neighbouring piglet-surplus states, Assam and Manipur, who procure piglets from breeders to sell in weekly markets or directly deliver in farmer's house

Traders-III: From Mon/Phek/Dimapur district who visit Assam/Manipur/Myanmar border to procure piglets

Market-I: Weekly market of Mon/Dimapur district

Market-II: Weekly markets of Assam/Manipur

Figure 2: Supply chain for piglet marketing in Mon district

All three surveyed districts had similar supply chains for procurement of pigs from outside Nagaland for rearing to slaughter. Traders from Dimapur district visit the weekly markets in Golaghat district (Bihara, Sarupathar, Borpathar) in Assam (Figure 1) to procure piglets from the local traders. The piglets are then transported by bus, mini-truck or auto van for sale in Dimapur. For supply of piglets to Mon, traders from Assam visit the Dishang Mukh weekly market of Sivsagar district in Assam on the southern bank of the Brahmaputra River (Figure 1), where traders from Lakhimpur and Dhemaji districts of Assam sell piglets. Traders from Sivsagar procure the piglets and transport them by mini-truck or bus to the area bordering Nagaland for sale at the weekly markets of Tizit, Namtola, Banfera and Naginimora in Mon. Transport costs INR 1000–1200 per mini-truck. Piglet traders reported that about 200 piglets were sold each month at these weekly markets. The traders faced no major problems during transport and sale of piglets apart from 'hidden expenses' (bribes to police and the underground party).

Table 11: Market chains for piglets/growers in the surveyed districts

Market chain	Percentage of marketed piglets		
	Dimapur	Mon	Phek
Local breeders to rearers (direct)	60	80	60
Local breeders to rearers at local market	10	5	10
Local breeders to traders at local markets	10	5	0
Local breeders to traders at external market	Nil	Nil	Nil
External breeders to traders at local market	20	10	30

Deficit of piglets/growers exists in all three districts

In Phek, a few traders procure piglets from Senapati districts of Manipur and from Myanmar. In Senapati, traders procured piglets from the weekly market where breeders and traders brought 'piglets' for sale from within the district and the neighbouring Thoubal, Imphal and Bishnupur districts of Manipur. It is important to clarify that the 'piglets' are not the two-month-old weaners seen elsewhere but four to eight-month-old growers of 25–40 kg live weight that cost INR 3000 to 5000 each. According to the traders, weaner piglets cannot thrive well in the cooler climate of Nagaland so producers prefer to buy growers. They estimated that 1000–1500 growers are imported every month into Phek and neighbouring districts from Manipur. Although there is a ban on imports to Phek from other districts or states, the import of piglets/growers was permitted as a special consideration. Nevertheless, following the recent cases of avian influenza in Myanmar, the ban on imports from Manipur and Myanmar was re-imposed. The growers are transported by mini-truck at a cost of about INR 7000 for the 280 km journey. Apart from the cost of transport, there are hidden expenses in the form of bribes to the police and the underground party. It was not possible to establish the amounts paid to the underground party.

From Myanmar, another 300–500 grower pigs are procured. A trader reported that there are unmanned gates at the India–Myanmar border through which stock is transacted. The supply chain beyond the border is not known. The traders generally buy at the check gate and transport the pigs to the villages by mini-truck. Unlike in Mon and Dimapur districts, in Phek the imported pigs are procured to the advance order of producers and delivered to producers' farms. As a result, there were no lairage expenses. As elsewhere, the traders reported that the major problem in running their businesses was the high hidden expenses incurred while transporting the pigs.

Traders in Mon and Phek reported that the market for growers (mainly crossbreeds) has increased over the years and the growth is much faster in Phek than in Mon. Having seen the higher growth performance and profitability of growers imported from Manipur, many producers have shifted from rearing indigenous pigs to crossbreeds. In contrast, rearers in Mon district said that the crossbreeds procured from Assam did not grow well. Therefore, many village pig rearers still preferred indigenous pigs that had the advantage of producing meat with a taste that was preferable to that of crossbreeds. It was also reported that some people, especially in remote villages, still preferred indigenous pigs which require less feed and care and whose pork tastes better. Nevertheless, the field surveys showed that only 10% of Naga people still preferred indigenous pigs while about 90% preferred to rear high-grade crossbred pigs because of their faster growth and capacity to produce more income. An interesting observation was that some households in Dimapur and Phek reared indigenous pigs and crossbreeds to achieve twin objectives; crossbreeds were reared for sale while indigenous pigs were consumed by the household.

Figure 3 presents a summary of the costs that were reported in several market channels in Mon district. In the breeder-trader I-trader II-rearer supply chain – which is mainly to import piglets from Assam – transport and lairage costs, hidden expenses and the profit margin of trader-I were significant, leaving about 67% of the retail value of the piglets to the producer (Figure 3). The net daily profit per individual trader was about INR 170. Given that in Mon, an average of 83% of the retail value of piglets is paid to the producer (Figure 4), it appears that the market chain for piglets in the other two market channels efficiently serves pig breeders and traders in the district.

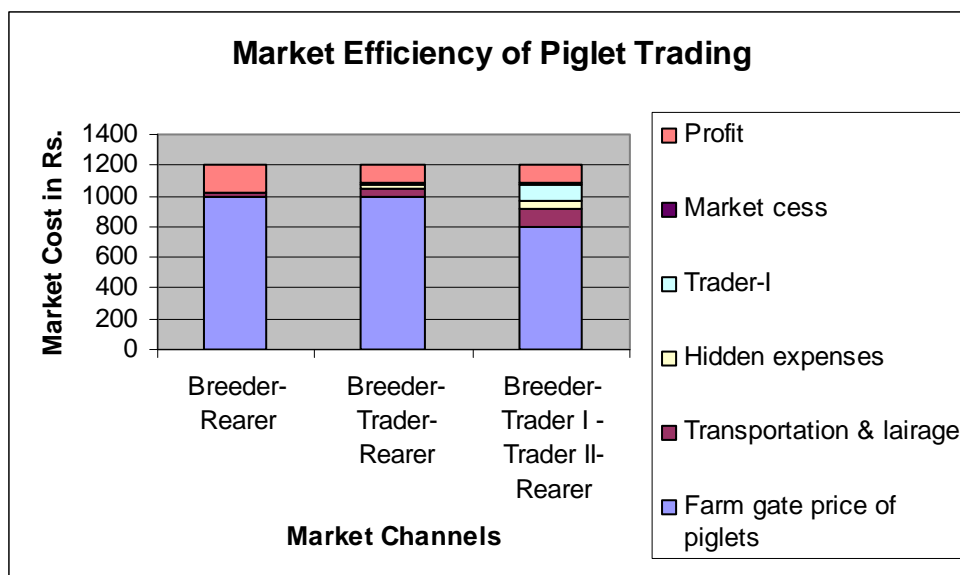


Figure 3: Marketing costs for piglets in Mon district.

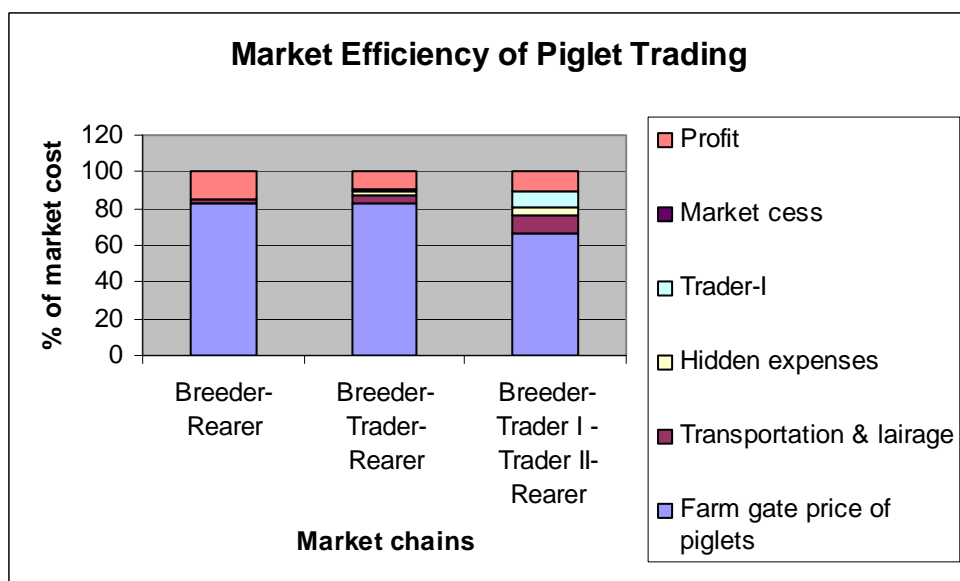


Figure 4: Relative marketing costs for piglets in Mon district.

Supply chain for slaughter pigs and pork marketing

The supply chain for slaughter pigs in Dimapur district is presented in Figure 5. As expected, most producers in the villages slaughtered their pigs and sold the pork in the village. Factors influencing this decision included absence of visiting pig traders, distance

from markets and poor transport facilities. Slaughter for local sale was generally during the time of local festivals and Christmas when there was good demand for pork in the village. About 80–90% of slaughter pigs were marketed in this way in Mon and Phek districts, while in Dimapur and Kohima districts the proportion was only about 20% (Table 12). When producers in rural areas of Mon and Phek planned to slaughter a pig, they usually informed the villagers beforehand to avoid problems in selling the pork.

Table 12: Market chains for slaughter pigs in the surveyed districts

Market chain	Percentage of marketed piglets		
	Dimapur	Mon	Phek
Local rearers to consumers (direct)	20	70	80
Local rearers to consumers at local market	10	10	10
Local rearers to traders at local market	10	10	10
Local rearers to traders for external market	-	-	-
External rearers to traders at local market	60	10	-

Large deficit in all three districts

Source: Field surveys

In contrast to Assam where slaughter weights are generally lower (Deka et al. 2007), crossbred slaughter pigs in Nagaland are often reared for more than two years to live weights of 150–220 kg before being slaughtered or sold for slaughter. At least INR 15,000 is paid to the producer. For indigenous pigs, the rearing period may be 4–6 years and the live weight 40–80 kg. The social prestige of having a very heavy pig at social and religious functions is a factor that influences these fattening practices.

About 10% of producers in the survey districts sold their slaughter pigs to pork retailers or pig traders (Figure 5 and Table 12). The retailers and traders generally visit the villages when they do not have access to outside supplies of pigs – whether because of a strike, flooding or a landslide in Assam or Nagaland – or when they get a bulk order for pork that they can only supply by buying local (indigenous) pigs. The price per unit weight of local pigs was reportedly higher than that of imported (crossbred) pigs and the pork was sold at a premium price. Producers said that selling their pigs to a trader was more profitable than selling the pork themselves because they received the sale price as a lump sum. When they sell pork directly to consumers, producers incur reduced cash income as they often have to give credit, accept barter goods or give gifts of pork to close relatives.

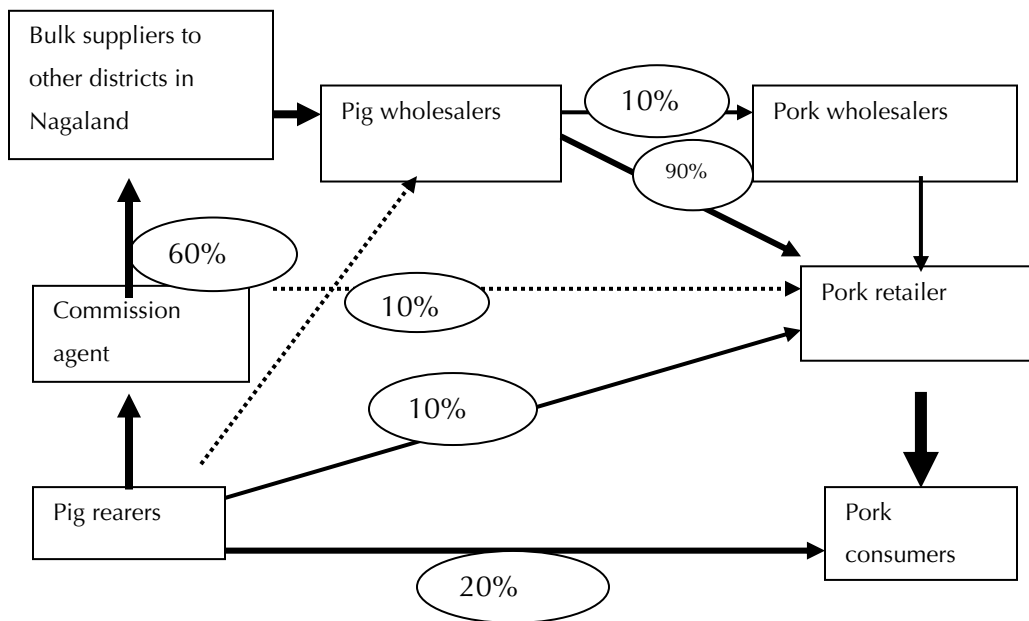


Figure 5: Supply chain for slaughter pig and pork marketing in Dimapur District.

The major supply chain of slaughter pigs to Dimapur district (including Kohima) is importation from UP and Haryana (Mujapharnagar, Lucknow, Kanpur and Bareilly) (Table 12). The pig wholesalers, who were originally from UP and Haryana, said that their close relatives in these states served as key contact persons and suppliers. They procured pigs from local traders or producer households for supply by truck or train to Nagaland. A truck-load of 45 to 50 pigs costs INR 280,000 to 300,000 (including INR 70,000 for transport) while transport by train costs about INR 140,000 for delivery of pigs to Dimapur. All transactions are through internet banking; credit is not popular. Wholesalers said that their major problem was hidden expenses while transporting pigs through Assam and Nagaland; these expenses often made their businesses less remunerative. Whereas the three pig wholesalers reported that they imported about 1000 slaughter pigs per month from outside the state, pork wholesalers and retailers indicated that the actual figure is about 5000 pigs per month.

Pig retailers procure pigs from the wholesalers then slaughter the pigs and sell the pork in the market in Dimapur (Figure 5). Pork wholesalers in Kohima town procure pigs from the Dimapur-based wholesalers and pay about INR 5000 to transport the pigs by truck to

Kohima. The pigs are then stored in a stocking yard for up to two days, incurring expenses for feeding. The pork wholesalers in Kohima slaughter all the pigs required for the town and use their own vehicles to deliver the carcasses to pork retailers. There are no pork wholesalers in Dimapur, possibly because of the ready availability of slaughter pigs.

In Mon, only 5% of slaughter pigs are procured from Assam. In Phek there is no external sourcing of slaughter pigs (Table 12) following a ban imposed by Chakhesang Public Organization and Tribal Ho Ho. Veterinary staff said that the ban had encouraged local producers to rear more pigs to meet the unsatisfied demand for pork, resulting in a gradual increase in pig production in the district. This contrasts with the published livestock census statistics for 1997 and 2003 that indicate a more than doubling of the district's pig population. Recent market conditions indicate that consumers have found it difficult to procure pork and that some former pork retailers are jobless. The ban has also not been highly effective as producers still procure grower pigs (25–40 kg live weight) from outside the state, some of which are suspected to carry diseases into Nagaland.

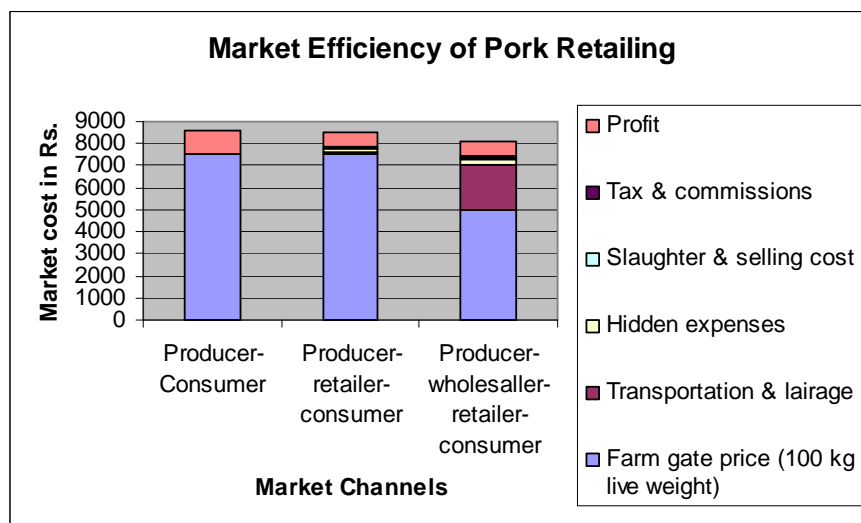


Figure 6: Marketing costs for pork in Kohima district.

Figure 6 presents a summary of the costs that were reported for the different market channels for pork in Kohima district. In Kohima town, for example, pork wholesalers buy water to clean the offal at a cost of INR 500 for a small tank of water mounted on a jeep while producers in the village do not need to buy water. In Dimapur and Kohima market, pig carcasses are prepared by burning the hair with liquid petroleum gas while straw is

used in rural areas. A cylinder of liquid petroleum gas costing about INR 320 is enough to remove the hair of up to nine pig carcasses. In Kohima, pig hairs are not burnt during winter months but are plucked and sold to traders from outside the state for INR 200–400 per kilogram. From the analysis of the costs along the market chain, the net daily profit per individual trader was estimated at INR 340. This estimate, together with the 87% of pork retail value that is paid to the pig producer (Figure 7), suggests that the market chain efficiently serves the producers, traders and consumers in the district and in Kohima town.

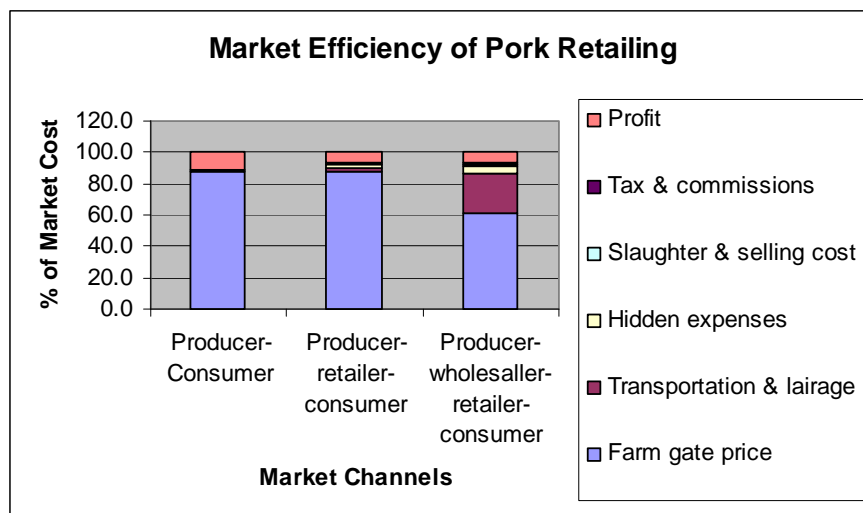


Figure 7: Relative marketing costs for pork in Kohima district.

3.2.2. Input market (piglets, feeds and veterinary inputs)

The major inputs for pig production are piglets/growers, labour, feed and veterinary supplies. However, as pointed out earlier, most pig producers in Nagaland use ‘low-input, low-output’ systems in which there are minimal purchased inputs other than the pig itself.

Piglets

Most piglets are procured directly from breeders and only a few are supplied by piglet traders from within and outside the districts (Table 11). Relative to requirements, the supply from public-sector sources (government breeding farms) is low – only 1370 piglets in the three districts in 2006-07. Each piglet costs INR 600 to 1000 (INR 130/kg live weight) depending on breed, age, sex, growth performance and source. Live weight for age has a strong bearing on the price. Nagaland pig keepers mostly prefer black-coloured piglets

with drooping ears, a short snout and an elongated body and specifically the types known locally as 'Bilati' or 'Burma' which the ICAR-Jharnapani and VAHD staff called 'Large Black'. These piglets are preferred because of their black colour, faster growth and larger litter size. The Large White Yorkshire and Hampshire breeds are less popular.

Although producers in Dimapur and Phek districts prefer crossbred pigs, the preference in remote rural areas is for indigenous pigs (despite their slow growth) because of their lower feed requirement and the better taste of their meat. As shown in Table 13 the price of grower pigs from Manipur is much higher than those from Dimapur and Mon districts, reflecting their higher live weight. Season greatly influences the price and availability of piglets/growers which are higher during November to March. Producers usually start rearing piglets during the winter so that the fatteners are ready for slaughter by Christmas when prices are higher.

Table 13: Price of farm inputs for pig production

Farm inputs	Price (INR)		
	Dimapur	Mon	Phek
Indigenous piglets	600–700	800–1000	700–800
Crossbred piglets	1200–1500	1000–1500	1000–1300
Grower pigs procured from Manipur			3000–5000
Rice polish no. I (INR /kg)	6	9	8
Rice polish no. II (INR/kg)	4	6	
Broken rice (INR/kg)	10		12
Maize (INR/kg)	10		
Crushed maize (INR/kg)	13	15	
Wheat bran (INR/kg)	8.50	11	10
Soybean, smaller size (INR/kg),	25		
Soybean, bigger size (INR/kg)	15		
Oilcakes (INR/kg)	10		
Juguli/Doxi/Aji Chi/Jukhu (INR/16-litre tin)	7		10
Hotel food waste (INR/month)	150		
Breeding services	500–700		

Source: Field surveys

Feeds

In Nagaland, as elsewhere in the NER and in the hill regions of Southeast Asia, pig production is mainly based on family labour and feeds gathered or produced by the household. Purchases of feeds, apart from some crop and milling by-products, are not frequent and except for government pig farms, the use of commercial concentrate feed is negligible. The main feeds used are rice polish, maize, wheat bran, *Colocasia* and green forages. The number of purchased feed ingredients used in Dimapur is relatively higher than in the other two districts (Table 13), possibly because of a vibrant market for pork, easy access to farm inputs and the purchasing power of the producers. In rural areas, if producers do not have sufficient rice polish or maize to feed year-round, they can source the feeds from milling units or local feed suppliers. There are two qualities of rice polish: no. I is obtained from the sheller mills and no. II from the huller mill. Due to milling differences, no. I rice polish is reported to be smoother in texture and more palatable than no. II, although awareness about the qualities of rice polish amongst producers in rural areas was not good because producers seldom buy it. In contrast to Assam, very few Naga people (less than 1%) prepare country liquor because their religion (Christianity) does not permit them to prepare or consume it. The women and children in pig-keeping families are generally active in procuring piglets and feed.

Veterinary services

There is one veterinary hospital in Dimapur district, two in Mon and four in Phek. There were private veterinary clinics in Dimapur and Kohima towns but not in Mon and Phek districts. Veterinary medicines were not sold in human clinics. In case an animal is sick, producers have to rely on government services and supplies that are often inadequate. From the private veterinary clinics in Dimapur and Kohima, it was understood that the highest sales were of dewormers, mineral and vitamin mixture and antibiotics. Swine fever vaccine was hardly available in the clinics or through government offices.

3.3. Projections of demand and supply of pork

Information from the field surveys and secondary data showed that Nagaland has a large deficit of slaughter pigs relative to its current consumption (Table 12). Pork retailers, pork and live pig wholesalers and pig producers in all three districts indicated that current

demand for pork was only partially met by supplies from within the state and that there was a significant dependence on outside supplies.

The main Dimapur-based suppliers of imported slaughter pigs to Nagaland indicated that 3–4 years ago they used to procure about 10,000 slaughter pigs per month from northern Indian states like UP and Harayana to satisfy demand from pig-deficit districts in Nagaland (Dimapur, Kohima, Phek, Zunehobto and Mon). As at June 2007, they procured only about 1000 pigs per month (pork wholesalers and retailers indicated about 5000 pigs per month), which were only sufficient to meet the requirements of Dimapur and Kohima districts. Wholesalers reported that increased demand for pigs in Northern India had resulted in higher procurement prices. Transport costs, including ‘hidden expenses’ (bribes at check points), had also risen such that the total cost of INR 280,000–300,000 for 40–45 pigs (including INR 70,000 for transport) was much less remunerative. Consequently, they have significantly reduced the number of pigs they import into Nagaland.

Pork retailers who were interviewed in May and June 2007 said that demand for pork in Dimapur and Kohima districts was growing more slowly, possibly because of the existing large consumption base, the influx of people from outside the state (who do not traditionally eat pork) and an inadequate supply of slaughter pigs. In Mon and Phek districts, consumption of pork has decreased substantially in the recent past mainly because of the lack of supply of slaughter pigs from external sources. Almost all pork retailers in both districts have stopped selling pork because of the lack of pigs. Nevertheless, the shortage of supply has not affected the price of pork. This is because the market price is controlled by the municipal and village councils and the town council committees. Other reasons are the low purchasing power in rural areas and the availability of other sources of meat, including that gathered from the forest.

Pork wholesalers in the New Market, Kohima town slaughtered 80–100 pigs per day (2500–3000 pigs/month) to meet the requirement for pork sold by retailers in the town; all the pigs were procured from Dimapur pig wholesalers. Therefore, it can be presumed that the figure of 1000 imported pigs per month stated by the pig wholesalers in Dimapur does not reflect the real situation. Taking into account the slaughter of pigs for Dimapur district, the actual figure should double that reported. The veterinary officer at the Assam-Nagaland

Livestock Check Post reported that although taxes are paid for the 800–1000 pigs that are brought to Nagaland every month, many more slaughter pigs enter the state without being passing through the check post. Given the large number of entry routes into Nagaland, it is difficult to estimate the number of slaughter pigs imported from Assam. However, it seems reasonable to suggest that 6000–7000 pigs per month are imported into the state.

Mon district is experiencing a severe shortage of slaughter pigs, mainly because of its decreased pig population which reflects a 27% decline between the 1997 and 2003 censuses (Table 14). The current lack of supply from UP and Haryana and an inadequate supply from Assam has aggravated the situation. Consequently, unlike two to three years ago, there is no regular outlet for selling pork in Mon town. The pork retailers in Mon reportedly had to reduce their businesses because of the shortage of externally-sourced slaughter pigs and the difficulty of locating and transporting local pigs given the poor roads and transport facilities. Thus, consumers in Mon have been forced to shift their preference from pork to beef which is readily available and cheap.

Table 14: Estimates of pig population and percentage changes in 1997 and 2003 in Nagaland and the surveyed districts

Location	Pig population 2003			1997 population	% change 2003–1997
	Indigenous	Crossbred	Total		
Dimapur	47,153 (32)	98,123 (68)	145,276	137,576	6%
Mon	15,007 (40)	22,167 (60)	37,174	51,246	-27%
Phek	32,449 (53)	28,812 (47)	61,261	28,487	115%
Nagaland			644,214	571,176	12%

Percentages in parentheses

Source: Livestock census (2003) and VAHD, Government of Nagaland (1997)

A few years back, outside sourcing of slaughter pigs in Phek was prohibited by the Chakhesang Public Organization and Tribal Ho Ho in order to stimulate pig production in the district. Estimates from the 1997 and 2003 latest censuses indicate that the official pig population in the district has more than doubled (Table 9). However, it appears that this increase has not been sufficient to meet local demand. Former pig traders in Phek town said they used to slaughter 30–40 pigs per day but now slaughter only 1–10 pigs due to the absence of externally-sourced pigs; these pigs are marketed by their producers.

It is difficult to estimate the volume of pork sold in the surveyed districts because of the uncertainty of market information and the localized nature of most slaughtering (rather than through daily or weekly markets as in Assam). Based on 2007 estimates of human population and the observed pattern of pork consumption, preliminary estimates of annual per capita pork consumption in Dimapur, Mon and Phek districts are 10.56 kg, 1.97 kg and 5.28 kg, respectively. The VAHD 2004–05 report gives the total annual production of pork (in thousand tonnes) in Dimapur, Mon and Phek districts as 6.97, 1.67 and 2.75, respectively, translating to annual per capita pork consumption of 18.28 kg, 5.20 kg and 16.25 kg for the respective districts. These estimates are much higher than those of the NSSO round of 1999–2000 (Table 10) and those from our study. The higher estimates from the VAHD statistics may be because imported slaughter pigs were available in 2004–05.

In order to estimate the requirement for pork in 2010 in Dimapur, Mon and Phek (Table 15), the calculations were based on the following assumptions:

- All the households in surveyed districts consume pork.
- Each household in Dimapur, Mon and Phek currently consumes, respectively, an average of 4, 0.75 and 2 kg of pork per month (based on our interviews with consumers, traders and village headmen).
- Pork consumption by existing consumers will increase by 10% between 2007 and 2010 (based on the increased trend of consumption as reported by market agents).

The requirement for pork in 2010 (in thousand tonnes) was estimated at 6.60, 1.04 and 1.21 for Dimapur, Mon and Phek, respectively, resulting in a per capita consumption of 10.55, 1.98 and 5.27 kg per annum. To meet this increased demand for pork, 87,000, 13,000 and 16,000 slaughter pigs will be required in 2010 in Dimapur, Mon and Phek, respectively, up from the current estimated production of 70,000, 11,000 and 14,000 (Table 15).

Table 15: Estimates of demand for and supply of pork in 2007 and 2010

Variables	Dimapur		Mon		Phek	
	2007	2010	2007	2010	2007	2010
Projected human population	505,984	625,604	426,228	527,140	201,877	230,441
No. of households (avg size 5)	101,197	125,121	85,246	105,428	40,375	46,088
Av. cons. pork kg/month/hh	4	4	0.75	0.75	2	2
Current pork requirement kg	4,857,446	6,005,798	767,210	948,852	969,010	1,106,117
10% increase in no. of consumers	485,745	600,580	76,721	94,885	96,901	110,612
Revised pork requirement kg	5,343,191	6,606,378	843,931	1,043,737	1,065,911	1,216,728
Slaughter pigs (av. 76 kg) required to produce the pork	70,305	86,926	11,104	13,733	14,025	16,010
Projected total pig population	151,175	155,755	30920	26930	122849	207020
Slaughter pigs (if 30% of pop. slaughtered annually)	45,353	46,727	9,276	8,079	36,855	62,106
Estimate of pork produced from local population	3,446,790	3,551,214	704,976	614,004	2,800,957	4,720,056
Gap in pig requirement	10,791	20,809				
Procurement by Meghalaya wholesalers	5,200	5,200				
Gaps in requirement of pork	-1,896,401	-3,055,164	-138,955	-429,733	1,735,047	3,503,328
Surplus/deficit of pigs/year	-24953	-40200	-1828	-5654	22830	46096
Surplus/deficit of pigs/month	-2079	-3350	-152	-471	1902	3841

The 2003 livestock census in Nagaland reported that the pig population in Dimapur, Mon and Phek was 145,276, 37,174 and 61,261, respectively. If it is assumed that the trend in the growth of the pig populations remains the same as during 1997-2003 (Table 14), the estimated pig populations in 2007 will be 151,175, 30,920 and 122,849 for Dimapur, Mon and Phek, respectively (Table 15). This gives a pig-to-person ratio of 290:1000, 70:1000 and 600:1000, respectively, compared to the NSSO estimates of 471:1000, 143:1000 and 413:1000. Clearly, Mon has a much lower concentration of pigs than the other two districts. Information from the field surveys suggested that the growth rate of the pig population in Phek during 1997–2003 was much lower than the 115% indicated by the census results. It is also very unlikely that the population in Phek will grow quickly by 2010. Therefore, the estimated pig-to-person ratio for the district is probably too high and it will not be possible to produce an additional 46,000 pigs above current level of

production. If we project the current growth rate of the pig population in Dimapur and Mon districts to 2010, there will be a deficit of about 40,000 and 6,000 pigs per annum, respectively, between projected demand and supply from local production (Table 15). For production within the districts to meet the projected deficits, at least 20,000 additional families or individuals would need to increase their scale of production and/or productivity.

3.4. *Food safety issues*

In Nagaland, as elsewhere in the NER, there is little or no formal infrastructure for slaughter of pigs or display of pork, which raises concerns about public health issues related to food safety. Pork is sold generally at the roadside or in a field displayed on a bamboo or wooden platform or on the ground covered with a gunny bag, plastic sheeting or paper. Invariably, there were no facilities for hygienic slaughter of pigs or sale of pork; only Dimapur town had a public concrete, cleanable structure for slaughtering pigs. The practice of slaughtering diseased pigs and selling the meat to consumers also poses serious risks to human health.

These health risks are generally addressed through publicly-funded veterinary and meat inspection services for retail, wholesale and slaughter facilities that are particularly relevant to urban markets. The municipal councils of Dimapur and Kohima reported that there were 35 and 18 licensed pork retailers in the respective towns and that the number of unlicensed retailers was probably higher. The informants at both councils said that it is difficult to bring the unlicensed pork retailers under the ambit of the regulations because of the temporary nature of their businesses operations and lack of cooperation from the public. Further, ante and post mortem inspections of slaughter pigs and of pork were not carried out regularly due to the lack of an organized slaughterhouse (except in Dimapur where a small slaughterhouse was being commissioned), inadequate physical and human resources and the absence of proper regulation. As a result, the hygienic quality of pork sold in the market was not ascertained. Similarly, the possible risks to public and livestock health from pigs imported into Nagaland is a concern; key informants at the municipal council opined that although there is check gate in Dimapur to facilitate health checks by the government veterinary officer, in practice the inspection is not effective.

Although these risks to public and livestock health are real and could have major impacts, the lack of public awareness has resulted in few improvements in the way pigs are slaughtered and how the pork is prepared and presented for sale. These deficiencies in public health measures should be addressed through a risk assessment along the production-to-consumption chain in order to systematically analyze the traditional practices of marketing and slaughter of pigs and sale of pork. Such systematic studies would identify the critical intervention points for improving hygiene and food safety and safeguarding public health. A public awareness campaign should also be mounted to advise consumers on how to improve food safety when buying and cooking pork.

A specific public health concern was identified during the field surveys; veterinary officials, pig traders and producers repeatedly reported that some pig rearers in Nagaland (especially in Phek and Kohima districts) used medicines to increase the growth rates of their pigs. The medicines were supplied from Manipur and Burma and one was suspected to be a corticosteroid. The medicine caused the pigs to deposit fat quickly but when they were slaughtered, the fat 'dissolved rapidly' and produced an off-flavour. Some consumers feared consuming the pork because of possible health hazards. This public health concern also merits systematic study.

A specific food safety risk associated with pigs is infestation by worms, particularly the zoonotic tapeworm (*Taenia solium*) which can be transmitted among humans and between humans and pigs causing neurocysticercosis. Humans can be infected with tapeworms after eating infected pork. However, because of the Naga traditional ways of cooking pork, the chances of tapeworm infection in humans is greatly reduced. Thus, unlike in Assam, consumers in Nagaland were not very concerned about worm infestation in pig and did not routinely examine pork before purchase for the cottonseed-like follicles (measly pork) that indicate the presence of *T. solium*. Similarly, pork wholesalers and retailers did not check thoroughly for indicator symptoms (Mutua et al. 2007) when procuring slaughter pigs from producers.

3.5. Main issues in consumption and marketing

From the information gathered during the appraisal and the discussion in the section above, we can draw various conclusions about the consumption of pork and the marketing of pigs in Nagaland and highlight some of the key issues.

1. Backyard pig keeping is an integral part of the livelihoods and cultural practices of the Naga people; as a result, pork is their preferred choice of meat.
2. Production from backyard units is low and much of the market for pork – particularly in Dimapur and Kohima where most urban dwellers live – has depended on slaughter pigs purchased from outside the state.
3. Imported supply is now at risk because higher prices of slaughter pigs in source areas (mainly UP and Haryana states) are severely restricting the numbers imported by the wholesalers based in Nagaland's major urban centres. As a result, there is an acute shortage of slaughter pigs.
4. The demand/supply scenario for pork was further complicated in Phek where the local tribal organization has banned the import of slaughter pigs as a means of stimulating local production. However, it is too early to assess the response from existing local producers or to know if there are significant numbers of new entrants to pig production.
5. As a result of the general shortage of slaughter pigs, pig wholesalers and pork retailers have pressured the local government committees responsible for controlling prices to increase the price of pork. Any price rise has to be seen in the context of pork prices that were said to have risen over the last ten years by about 12% in real terms in Dimapur and Mon districts and by nearly 50% in Phek district.
6. The response of some consumers to the shortage of pork and its higher price has been to shift to alternative sources of cheaper meat, e.g. beef and broiler chicken, or to substitute pork with protein-rich animal sources gathered from CPR.
7. The preference for pork over other meats was based on taste rather than price. Fresh pork from local (rather than imported) pigs was the major quality attribute sought at purchase. There was no price difference between lean and fat pork though pork from indigenous pigs was more expensive than that from crossbreeds.

8. Demand for pork was higher during winter than summer and at various festivals. In rural areas, pork was consumed mainly on the day that a local producer slaughtered a pig.
9. Sales of processed pork products were minimal relative to fresh pork. The supply of processed pork was limited to a few shops in Dimapur and Kohima.
10. These initial findings on pork consumption suggest that more detailed studies are required to better define and quantify consumer perceptions of quality – including aspects of taste, appearance and composition – and to estimate to what extent and under what circumstances other meats like beef and broiler meat will compete with pork. Particular attention needs to be given to estimating local demands for household consumption and at social events (including festivals) and the demand from urban centres.
11. More reliable estimates of the current and projected demand for pork and competing products will better inform strategies for investing in pig production and marketing.
12. A major concern is food safety. Current sales of pork in Dimapur and Kohima are through informal unhygienic markets that have inadequate infrastructure and are served by under-resourced institutions which cannot ensure consistent standards of meat hygiene and food safety.
13. Deficiencies in public health measures should be addressed through a structured risk analysis along the production-to-consumption value chain. An assessment of local slaughter practices will be central to the risk analysis given that in Nagaland, producers slaughter a high proportion of pigs and sell the meat directly to consumers. The systematic study will identify the requirements for improved infrastructure and for training of all participants in meat hygiene and food safety. These requirements should be based upon consumers' needs, perceptions and their willingness to pay for improvements in hygiene.
14. Although there is concern amongst technicians about measly pork (pork infestation with the zoonotic tapeworm *T. solium*), traditional knowledge and food cooking practices appear to reduce the risk of adverse impacts on human health and pork consumption. Nevertheless, other zoonoses may pose threats to public health and thus merit review. Systematic government action plans should be prepared to address current and emerging zoonoses (e.g. Japanese encephalitis).

15. The use of growth promoters (possibly corticosteroids) supplied from Manipur and Burma should be studied systematically to identify their composition and assess their effects on pig performance of pigs and human health.
16. Marketing systems for piglets and slaughter pigs appeared to be efficient with attractive prices for producers and reasonable margins for market agents. There was some rent-seeking ('hidden expenses' or bribes) by police which added to the cost of transport, increased the cost of meat to consumers and reduced profits to producers and traders. An awareness program for all participants in the market chain – producers, traders, police and other officials – is required to address this problem.
17. Given the significant deficits in pork, slaughter pigs and weaner piglets in Nagaland, improvements in the supply chain linking producers to input- and output-market agents and pork consumers can be an important source of employment generation and small-scale business.
18. Key improvements to the market chain should include border health inspections and quarantine periods to minimize the risk of disease introduction from the piglets, growers and slaughter pigs imported into Nagaland from Myanmar and the neighbouring states of Assam and Manipur.

4. Pig production systems

Backyard pig keeping is an integral part of the livelihoods and cultural practices of the Naga people. Pig keeping can therefore serve as an entry point for publicly or privately financed interventions to improve incomes and generate employment. For the interventions to be effective, it is important to understand current pig production systems and how these systems are changing. The field surveys were designed to gather this information.

4.1. Ethnic and socio-economic distribution

As expected, most surveyed households kept one or more pigs (Table 16). Fattening (feeding of pigs for slaughter) was more common than breeding or breeding and fattening combined, especially in Mon. Whereas indigenous pigs are dominant in the remoter areas of Nagaland, such as the Mon and Wakching clusters in Mon district, crossbreeds are the majority elsewhere (Table 16). In Dimapur district, crossbreeds have all but displaced the indigenous population.

Table 16: Socio-economic and production characteristics of the pig systems in Nagaland

Districts	Clusters	Ethnic groups	Pig-keeping households (%)	Breed type (%)		Herd type (%)		
				Indigenous	Crossbred	Breeding	Breeding & fattening	Fattening
Mon	Mon	Konyak	60	80	20	15	10	75
	Wakching	Konyak	60	80	20	10	10	80
	Tizit	Konyak	60	20	80	15	10	75
Phek	Meluri	Putsuri	80	40	60	20	15	65
	Kikruma	Chokri	90	30	70	5	5	90
	Pfutsero	Khezha	90	30	70	10	10	80
Dimapur	Medizephema	Angami	80	5	95	30	10	60
	Neuland	Sumi	90	-	100	30	10	60
	Dimapur	Various*	80	-	100	30	10	60

* Sumi, Lotha, Ao, Angami, Rongmai, Zeliang, Chakchang

Source: Interviews with traders at weekly markets

All ethnic groups in the surveyed areas considered that rearing a few pigs was an important supplementary source of livelihood. However, less than 1% of households reared pigs as

their primary source of livelihood. These households were mainly in Dimapur town where most pork consumers in Nagaland are concentrated. The town is also relatively rich in feed resources suitable for pig production. In these few households, pig production largely consisted of small-scale, backyard 'low-input low-output' systems.

Pig production played important socio-economic roles amongst all the ethnic groups in the surveyed clusters. In all households, pork was an essential commodity for religious and social festivals. The households also considered pig keeping an important income-generating activity. As noted in Section 3.2.1, crossbred pigs were often reared for more than two years to live weights of 150–220 kg before being slaughtered or sold; the producer is paid at least INR 15,000. For indigenous pigs, the rearing period may be 4–6 years and the live weight 40–80 kg. The social prestige of having a heavy pig at social and religious functions influences these fattening practices. Rearing of pigs solely for home consumption was restricted to a few wealthy households who kept indigenous pigs.

Resource availability affected the proportion of households that reared pigs. In Mon where only 60% of households kept pigs, some households said that they were too poor to purchase or feed piglets. Their immediate need for cash income resulted in their labour being dedicated to agriculture, daily-paid casual labour and other activities that generated income in the short term. These commitments restricted the availability of adult labour to manage pigs because only the very elderly remained home during the day. The interviewed households in Mon also pointed out that the district's pig population is mostly indigenous except in the Tizit cluster (Table 16) and their slow growth performance gave poorer returns than other income-generating activities.

While both men and women played active roles in managing the pigs, women and children were mainly responsible and spent 1.5–2 hours per day feeding the pigs and carrying out other tasks. Hired labour was not used by the surveyed families who were happy to rear pigs which, with little investment, earned them a good income when sold or slaughtered. Women reportedly got more satisfaction from investing time in pig keeping than in weaving or handicraft activities.

Given this interest in pig keeping, some poor households in Mon and Phek were reported to use the *adhiary* ('half') system, a type of share-cropping. In this system, a person with money will procure piglets and give them to poor farmers to feed and manage. Any profit is divided equally when the pigs are sold but if a pig dies in the course of rearing, the loss is shared.

Lack of finance was the main factor that limited pig rearing for most producers in Mon and Phek. Except for a few local money lenders, there were no other credit sources in the villages. Formal banks and financial institutions, including insurance companies, were not keen to assist pig producers.

4.2. *Production systems and their classification*

The pig production systems in surveyed districts of Nagaland can be classified broadly into two management types: penned and scavenging. The herding system of pig management which is practised in some parts of South and Southeast Asia is not practised in Nagaland.

4.2.1. Penned system

In Phek district, 80% of pig-rearing households used the penned system. In Dimapur and Mon districts, 98% of pig-rearing households managed 1–15 pigs under the penned system with most households keeping between one and three pigs. Producers were reluctant to rear breeding pigs because of the amount of labour required and inadequate knowledge on management of breeding pigs.

Pigs are housed in a small bamboo or timber pen that is roofed with tin or jungle leaves. The floor is concrete or a bamboo/wooden platform. Although costlier, a concrete floor lasts longer and has no annual recurring expenses for repairs unlike bamboo/wooden platforms. Damaged platforms also caused physical injury to the pigs. Nevertheless, a large section of producers preferred platform floors because of the uneven topography of the household backyards and ease of cleaning. In India, pigs reared on mud floors achieved higher weight gains than those reared on concrete floors (Jain et al. 2003). Kumar et al. (2004c) found that piglets raised on a concrete floor with an asbestos roof performed better

than those raised on an earthen floor with a tiled roof. Our study did not assess the comparative performance under backyard conditions.

In Dimapur district, the pigs were kept inside the pen day and night and consistent with the report by Bora (1984), they were given feed and water twice or thrice a day. Herd sizes were generally larger than in Mon and Phek, possibly because of better access to farm inputs and markets and because households were generally better off economically. However, hired labour was not used to manage the pigs. In Mon and Phek, feed and labour constraints meant that households were not keen to expand their existing units. Exceptions were the households with only one or two piglets who said that they were likely to buy one or two more piglets for fattening.

About 98% of pig-rearing households in Mon and 80% in Phek kept their pigs in pens (Table 17). Pig herds in Mon and Phek districts were composed of one to three pigs per household, fewer than the number kept in Dimapur households. An important factor in the shift from scavenging to penning in Mon was the ban on scavenging pigs imposed 15 to 20 years back by the Konyak Students' Union. The ban on scavenging pigs in Phek was imposed only recently. In both districts, the use of locally available materials to construct the pens makes it less costly than in Dimapur. Concrete floors and tinned roofs are rare, possibly because households are poorer, construction materials are scarce and the cost of transport high. There are even fewer brick and cement houses with tinned roofs in the rural areas of Mon and Phek.

4.2.2. Scavenging

Fifteen to twenty years ago, scavenging was the traditional method of pig management among tribal households, irrespective of ethnic or geographical location. More households kept sows which might be served by wild boars and farrow in the jungle. However, management is changing from scavenging to penning because of the ban imposed by village councils and based on advice from Church leaders to reduce the unhygienic conditions created by scavenging pigs.

Only 2% of pig-keeping households in Dimapur and Mon districts keep scavenging pigs, mainly in the remote hilltop villages. In Phek, 20% of households keep scavenging pigs. In the Meluri cluster of Phek, where the village councils recently banned scavenging and many producers continue to rear scavenging indigenous pigs, households complained of lack of space in their small homestead plots in which to construct pens.

The productivity of indigenous scavenging pigs is low. However, households preferred to rear indigenous pigs because of their feeding costs are lower and they produce better-tasting pork. There were also no problems in serving a sow as sows were generally mated by their male offspring which reach sexual maturity at a very early age, a phenomenon confirmed by the state veterinary department.

4.2.3. Performance of indigenous and crossbred pigs

Table 17 summarizes the performance of indigenous, low-grade crossbred and high-grade crossbred pigs reported during the field surveys. Farrowing intervals for penned sows were reported as 6–8 months, similar to the 6.5 months recorded on the College of Veterinary Science in Assam farm under the All India Coordinated Research Project on Pig (AICRPP). In the same project, 50:50 Hampshire-indigenous crossbreeds attained about 90 kg in 10 months, similar to the field performance of 80–90kg for high-grade crossbreeds during the current study. This reflects more intensive feeding and other observed management practices, e.g. in Dimapur district. In the AICRPP, average litter sizes at birth (6.91) and at weaning (5.91) were lower than those reported by our study informants (7–16 and 6–10, respectively). Breed differences may explain some of the variation. Most pigs kept by Nagaland producers are Bilati/Burma crosses which are reported to give larger litters.

While the AICRPP results indicated that piglets could be weaned at 28 days of age, the reported field practice was 50 days or later (Table 17). Research in Assam indicated that better post-weaning growth could be achieved when piglets are weaned at 42 days rather than at 28 or 56 days (Gogoi 2006). The same study showed that weaning at 42 days did not adversely effect piglet survival. As expected, the growth of indigenous pigs was much slower than crossbred pigs, reflecting the lower genetic potential of indigenous pigs and

the scavenging system of production on which most depended. Rohilla et al. (2000) have reported comparative carcass performances of exotic and Naga pigs.

Table 17: Reported performances in the three pig genotypes

Production traits	Indigenous	Crossbreed	
		Low-grade	High-grade
Farrowing interval (months)	6-8	7-9	6-8
No. of litters in lifetime	4-6	4-6	4-6
Litter size at birth	2-6	4-10	7-16
Litter size at weaning	1-4	3-8	6-10
Age at weaning, days	90-105	60-120	50-60
Fatteners live weight at 10 months (kg)	15-20	30-40	80-90

Source: Field study

4.3. Breeding and reproductive management

4.3.1. Breeds, crossbreeds and their origins

Market agents and producers reported that previously the pig population was almost entirely indigenous. However, with the growth in demand for pork and its role in income generation, indigenous pigs were gradually substituted with crossbred pigs imported from the neighbouring states of Assam and Manipur and from Myanmar. Piglets imported from Assam are mainly Large Black crosses, while those from Manipur and Burma are generally Burma/Bilati crosses. Based on the physical characteristics and the reported performance of pigs in the surveyed districts, the growth of crossbred pigs in Dimapur and Phek districts was much better than in Mon district. Producers in Dimapur and Mon said that crossbred piglets procured from Assam did not grow well, possibly because of their poor genetic potential for growth and lack of adaptability to the cooler climate of Nagaland. In the Tizit cluster of Mon district, 80% of the pigs were crossbreeds procured from traders from Assam. In contrast, in the Mon and Wakching clusters which are far from the border with Assam and situated at higher altitudes, only 20% were crossbreeds. The producers said that in the cooler areas of Mon and Wakching, two-month-old piglets bought from Assam did not thrive and suffered from high mortality, a clear indication of the importance of genotype-environment interactions in pig production in Nagaland.

The current population of crossbred pigs is mainly Burma/Bilati crosses along with some Large Black pigs mainly in Mon district and Large White/Yorkshire crosses in Dimapur. Large White/Yorkshire and pure-bred exotic pigs were not common. There is a difference of opinion amongst the R&D agencies about the actual type of pig being procured from Manipur and Myanmar. Although the local people called it a 'Bilati/Burma' pig, an ICAR scientist in Nagaland and a VAHD official called it 'Large Black' while in Assam it was reportedly from Nepal and called 'Ghungroo'. In contrast to the short and curved snout of the Burma/Bilati pigs, the Large Black in Assam was characterized by its long, straight snout, undulated ears and an elongated body.

Amongst the general population of crossbreeds and especially in Mon, there were pigs with the characteristics of two or more breeds, a probable consequence of the apparent haphazard crossbreeding practised in Assam (Deka et al. 2007). Given the uncertain origin of many pigs, it was not possible to ascertain their genetic composition or to conjecture which crossbreeds and crossbreeding system(s) might give optimal performance under the prevailing penned production system and the associated feeding practices. Nevertheless, it seems reasonable to support the results of the research in Meghalaya which indicated that 87.5% of upgraded pigs were more suitable for smallholder producers than pure Hampshire, Large Black or 75% upgraded pigs (Das et al. 2005), although the field validity of the latter may be questionable. Moreover, the field surveys produced no evidence of systematic crossbreeding or organized selection of breeding boars. Neither the government nor NGOs had carried out any training programs on crossbreeding or within-breed selection. Nevertheless, the adoption of crossbreeds to replace indigenous pigs, together with the shift from scavenging to penning, has been the major management change in pig production in the surveyed districts.

4.3.2. Sources of breeding and fattening stock

Pig producers in Nagaland bought breeding and fattening stock from three sources: small-scale producers who kept sows, VAHD state pig farms and from outside the state (Table 18). Between 2006 and 2007, only 1370 piglets were available from the VAHD breeding farms in the three surveyed districts. Most producers purchase crossbred piglets from nearby households where they can check the health status and age of the piglets, discuss

the price and take into account their previous experience of rearing similar pigs. Households in Phek and Dimapur prefer to buy imported piglets from Manipur and Burma, while those in Mon and Dimapur import piglets from Assam (Table 18).

Table 18 : Sources of piglets and relative proportions in the three surveyed districts

Source	Dimapur	Mon	Phek
Small-scale producers	80	90	70
Assam	10	9	0
Manipur	10	1	20
Burma	0	0	10
VAHD breeding farms	<1	<1	<1

4.3.3. Reproductive and weaner management

Natural service is the only breeding method used by producers in the district; there were no reports of artificial insemination (AI). For crossbreeds, boars are used for breeding until three to four years old while sows are used for three to five years, producing four to six litters (Table 17). Thereafter the parent stock is usually replaced by its own progeny. Some households that used the penned system kept one to five sows and a breeding boar. Larger herd sizes were observed in Dimapur. Households that did not rear boars used one from other households in the village, paying INR 200 to 700 or one piglet (after weaning) for each service. Informants estimated that a boar gives five to 15 services in a month. Repeat breeding cases were rare.

The intensity of service is almost the same throughout the year, although producers prefer for pigs to mate during June to September so that litters are born during October to January and piglets are ready for sale during December to March when they fetch higher prices. Research on seasonal effects on litter size and weights has been reported from Assam but the results are inconsistent; some suggest that the largest and heaviest litters at birth and at weaning occur when sows farrowed during the post-monsoon season (Phookan 2002; Deka et al. 2004; Roychaudhury 2005) while others showed maximum litter size in the rainy (Saha 2002) and pre-monsoon seasons (Kalita et al. 2001).

Breeding is not a problem for indigenous pigs because on many occasions, male piglets serve their mothers even before weaning. Consistent reports from producers and veterinary officials stated that male indigenous piglets attain sexual maturity at 2–3 months of age. This inbreeding within the indigenous pig population may account for problems like atresia ani, hernia and closure of eyelids that are increasingly common in the population.

In contrast to Assam, early weaning was not common in Nagaland. Only a few breeders in Dimapur practised it, especially when they could not meet the demand for piglets. Breeders were not aware of any recommendations relating to age at weaning.

4.4. Management of feeding

In the small-scale backyard pig production that is typical of all districts of Nagaland, pig feeds are invariably the by-products of the staple paddy (rice), maize, *Colocasia*, vegetables and gathered forages (Table 19). Pigs therefore serve to convert crop by-products and other feed resources of low or no value into high-value pig live weight and pork.

Paddy, maize, *Colocasia* and tapioca (cassava) are cultivated in the three surveyed districts. In Dimapur, paddy is the main crop because plain land is available, while the *jhum* and terrace plots in Mon and Phek produce maize, paddy and *Colocasia*. Thus, feeding practices in the clusters varied depending on the cropping system, season and, to a lesser degree, availability of milling by-products and other feeds in the local market (Table 19).

Pig producers in Dimapur fed their pigs on rice polish, broken rice, crushed maize, wheat bran and oil cakes. Rice polish, rice bran and crushed maize are products from home-grown crops, while wheat bran and oil cakes are bought from the local market. These purchased feeds, which are only used by some households, are procured from three wholesalers and one feed mill in Dimapur town. Households in the Neuland cluster cultivate tapioca, *Colocasia*, sweet potato, pumpkin, gourd and other forages in their backyard to feeding their pigs. Of all the cultivated feed crops, sweet potatoes were most versatile because the foliage can be harvested several times a month, does not require cooking and is very palatable for the pigs. Additionally, the sweet potato crop lasts for three years when transplanted. By growing *Colocasia*, tapioca, maize and sweet potato in

the same plot, Neuland pig keepers reported that they could meet their year-round requirement for forage and that the availability of quality feed in the homestead lowered the cost of feeding their pigs. Households that did not cultivate feed crops gathered forages from the forest and other CPR. For example, in Dimapur town, pig producers collected forages from both sides of the railway lines.

Table 19: Feeds used for pigs in the surveyed clusters of the three sample districts

District	Cluster	1st major component	2nd major component	3rd major component	Occasional feed resources
Dimapur	Dimapur	Rice polish, broken rice	Maize, wheat bran, forages*	<i>Colocasia</i> , tapioca, hotel and kitchen waste	Residue of country liquor (Doxi), oil cakes, fish meal
	Neuland	Rice polish, broken rice	Maize, <i>Colocasia</i> , forages*	Papaya, sweet potato, tapioca, pumpkin, kitchen waste	Wheat bran, fish meal, oil cakes
	Medizephema	Rice polish	Maize, forages*	<i>Colocasia</i> , tapioca, kitchen waste	Wheat bran, oil cakes, fish meal
Mon	Tizit	Rice polish	Maize	<i>Colocasia</i> , forages*, kitchen waste	Wheat bran
	Mon	Rice polish	Maize	<i>Colocasia</i> , forages*, kitchen waste	Wheat bran
	Wakching	Rice polish	Maize	<i>Colocasia</i> , forages*, tapioca, kitchen waste	Wheat bran
Phek	Kikruma	Rice polish, broken rice	Forages*	Maize	Wheat bran
	Pfutsero	Rice polish, broken rice	Maize	Forages*	Residue of country liquor
	Meluri	Rice polish	Maize	<i>Colocasia</i> , tapioca, forages*	Residue of country liquor

*Forages: from the jungle and other common property resources

Source: Primary household survey

Pig producers in Mon district used rice polish, maize, *Colocasia* and tapioca as the major feed ingredients (Table 19). In addition, some households procured small quantities of wheat bran. Almost all the feed ingredients were produced by the household, although

backyard cultivation of *Colocasia*, tapioca or sweet potato specifically for feeding pigs was not common. Instead, food crops were grown in the *jhum* plots to feed the family and the residues were fed to the pigs. In Mon town, five or six feed suppliers sold wheat bran and other feed ingredients to poultry farmers. These suppliers reported that sales of feed ingredients, especially wheat bran, had increased in the past 5–10 years.

Feeding practices in Phek district were similar to those in Mon. Household crop by-products were the major source of feed. Cultivation of feed crops in backyards was not common, possibly because of the small size of the homestead plot, and few feeds were purchased. Some producers, especially breeders in Mon and Phek, reportedly fed eggs to breeding boars before and after natural service.

Deka et al. (2007) report that in Assam, where the majority of households are Hindu, the residue of rice-based country liquor (*juguli*) is the major source of feed for pigs. However, in Nagaland, where most families are Christian, it is not customary to prepare and consume country liquor. Exceptions are the Rongmai and Zeliang communities, which are Hindu, which prepare the liquor (*Doxi*, *Khe chesa* or *Aji chi*) and some households in the Dimapur, Pfyusero and Meluri clusters. In common with the practice in Assam, these groups prepare country liquor and feed the residue to pigs (Table 19).

The seasonal availability feeds is an important factor that affects feeding practices (Table 20). The major feed source, rice polish, tends to be scarce and more costly during July to October when the old stock of paddy is exhausted and the new crop has not been harvested, while maize tends to be scarce between March and August. When rice polish and maize are scarce, pigs are fed more *Colocasia* and forage.

Between January and June when *Colocasia* leaves are not available, its tubers are used as pig feed (Table 20). *Colocasia* is a common human food and pig feed in other parts of the tropics. The Australian Centre for International Agricultural Research has carried out research to improve taro production. Results of this research could be relevant to Nagaland and other states in the northeast of the country and elsewhere.

<http://www.aciar.gov.au/web.nsf/doc/ACIA-6NE7TR>).

Table 20: Seasonal availability of feeds in Nagaland

Feeds	Jan- Feb	Mar- Apr	May- Jun	Jul- Aug	Sep- Oct	Nov- Dec	Fresh or cooked
Rice polish/broken rice	A	A	A	Sc	Sc	A	Fresh/cooked
Maize	A	Sc	Sc	Sc	A	A	Fresh/cooked
Wheat bran	A	A	A	A	A	A	Fresh/cooked
Oil cakes	A	A	A	A	A	A	Fresh/cooked
<i>Colocasia</i> leaves	NA	NA	NA	A	A	Sc	Cooked
<i>Colocasia</i> tubers	A	Sc	Sc	Sc	Sc	A	Cooked
Tapioca	A	Sc	Sc	Sc	A	A	Fresh/cooked
Sweet potato	A	A	A	A	A	A	Fresh
Forages from CPR	A	Sc	A	A	A	A	Fresh/cooked
Water hyacinth	NA	NA	A	A	Sc	Sc	Fresh/cooked
Kitchen waste	A	A	A	A	A	A	Fresh/cooked
Hotel waste	Sc	A	A	A	A	Sc	Fresh/cooked
Jack fruit	NA	NA	A	A	NA	NA	Fresh/cooked

A: available; NA: not available; Sc: scarce; CPR: common property resources

Source: field study

Kitchen and hotel food waste were fed to pigs, especially in urban and peri-urban areas (Tables 19 and 20). Based on research in India, Singh (1986) recommends that the cost of feed can be minimized by substituting a ration with up to 50% of kitchen waste without adversely affecting growth performance. The availability of hotel waste may explain the significantly higher body weights of piglets maintained in peri-urban areas compared to rural areas of India reported by researchers (Kumar et al. 2005).

Feeds which are based principally on crop residues and gathered forages result in only moderate growth rates when fed at traditional levels to young crossbreeds (Table 17). The major feeds – rice polish and maize – are good sources of energy but the traditional diets fed to pigs are not balanced for energy, protein and minor nutrients, and without purchased supplements or additional home-grown feeds, growth rates at the different stages of the weaner-to-slaughter cycle will not improve (Yadav et al. 1994, Yadav et al. 1995; Kumar et al. 2002; Kumar et al. 2004b; Sailo 2005; Gupta et al. 2006; Kumarsean et al. 2006). Research has shown that, if supplemented, crossbreeds fed on local feed rations respond well in terms of growth rate (Yadav et al. 1994; Pal et al. 2000). As documented

by Deka et al. (2007), options that have been explored in NE India include buckwheat and various legumes (Gupta and Bujarbaruah 2005), maize grain up to 80% and rice polish up to 50% along with good quality vegetable protein and mineral mixture (Gupta et al. 2006), and raw sweet potato tubers of up to 40% dry matter (Yadav et al. 2005). Other studies carried out in Assam have examined factory tea waste (Chetia et al. 1991), garbage (Bora 1999) and cabbage (Assam Agricultural University 2005).

Presenting these options to pig producers through participatory methods to evaluate their fit relative to current crop systems and availability of household labour, land and other resources would be one way to move towards faster growth rates and increased throughput from existing backyard pig units. Other options should also be considered, such as ensiled sweet potato vines and tubers (Yadav et al. 1990; Anon 2005; Gupta et al. 2005; Peters et al. 2005; Beckmann 2006; Ilangantileke 2007), QPM (Consultative Group on International Agricultural Research 2005), forages and other feeds being researched by the International Centre for Tropical Agriculture and its partners in Southeast Asia (Chanphone and Choke 2003).

It must also be remembered that in these households where small-scale units use few purchased inputs, other demands on family labour, land and other resources may take precedence over improving pig growth rates, particularly if the level of risk associated with new feeds is unclear or unacceptable.

4.5. *Health management*

In these small-scale, backyard 'low-input, low-output' systems that characterize pig production in Nagaland, losses from diseases and preventative medicine practices were rare. Veterinary staff and pig producers cited the most important pig diseases as swine fever, internal worms, piglet diarrhoea, pneumonia, FMD, haemorrhagic septicaemia (HS) and mange. However, veterinary staff said that cases of FMD and HS were not very common. Conditions like hernia, retention of placenta, posterior paralysis and atresia ani were reported to be especially prevalent in indigenous pigs. Producers felt that the penned system of pig management (as opposed to scavenging) significantly reduced the incidence

of diseases. Parasitic infestation is more common when pigs scavenge or are tethered than when they are penned (Bandyopadhyay 2002).

Except for mortalities from swine fever and piglet diarrhoea, losses from other causes were few although deaths due to predators (especially tigers) were reported in the hilly areas of Medizephema cluster in Dimapur district. Piglet mortality was low and was mainly due to piglet diarrhoea and crushing by the sow. Several studies have suggested that indigenous pigs are highly susceptible to piglet diarrhoea and pneumonia (Pal et al. 2000). It has also been reported that the major causes of piglet mortality are diarrhoea, pneumonia, crushing, trembling death and non-specific disease conditions like debility and naval ill (Kalita 1996; Murugkar 1998). These findings are consistent with the reports from our interviews.

Veterinary staff reported that swine fever is prevalent at various intensities throughout the state and causes mortality. However, less than 1% of producers vaccinated their pigs against the disease, apparently because of inadequate knowledge of this preventive measure, poor availability of the vaccine and the fact that the vaccine, when available, comes in a vial of five or ten doses, more than required by most pig keepers. Veterinary staff also reported that in 2005, vaccinated pigs in Kikrumba cluster, Phek district were affected by an outbreak of swine fever (the vaccine was made by Bio Med); this discouraged producers from vaccinating their pigs. VAHD had limited stocks of swine fever vaccine and supply from private veterinary clinics was irregular. Given these circumstances and experiences, it was not surprising that most producers in Nagaland did not vaccinate their pigs against swine fever. Although the swine fever outbreak in Kikrumba was diagnosed through post mortem analysis, discussions with key informants revealed that except for post mortem analysis and examination of faecal material, no other laboratory tests were carried out to diagnose suspected diseases.

Other preventive measures were equally rare; less than 5% of pig producers in Dimapur district and less 1% in the other two surveyed districts dewormed their pigs. Additionally, feeding pigs with mineral and vitamin mixtures was not a common practice. Producers generally treated their pigs with traditional medicines (e.g. *ganja*, liquor, jungle leaves, honey, urine etc.) or human medicines if they were available. In Dimapur, richer farmers called a veterinarian to treat their diseased pigs at a cost of INR 50 to 100.

Given the low disease risks, the long distances to government veterinary hospitals, the irregular presence of veterinary doctors and the limited availability of veterinary medicines, it was not surprising that most pig producers did not visit the VAHD dispensaries that are the main source of formal veterinary services in the state. There are 27 dispensaries in total, seven of which are in Kohima, four in Phek and two in Mon. Each is headed by a veterinary assistant surgeon (VAS) working with two to three veterinary field assistants (VFAs) and support staff who treat the animals brought to the dispensaries and answer calls to homesteads. There were very limited supplies of medicines and vaccines in the dispensaries; pig producers generally received only advice from the VAS or First Aid. Veterinarians were not paid for their services; medicines in the hospital and vaccines should be bought from the market. It was only in Dimapur and Kohima towns that there were private veterinary clinics. In Mon and Phek, veterinary medicines were not sold in human clinics.

The surveys revealed a low level of awareness among producers on pig diseases and preventive measures. Research in India has shown that educational level, size of the farm, socio-political participation and exposure to mass media and extension agencies positively affected attitudes towards vaccination (Sasidhar 2001). However, government and NGO extension services were either very poor or absent in the surveyed areas. In some villages, VAHD had piglet propagation and comprehensive rural livestock extension service programs. NEPED implemented a pig development program in some villages in Mon and Phek districts. However, the knowledge-based components for motivation, training and monitoring and evaluation were said to require strengthening.

Of immediate concern is the practice by producers of slaughtering and selling diseased adult pigs in order to reduce financial losses. This practice represents a significant public health risk that needs to be addressed through public awareness campaigns and training for pig producers and local animal health workers.

4.6. *Main issues in production systems*

From the information gathered from the field surveys and secondary sources, various conclusions can be reached about the pig production systems in the three surveyed districts of Nagaland. There are also important issues that relate to the constraints to and opportunities for improving pig production for income generation and better livelihood security in the state.

1. Consistent with the hypotheses presented in Section 2.3, pig production in Nagaland is a small-scale backyard enterprise practised by all ethnic groups to fulfil socio-cultural obligations, generate income and accumulate capital. For most households, it is a source of supplementary, rather than primary, income. Specialized producers are mostly in and around Dimapur town. Income from pig keeping pays for essential household expenses (e.g. school fees) and provides some degree of financial independence to the women in the family.
2. Small-scale pig production generally consists of rearing one to three pigs. It depends on family labour (mainly women's and children's) and on other local inputs that are of no or low opportunity cost, e.g. crop by-products used as feed. As a result, production practices vary more by cropping system and access to farm inputs and markets than by ethnic group.
3. While most households keep a pig or pigs, the poorest families could not afford to rear pigs. These households represent an important social target for publicly-funded development interventions like hand-on-the-gift schemes and other credit mechanisms.
4. Production systems are changing. Fifteen to twenty years ago all pigs scavenged but nowadays, most are fed in pens. The other major management shift is the replacement in many areas of indigenous pigs by faster growing crossbreeds, a change stimulated by the increased demand for pigs and pork and the greater potential of crossbreeds for income generation.
5. The adoption of crossbreeds in areas with reasonable road infrastructure (and therefore with access to markets and supplies of crossbreeds) raises some important issues related to breeding. These include the need for:

- Phenotypic and genetic characterization of Nagaland's indigenous pig populations to inform the design and management of effective *in situ* and *ex situ* programs to conserve these valuable genetic resources.
 - Better understanding of the origins and relative performances of the crosses currently available in the state.
 - Cost-effective ways of making available to poor households and communities proven stock of the most competitive crosses.
6. To underpin these various actions, a breeding policy and action plan is required that recognizes the importance of genotype-environment interactions in pig production in Nagaland and, therefore, the need for area and production system specificity in breeding recommendations. This will in turn require a review of the current governance, objectives and performance of the government pig breeding farms and their re-orientation to better serve their clients.
 7. A notable feature of pig production in Nagaland is the low proportion of pig-rearing households that keep breeding sows. One result is a significant local deficit of grower pigs and weaners. Households claimed to have inadequate knowledge about and a lack of confidence in rearing a sow as it was reportedly more laborious and time-consuming than feeding a fattening pig.
 8. This suggests that cropping system-based interventions to increase the availability of feed resources coupled with training programs on breeding stock management will stimulate more households to keep breeding sows and therefore increase the availability of grower pigs and weaners.
 9. Cropping system-based interventions will also be central to increasing the availability of local feed resources to improve the productivity and profitability of pig fattening. Current feed availabilities and feeding practices restrict the growth rates of pigs, which in turn reduces feed conversion efficiencies and limits the number of pigs that a household can produce annually.
 10. The major factors limiting the scale and efficiency of pig production are the limited quantity and quality of locally available feed resources – mainly from the household's crop by-products – and the lack of knowledge about how they can be best combined in balanced rations to give faster and more efficient live weight gains. Participatory methods will be required to evaluate the fit of improved feed resources and feeding practices relative to the availability of household labour,

- land and other resources, and to assess their impacts on productivity and profitability.
11. Interventions that should be promoted are the non-conventional feed resources (e.g. rice bean *Vigna umbellata* and legume forages) and improved varieties (e.g. sweet potato, tapioca, *Colocasia*/taro, QPM) documented by various R&D organizations and practised by some producers in Dimapur district.
 12. One recommended intervention stems from locally available feed resources (with their strong dependence on rice by-products and maize) lacking protein, mineral and vitamins relative to energy. This deficiency could be offset by testing with local feed suppliers a low-cost feed supplement (e.g. incorporating fish meal, oil cakes and a mineral and vitamin mixture) of the type used by some stall-feeding units in Assam.
 13. Closely related to these breeding and feeding issues are the reports by most interviewees that they had inadequate knowledge about breeding (especially the care of sows during pregnancy and lactation), feeding and health care management (medication and vaccination). However, there was no systematic government approach to address this lack of access to technical extension advice, although there were reports of sporadic training courses on pig management (see Chapter 5).
 14. To meet this widespread demand for technical support, a systematic program is required that develops and delivers needs-based, client-oriented extension and training to improve production through incremental steps achievable within the limits of current household resources, especially feed and family labour. Particular attention should be given to learning from the current best practices of successful small-scale producers and to ensuring that women are the primary partners in these programs. Given the constraints faced by government departments, the needs assessment and the implementation of the program would benefit from being the responsibility of a special project implementation unit or a national-level NGO.
 15. While swine fever was said to be a major disease constraint, confirmatory diagnosis was not carried out and current delivery systems were not effective for supplying the vaccine. Alternatives to vaccine control are required through community-based programs in which locally-based, fee-earning veterinary assistants supply a variety of services including castration and First Aid. The experiences with community-based para-veterinarians are relevant (Catley et al. 2004). Unemployed veterinary

graduates may be encouraged to participate in these programs and supply medicines and other farm inputs. An important component should be community-based training in early clinical diagnosis of swine fever and the collective actions that are required to prevent the spread of infection. Some useful lessons are available from programs in Southeast Asia (see Braidotti 2007).

16. Lack of working capital was a recurring constraint observed during the field surveys and high interest rates were commonplace. More effective schemes are required to make credit available to producers; NGOs may be a viable alternative. Similarly, insurance coverage for pigs reared by self-help groups (SHGs) may be possible through a group insurance scheme.

5. Policy and institutional issues

Supportive institutions and policies are essential if the pig sub-sector is to serve as a strategic pro-poor entry point for improving livelihoods and generating employment in Nagaland. Secondary sources were reviewed and information gathered through key informant interviews and field surveys to identify policy and institutional issues that may constrain improvements to the pig sub-sector or represent opportunities for improving the policy and institutional environment in Nagaland.

5.1. Regulatory environment

The government regulations that relate to the production and marketing of pigs and livestock in general are discussed below.

Livestock Importation Act, 1898 (Amendment Ordinance, 2001)

Under this act, the central government regulates, restricts or prohibits the import of livestock from foreign countries. The act was amended in 2001 to regulate the import of livestock products so that they do not adversely affect human and animal health. The act may affect the importation of pig breeding stock. However, the current government policy regarding importation is not clear. Furthermore, Nagaland's extensive borders hinder effective control of cross-border trade in live animals, including pigs.

Transport of pigs by rail or road

A valid health certificate from a veterinarian is required to transport pigs by rail or road. There are specific instructions for provision of food and water, first aid, floor space and covering etc. In practice, however, many transporters in Nagaland do not adhere to these rules, resulting in 'rent-seeking' by the police (see Section 3.2.1).

Prevention of cruelty to animals (transport of animals on foot) rules, 2001

A valid health certificate is required to transport animals on foot. There are specific conditions to be met as regards feeding and watering arrangements, the maximum distance covered per day, transportation time, period of rest etc. However, as for transport of pigs by road or rail, actual implementation of these rules is limited.

Breeding and experiments on animals (control and supervision) rules, 2001

Under these rules, an establishment that wishes to breed or purchase animals for experimental purposes must be registered to do so first. Breeders shall also not transfer any animals to an unregistered establishment. However, as there are few animal experiments in Nagaland, this act has little practical importance within the state's pig sub-sector.

Pig slaughtering and meat inspection

Given the absence of formal slaughterhouses and the inadequate resources (staff and transport) to effectively implement registration and inspection, meat inspection in Nagaland is cursory even in the municipal councils of Dimapur and Kohima which have veterinary officers for that purpose. As outlined in Sections 3.4 and 3.5, deficiencies in public health measures should be addressed through a risk assessment along the production-to-consumption chain that identifies the requirements for training and improved infrastructure. An assessment of local slaughter practices will be central to the risk analysis given that in Nagaland, producers slaughter a high proportion of pigs and sell the meat directly to consumers.

5.2. *Government and donor participation in the pig sub-sector*

The programs by the government and donor agencies in support of Nagaland's pig sub-sector supply improved breeding stock, production training, extension and credit. Principal amongst these efforts to reach the rural communities are the following programs.

VAHD pig breeding farms

There were four VAHD pig breeding farms in the surveyed districts, one each in Dimapur (Medizephema) and Mon (Tizit) and two in Phek (Phek and Sathazu). During 2006–07, the four farms produced 1370 piglets of the Hampshire, Yorkshire and Large Black/Burma breeds. VAHD either sells the piglets directly to farmers or distributes them through government-sponsored programs. Poor feeding and management was witnessed at the Medizephema and Tizit breeding farms; at the Medizephema farm, pigs were scavenging and their condition was very poor. Another factor working against the farms was that

smallholders do not like to rear the Large White Yorkshire and Hampshire breeds. As mentioned previously, VAHD has not introduced AI into the state.

VAHD piglet propagation program

Launched in 2006 to commemorate the year of the farmer, this program has covered 300 villages in the 60 assembly constituencies. In each project village, VAHD distributed ten piglets to ten households to be reared for breeding and supply of crossbred piglets through hand-on-the-gift schemes amongst the villagers. By December 2006, the VAHD farms had distributed 3000 piglets procured from Assam and Manipur at a cost of INR 1000–1500. When interviewed, villagers in project villages in Mon and Phek districts confirmed receiving the crossbred piglets but reported high mortality rates. The program did not have a training component or regular monitoring.

VAHD backyard piggery scheme

Launched in 2006, this scheme covered two villages of two assembly constituencies in Dimapur and Phek districts. A total of 182 piglets were distributed to villagers for rearing.

VAHD Comprehensive Rural Livestock Extension Program

This program was also launched in 2006. Veterinary officers and staff visited each village at least once every three months to provide vaccines, treatment and marketing extension services. A department source said that all villages were visited at least once in 2006. Field veterinary officers reported that no vehicle was provided (though bus fares were paid), making it difficult to deliver the extension services. During the 2006-07 financial year there was a two-day training program in each district on the backyard system of pig rearing.

NEPED

NEPED implemented a rehabilitation program in ten districts through pig production. In Phek, the program covered 163 households in nine villages while in Mon it covered 121 households in six villages. Each household received two piglets (or their cash equivalent), some medicines and basic instructions on piglet rearing. In Mon district, the quality of the piglets was reportedly poor and about a third of the piglets in Phukton village had died. Villagers said that they were not trained before the crossbred piglets were distributed and there was no subsequent monitoring by NEPED staff.

Swarnajayanti Gram Sawrozgar Yojana (SGSY)

This Government of India scheme was implemented by the District Rural Development Agency (DRDA) of the Government of Nagaland. DRDA organized some SHGs in each block (administrative level below the district) through the block development offices. Since the inception of the program in the three surveyed districts, 1058 SHGs (minimum five members per group) had been organized of which 683 had started income-generating activities. A key informant from the DRDA in Kohima reported that about 20% of the SHGs had taken up pig rearing; the others had started weaving, handicrafts, small trading, vegetable cultivation etc. All the SHGs received a revolving fund of INR 10,000 and a small percentage received project finance of INR 50,000. Commercial banks were not very keen to extend credit to the SHGs, possibly because of the poor recovery rate (10–15%) of existing loans; instead, they merely released the grant portion provided by the government. In addition to financial support, DRDA organized orientation programs lasting one to two days but the SHGs said that these were insufficient to meet their needs. Key informants in the districts said that there was no follow-up and that information flow was poor between the SHGs/blocks and the district headquarters although information flow was good between district and state headquarters. Consequently, the key informants were not confident about the likely impact of the program. There were some extension workers (*Gram Sewok/Sewika*), mostly women, who delivered extension services. However, they were ineffective because they found it difficult to move frequently to the villages.

Don Bosco Vocational Training Centre, Dimapur

This non-governmental centre trains young school dropouts, former drug addicts and former extremists in income-generating activities. During the past two years, about 1000 youths were trained in pig management; some were sponsored by social organizations in Nagaland while others were self-sponsored. Trainees attend regular refresher courses and receive practical training in pig management on the centre's demonstration farm; veterinary experts from ICAR and VAHD occasionally teach theoretical aspects of pig management. The centre does not have specific training materials. The centre staff reported that the demand for training had increased rapidly over the years. However, there was lack of information on which to assess the impact of the program.

5.3. *Delivery of livestock services*

Production and health extension

Although veterinary dispensaries are the main source of formal veterinary services in the state (Section 4.5), field reports showed that they contributed little to strengthening the capacity of households and communities to improve the health management of their pigs. The VASs and VFAs had inadequate physical and financial resources to perform their duties and VAHD had no specialized veterinary extension officers. The Comprehensive Rural Livestock Extension Service Program, the NEPED rehabilitation program and the SGSY attempted to fill the need for technical training in production and health management but, as mentioned earlier, the DRDA staff opined that the SGSY program was insufficient to meet farmers' requirements. The extension activities were also sporadic in nature and lacked needs-based training materials to address the problems that pig producers face in the field.

Producer organizations

Other than SHGs, the surveyed areas had no organizations like cooperatives or farm management committees to strengthen the delivery of input services through collective action amongst pig producers.

Institutional linkages

Interviews in the surveyed districts showed that coordination was poor amongst the institutions that promote pig production. For example, the programs of VAHD and NEPED were not inter-linked and VAHD staff were not well acquainted with the studies by staff from NU-SASARD and the ICAR campus Jharnapani on pig production in the state. In the same way, the research institutions did not appear to be conversant with the ongoing programs of VAHD and the problems that the programs faced in the field. Poor coordination was also reported amongst the DRDA, the State Institute of Rural Development (SIRD), VAHD and banks during the implementation of the SGSY. Banks were reluctant to extend credit to SHGs, despite the recommendation of the DRDA and other government agencies.

5.4. Main policy and institutional issues

There are important policy and institutional issues that constrain pig production and marketing in Nagaland and there are opportunities, via policy and institutional interventions, to improve livelihood security and increase incomes. If the widening gap between demand for and supply of pigs is to be met by Nagaland's traditional pig keepers, the priority must be to provide these village communities with effective extension support on breeding and feeding management. The current lack of orientation, training and motivation of government staff and their poor access to villages hinder extension efforts.

To overcome these deficiencies, it is critical that development policy and its implementation focus on the large majority of pig producers who are resource-constrained, particularly for quality piglets and feed. The policy should recognize that improvements in productivity and profitability will come from incremental production changes developed by innovative, community-based programs implemented by staff oriented towards the needs of their clients. Central to establishing these programs should be support to the members of village councils and VDBs and their communities to learn and adopt participatory approaches for addressing the shortage of quality piglets and breeding stock and for improving feed production and management. Programs based on producer participation (with the involvement of women critical to success) will ensure that their preferences are recognized (e.g. for Large Black Burma Bilati pigs rather than the Hampshire and Saddle Black breeds supplied by government farms). Such programs will also ensure that producers are directly involved in testing of the improved feed resources that will be essential for increasing the productivity of their small-scale production units. Similarly, the development policy should incorporate institutional interventions to reduce the vulnerability of these resource-poor households by addressing the threats of epidemic pig diseases, especially swine fever, through community-based schemes with para-veterinarians and training in disease surveillance and monitoring (Section 4.6).

Public funding will be required to drive these initiatives. This approach will also require a mindset change by government officials, an increased role by NGOs and building upon local social infrastructure, e.g. church groups. To achieve this, two complementary institutional mechanisms are recommended: (i) support for a program of capacity building

in participatory and action-research methods and (ii) establishment of a planning and coordination group as a platform to catalyze the process of mind-set change and prepare a pro-poor policy on pig sub-sector development. To be effective, the planning and coordination group will have to overcome the current inadequate coordination among the various R&D stakeholders.

As the risk averse nature of individual resource-poor pig producers may inhibit the adoption of new technologies, especially rearing of quality piglets, it is likely that micro-credit through community-based schemes will be an integral part of these programs. 'Seeing is believing' and therefore an integral part of the intervention program should include visits by new adopters of pig keeping to areas like Neuland in Dimapur where pig production has been successful.

Just as in the production phase of the value chain, there was poor coordination amongst public health institutions involved in the pre- and post-slaughter phases, even in major towns like Dimapur and Kohima. Public health issues resulting from current slaughter and meat-handling practices merit attention from the various government and civic bodies responsible for food safety, with improvements sought in hygiene while being conscious of the consumers' limited knowledge and awareness about hygienic issues.

Finally, the absence of any significant private-sector investment in large-scale breeding farms and feed mills in the surveyed districts and Dimapur and Kohima towns is worthy of note. It suggests that either the socio-political environment is not conducive to large scale investment in the pig sub-sector or that market conditions are not sufficiently advantageous. Given Nagaland's deficit in pig production and the continuing growth in demand for pork, it will be important that policies are designed that are even-handed in support of small-scale production with its important social equity contribution, and its counterpart, the possible emergence of more intensive peri-urban production units using purchased feeds, such as those developing in Dimapur.

6. Conclusions and recommendations

Pig production in Nagaland is a small-scale, backyard activity that serves to fulfil socio-cultural obligations, generate income and accumulate capital. It is an integral part of the livelihoods and culture of the various ethnic groups in Nagaland. Households kept one to three indigenous or crossbred pigs. An estimated 80–90% of households in the three clusters of Dimapur and Phek districts and 60% of households in Mon kept pigs. The pigs are managed in low external input systems that depend upon family labour and other local inputs, particularly feed, that are of no or low opportunity cost. As a result, levels of production are low with slow growth rates and poor reproductive performance. Well-targeted technical interventions in these production systems and the associated cropping systems can significantly improve the productivity and profitability of pig keeping.

Traditional management practices continue to dominate production with two exceptions; in most areas, scavenging systems have given way to penning and many indigenous pigs have been replaced by crossbreeds. It is only in remote areas where scavenging indigenous pigs are the majority. Production systems (housing and feeding practices) and their objectives (breeding, fattening or both) vary amongst locations and cropping systems, the latter because of the dependence on local feed resources. The most common production objective was the fattening to slaughter of purchased pigs; 60% or more of the pig-keeping households in each of the surveyed clusters kept fattening pigs only. Therefore to be successful, efforts and recommendations towards improving pig production should be specific to a household's production objective, location and ethnic or social group.

The dependence on locally available feed resources and traditional feeding practices limited pig performance. Low-grade crossbred pigs being fed for slaughter reached 30–40 kg live weight at 10 months of age and high-grade crosses 80–90 kg, with the lower weights more prevalent. A major factor that contributed to the low growth rate of crossbred pigs was the low nutrient density and low protein content of the pig feeds, which were mainly the by-products of the household's rice and maize crops, starchy roots, vegetables and collected forages. However, because these and other local feed resources were of low or no opportunity cost and family labour was used to care for the pigs, backyard pig production was an attractive, profitable way to earn income and fulfil socio-cultural

obligations. In contrast, few small-scale producers in or near Dimapur and Kohima have adopted intensive systems of pig production (stall-feeding using purchased concentrate feed) being promoted by central government agencies. However, some producers regularly bought milling by-products and planted crops specifically for use as pig feed.

The current lack of scaling up and intensification of pig production may be a contributory factor to the observed large deficit of slaughter pigs, particularly in Dimapur and Kohima towns. For many years, this deficit has been filled through the procurement of large numbers of pigs from outside the NER and particularly from UP. However, rising demand for pigs outside the NER is reducing the profit margins on these imported pigs. Along with concerns about disease control and attempts to stimulate local production, this is likely to further reduce the numbers that are imported in future.

There are too few weaned piglets and young growing pigs produced in the three surveyed districts to satisfy demand from local households that want to fatten pigs. These deficits are filled through young pigs traded from Assam, Manipur and Myanmar. Of the young pigs purchased for fattening, 10% in Mon, 20% in Dimapur and 30% in Phek were imported. Between 1000 and 1500 young pigs were imported each month from Manipur to Phek and neighbouring districts and another 300 to 500 were procured from Myanmar.

Despite these imports, the market for young and slaughter pigs of local producers was good; over the last 10 years the real price of pork (adjusted for inflation) increased by 8% in Mon, 17% in Dimapur and 46% in Phek. Further price rises were predicted with pig traders and pork retailers pressurizing the authorities to increase the price of pork. These market pressures suggest that demand is outstripping supply and that there is considerable potential to increase the productivity and profitability of local pig production.

Given the prevailing market conditions, it was not surprising that in all three surveyed districts pig producers were happy with the income they generated. However, they also said that they were unable to increase the number of pigs they kept because of the labour-demanding nature of feed collection and preparation. Aversion to risk is an important factor that inhibits change in these low-external-input, low-output activities of resource-poor households (Moll 2005; Siegmund-Schultze et al. 2007). Hence the conundrum: the

market continues to demand more pigs but the input constraints faced by most resource-poor producers limit their capacity to respond.

Given this structure of pig production and the demand and supply scenario, what **specific recommendations** can be given to overcome the constraints faced by the pig sub-sector in Nagaland and thereby to exploit the potential to increase the scale of pig production and to improve its productivity and profitability for these resource-poor households?

Some guiding principles will be critical for the success of interventions in the pig sub-sector:

- Improved efficiency and profitability of production should be achieved by incremental changes to better utilize existing resources through innovative community-based programs implemented by client-oriented staff.
- Participatory methods to identify and target priority problems and to develop and test interventions for specific locations will be essential to ensuring ownership and acceptability among the communities.
- A key element will be to identify and promote current best practices of the most successful community members.

Allied to these principles, mechanisms for institutional sustainability should be established by

- having a strong component of capacity building in participatory methods for local institutions and the target producer groups through hands-on training and exposure visits;
- ensuring that services are on a paid-for basis;
- avoiding program components that are free or highly subsidized and ensuring that any subsidy is reduced in a phased manner over a short period; and
- ensuring that public interventions have built-in staff incentives and effective monitoring and evaluation processes.

A participatory, action-research approach will ensure that the interactive, iterative process of identifying constraints, evaluating options to resolve the constraints and assessing the

benefits meets the needs of the pig-producing households and groups to improve their husbandry while increasing their capacity for innovation. Through continuous information sharing within their communities and groups and with their R&D partners, the base of locally relevant knowledge is increased. The process also facilitates the strengthening of institutional linkages and effectiveness amongst the R&D organizations including the agencies giving credit, the provision of which may play a key role in supporting the adoption of technical innovations.

Within that developmental context, what are the specific technical, institutional and policy constraints amenable to interventions?

Production constraints and opportunities

Producers lacked knowledge about feeding, health care and breeding practices that could improve pig production. Required are needs-based, client-oriented programs using participatory methods and action research to improve the capacity of pig producers to make more effective use of available feed resources, to maintain their pigs in good health and to breed productive crosses. The programs should be designed with the aim of improving production through incremental steps achievable within the limits of current household resources, especially feed and labour. Particular attention should be given to learning from the current best practices of successful low-external input producers and overcoming feed constraints.

Recommendation 1

Through location-specific programs for ethnic and social groups, apply participatory methods and action research to improve the feeding management of pigs.

For programs aiming to identify feeding practices that give faster growth rates and better reproduction, a key opportunity results from the most commonly used feed sources being rich in energy but deficient in protein. This constraint can be offset by three complementary interventions: (i) participatory testing of non-conventional protein-rich feed resources like rice bean, legume forages and soybean, (ii) participatory testing of improved varieties of crops such as tapioca/cassava, *Colocasia/taro*, QPM and sweet potato and (iii) testing the profitability for pig producers and feed suppliers of a protein-rich feed

supplement. The third intervention is likely to be relevant only where producers have good access to cash markets for the sale of their pigs, whereas the first two can be developed even with communities in remote areas.

Each of these feed interventions conforms to the principle of providing pig producers (whether individual households or church groups) with information and technological options that allow them to combine feeds optimally in relation to their local conditions, costs of production (including family labour) and the contribution of each feed to meeting the nutrient requirements of their pigs for profitable performance. These feed interventions should be complemented by technical support, drawing on the lessons from local best practices to improve the housing conditions of pigs.

The same participatory process should also be applied to evaluate the impacts of pig diseases and their threats to the viability of small-scale herds, particularly in relation to designing effective prevention and control systems for swine fever and FMD. Current systems for vaccine delivery do not work. Thus, alternatives are required through community-based training in the early clinical diagnosis of these viral diseases and the collective actions required to prevent the spread of infection. Such community-based schemes would include veterinary assistants paid by the community or a group of communities to supply a variety of services including castration, vaccination and first aid.

Recommendation 2

- 2.1 *Through participatory methods, develop innovative community-based schemes for early clinical diagnosis and control of swine fever and FMD.*
- 2.2 *Support the training of fee-earning technicians for the provision of veterinary services in the community-based schemes.*

Another technical constraint to increased production was the lack of quality breeding stock and weaners and the absence of systematic breeding programs. Current government breeding programs need to be reassessed and innovative community-based breeding systems developed, supported by a needs-based training program on the care and management of breeding stock. If a business plan using realistic production coefficients and market prices for a local breeding scheme looks promising, investments by private-

sector individuals could be encouraged. Key elements will be expanding the stock of the preferred type (Large Black/Burma cross) and making available quality crossbred boars for sale to breeders for use in fee-paying mating systems. To sustain crossbreeding, which is integral to increased productivity, breeding stock of the indigenous pigs of Nagaland needs to be made available. *In situ* conservation programs developed through community-based breeding schemes with appropriate incentives are a probable solution.

Recommendation 3

- 3.1 *Government breeding programs should include the Large Black/Burma cross preferred by most producers and produce quality crossbred boars for sale to villagers for use in fee-paying mating.*
- 3.2 *Through participatory methods, develop innovative community-based systems for sustaining crossbred pig populations and in situ conservation of indigenous pig breeds.*

Marketing and consumption constraints and opportunities

The food safety of pork needed improvement. With rising pork consumption and an increasing number of market participants between producer and consumer, the public health risks from unhygienic practices are growing. Currently there is little or no routine ante and post mortem inspection of slaughter pigs in urban areas where significant numbers of pigs are slaughtered and their pork sold. These deficiencies in public health measures should be addressed through a risk assessment along the production-to-consumption value chain to systematically analyze the practices of pig producers, pig traders and pork retailers and identify intervention points for improving hygiene and food safety. The evaluation should assess the requirements for improved infrastructure and inspection (manpower and physical resources) and for training in meat hygiene and food safety based upon consumers' needs, perceptions and willingness to pay. Given that producers in Nagaland sell a high proportion of pork directly to consumers, an assessment of local slaughter practices will be central to the risk analysis. In addition, the risk assessment will include the market chains from Assam and Manipur, the states outside the NER (especially UP) and Myanmar. The result would be a quality assurance program that incorporates training and certification.

Recommendation 4

- 4.1 *Carry out a risk assessment along the pork production-to-consumption value chain to identify critical intervention points for improving meat hygiene and food safety.*
- 4.2 *Support training for a quality assurance program to address the deficiencies in the management of pigs, their slaughter and the handling of pork in order to improve meat hygiene and food safety.*
- 4.3 *For training of trainers, the courses given by the Animal Products Development Centre in the Philippines should be considered.*
[\(\[http://www.aphca.org/reference/apdc_ph/apdc_index.html\]\(http://www.aphca.org/reference/apdc_ph/apdc_index.html\)\)](http://www.aphca.org/reference/apdc_ph/apdc_index.html)

A study of consumer preferences revealed that there was no price differential between lean and fat pork and that pork from indigenous pigs was more expensive than that from crossbreeds, reflecting consumer preferences based on taste. There is need to better define and quantify consumer perceptions of pork quality – including aspects of taste, appearance and composition – in order to inform government planning and possible private-sector investment. This will indicate how the market is developing, the type of pigs that should be kept, how they should be managed and how their meat should be presented to consumers. Integral to the study will be the documentation of the traits preferred by households and ethnic groups for the many pigs slaughtered at social and religious functions.

Recommendation 5

Carry out a study of consumer preferences and perceptions of pork quality – including aspects of taste, appearance and composition – to inform private investment and public planning.

Policy and institutional constraints and opportunities

Principal amongst the constraints faced by current and potential pig producers was their lack of access to technical information, reflecting the absence of effective production and veterinary extension services. Public funding is required for innovative, community-based programs using participatory methods implemented by staff oriented towards the needs of their clients. This approach will require a mindset change by government officials, an increased role by NGOs and building upon local social infrastructure, e.g. church groups. Two complementary institutional mechanisms are recommended to achieve this.

Recommendation 6

- 6.1 *Support a program of capacity building in participatory and action research methods.*
- 6.2 *Establish a planning and coordination group as a platform to catalyze the process of mindset change and to prepare a policy on the development of the pig sub-sector.*

To be effective, the planning and coordination group will have to overcome the current inadequate coordination among the varied R&D stakeholders like NU, ICAR-NEH, ICAR-NCRP, VAHD, NEPED, NGOs, commercial banks and insurance companies. This can be addressed within the overall policy on pig sub-sector development and the pro-poor strategy for its implementation. For capacity building in participatory approaches, the principles, methods and manuals presented by Jain and Polman (2003) apply (http://www.fao.org/world/regional/rap/susdev_rural_devt_regional.asp). For capacity building in action research methods, options include the courses on 'Participatory action research for rural development' and 'Participatory innovation development: a training of facilitators' by the Regional Centre for Asia of the IIRR in the Philippines (<http://www.iirr.org>).

Given the widespread poverty in Nagaland, it was expected that a lack of operating capital and limited credit facilities would constrain the development of pig production. Few households currently borrow money and even then, the loans are used for consumption not production. Loans are generally from friends and family rather than bank sources or local money-lenders (credit agents); most money-lenders are poor and supply only a small proportion of all credit. Micro-credit schemes managed by NGOs may be a viable way forward so that credit could be made available for individual households to achieve incremental improvements in their production systems. Capacity building of existing NGOs on project appraisal and financial management would be a first step towards their playing an intermediate role in money-lending. Technical extension should be integrated with provision of credit to achieve increased scale and productivity of backyard pig production.

Recommendation 7

Support the training of local NGOs in credit lending and financial management to facilitate the provision of micro-credit to small-scale pig producers and traders.

Through the appraisal of Nagaland's pig sub-sector it has been possible to arrive at a good understanding of who consumes pork, how pigs and pork are marketed and how pigs are produced. As a result, specific actions have been identified through which it will be possible to improve the contribution of the pig sub-sector to livelihoods in Nagaland and to accrue significant benefits for resource-poor households. For these proposed interventions to be successful, substantial capacity building will be required to achieve a shift in the R&D paradigm to client-oriented, needs-based programs. The recommendation for capacity building in participatory and action research methods to support innovation is therefore central to the proposed plan of action.

Another part of that paradigm shift will be to ensure that policies and publicly funded programs are even-handed in their support of small-scale production with its important social equity contribution and its counterpart, the possible emergence of more intensive peri-urban production units using purchased feeds, such as those developing in Dimapur. Monitoring and evaluating these changes in the structure of the pig sub-sector in Nagaland and in the nature of public support will be an important responsibility for the proposed planning and coordination group.

Finally, in common with the conclusion drawn by Deka et al. (2007) from their study of the pig sub-sector in Assam, this study has confirmed the potential in Nagaland for piggy development to improve the wellbeing of the rural poor. Policy, institutional and technical interventions (particularly capacity building in participatory R&D) have been recommended to exploit this potential for improved incomes and employment generation. The elements of the plan are consistent with the recent national-level analysis of the opportunities for, and the challenges to, smallholder livestock production in India reported by Birthal et al. (2006) and with the requirement for client-oriented, needs-based programs emphasized by Rangnekar (2006).

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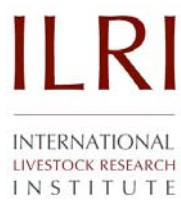
Abbreviations

AICRPP	All India Coordinated Research Project on Pig
AI	artificial insemination
CPR	common property resources
DRDA	District Rural Development Agency
DVO	District Veterinary Officer
FMD	foot and mouth disease
HS	haemorrhagic septicaemia
ICAR-NEH	Indian Council of Agricultural Research-North Eastern Hill region
IIRR	International Institute of Rural Reconstruction
ILRI	International Livestock Research Institute
NER	Northeastern region
NEPED	Nagaland Empowerment of People through Economic Development
NGO	non-governmental organization
NRCP	National Research Centre on Pig
NSSO	National Sample Survey Organization
NU	Nagaland University
QPM	quality protein maize
R&D	research and development
SASARD	School of Agricultural Sciences and Rural Development
SGSY	Swarnajayanti Gram Sawrozgar Yojana
SHG	self-help group
SIRD	State Institute of Rural Development
ST	Scheduled Tribe
UP	Uttar Pradesh
VAHD	Veterinary and Animal Husbandry Department
VAS	Veterinary Assistant Surgeon
VDB	Village Development Board
VFA	Veterinary Field Assistant

Appendix 1: List of key informants

Name	Designation and address
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Mr C Puro	Joint Director, Rural Development Department, Kohima
Mr Menuovilie	Chairperson, Kohima Municipal Council, Kohima
Mr Vizopal Chaya	Councillor, Kohima Municipal Council, Kohima
Dr Phola Konyak	Senior Lecturer, SIRD, Kohima
Dr Vezo	Vetico Centre (private veterinary clinic), Kohima
Dr Hezheto Sohe	District Veterinary Officer (DVO), VAHD, Dimapur
DrKhaisopou	Veterinary Surgion, Dimapur Veterinary Dispensary
Dr Inato	VAS, DVO's office, VAHD, Dimapur
Dr Havito	VAS, DVO's office, VAHD, Dimapur
Dr HI Jimomi	VAS, DVO's office, VAHD, Dimapur
Dr R Temjen Ao	CDO, ICDP, VAHD, Dimapur
Mr N Watsah	District Agriculture Officer, Dimapur
Mr Visasolie	Project Director, DRDA, Dimapur
Mr PN Angami	Deputy Chairperson, Dimapur Municipal Council, Dimapur
Mr Savino	Head, Department of APM, SASARD, Medziphema, Dimapur
Father Paur	Don Bosco Vocational Training Centre, Dimapur
Dr M Karunakaran	Manager, Pig Farm, ICAR, Jharnapani, Dimapur
Mr Megonyii	Chairman, Village Council, Pephema Old village, Dimapur
Mr Beiu Thepa	Chairman, Village Council, Seithebie village, Dimapur
Mr Riqhiche	Chairman, Village Council, Nikhekhu village, Dimapur
Mr Lal Singh	Pig Wholesalers, Burma camp, Dimapur
Dr W Mero	DVO, VAHD, Mon
Mr Ekhu Konyak	VFA, DVO's office, VAHD, Mon
Mrs L Leeya Yanlem	DVO's office, VAHD, Mon
Mr Hohmeth Konyak	VFA, DVO's office, VAHD, Mon
Mr Ango Konyak	Team Member, NEPED, Mon
Mr Benrithung	Junior Accounts Officer, DRDA, Mon

Mr T Phom	District Agriculture Officer, Mon
Mr Nyeiwang	Chairman, Village Council, Phukton village, Mon
Mr Y Yian	Chairman, Village Council, Tetok village, Mon
Mr Omnyei	Chairman, Village Council, Chui village, Mon
Chinp Angh Wapang	<i>Angh</i> (king), Mon Village, Mon
Mr P Ceting Yan	Gaon Buraha, Wakching village, Mon
Dr Mudozo Sahire	DVO, VAHD, Phek
Dr Senowelo	VAS, VAHD, Phek
Mr Zuvere Vero	Chairman, Village Council, Kikruma village
Mr Divi	Chairman, Village Council, Kezobasa village
Mr Chasu Rhi	Piglet trader, Pftusero, Phek
Mr Maipak	Piglet trader, Phek town
Mr Salunyi	Chairman, Village Council, Jhavame village
Mr Vechinieyi	Chairman, Village Council, Kutsapo village, Phek
Mr Thokhusie	NEPED Secretary, Khumiasii village, Meluri, Phek
Mr Keouwelo	Chairman, Village Council, Losami village



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